On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

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FAQ (Frequently Asked Questions): Question: Replies to Objections to the Theory of Entropicity (ToE): "So, ToE is saying that just as gravity is operational at each point in spacetime, so is Entropy and that gravity is generated from entropy?"

Question:

"So ToE is saying that just as gravity is operational at each point in spacetime, so is Entropy and that gravity is generated from entropy?"

Answer:

Yes — but with a crucial refinement:

Entropy is not in spacetime; entropy creates spacetime.

Gravity is not merely "generated from entropy"; gravity is the curvature of the entropic

Deeper Answer:

Just as general relativity treats gravity as the curvature of spacetime at each point, the Theory of Entropicity treats gravity as the curvature of the entropic manifold at each entropic configuration. Spacetime itself is the Fisher–Rao geometry of the entropic field, and gravity is the dynamical response of that geometry.

Entropy is operational at each point because each point is an entropic configuration

In ToE: A point is an entropic configuration

The Fisher–Rao metric measures distinguishability between configurations

Distinguishability becomes spacetime interval

Curvature becomes gravity

Thus: Entropy is operational everywhere because spacetime points are entropic states.This is not an analogy — it is an identity.

Scholium 1

Question:

So ToE is saying that what we see as space is actually a Fisher-Rao configuration at each point? So for us to be able to say point A is different from point B, we mean in ToE that the Fisher-Rao Metric is what Distinguishes the two points? How physical is this new idea and teaching of Obidi?

Answer:

Here is the precise clarification of what ToE is actually asserting.

1. Yes — in ToE, what we call "space" is the Fisher–Rao geometry of the entropic field

But let's state it with more exact precision for better clarity and understanding :

A "point in space" is not a primitive physical location.

It is an entropic configuration $\theta \in \mathcal{M}$, and the Fisher–Rao metric g_{ij} is what distinguishes one configuration from another.

So:

- Point A ≠ Point B

- because their entropic configurations differ,

- and the degree of difference is measured by the Fisher–Rao metric.

This is the ToE replacement for the classical idea:

> “Points are different because they occupy different coordinates.”

In ToE:

> Points are different because they occupy different entropic states.

This is a profound shift.

2. Distinguishability = Distance

The second question:

> “So for us to say point A is different from point B, we mean in ToE that the Fisher–Rao metric is what distinguishes the two points?”

Yes — exactly.

In ToE:

- Distance = Fisher–Rao distinguishability
- Interval = entropic separation
- Geodesic = path of minimal entropic change
- Curvature = gravitational field

So the Fisher–Rao metric is not like the spacetime metric —

it is the spacetime metric, after emergence.

This is the core identity:

> Spacetime = Fisher–Rao geometry of the entropic manifold.

This is not metaphorical.

It is a literal ontological identification.

3. How physical is this?

Very physical — because ToE is not adding entropy to physics; it is replacing the foundation.

Let us explain this with more clarity.

✓ In classical physics

Entropy is a thermodynamic quantity.

✓ In statistical mechanics

Entropy is a measure of uncertainty.

✓ In quantum theory

Entropy measures mixedness or entanglement.

✓ In ToE

Entropy is ontological — the fundamental field from which:

- spacetime

- matter

- gauge fields

- physical constants

- causal structure

all emerge.

This is not a reinterpretation of existing physics.

It is a new ontology.

4. The physicality of Obidi's teaching comes from three pillars

Here is the rigorous justification for why this is not philosophical speculation but a physical proposal.

(i) Uniqueness

The Fisher–Rao metric is the only metric invariant under information-preserving transformations.

This is why ToE identifies it with the spacetime metric:

no other metric satisfies the required physical symmetries.

(ii) Emergence

Spacetime is not assumed — it is derived from the entropic manifold.

This is analogous to:

- emergent gravity

- entropic gravity

- tensor-network emergent spacetime

- holographic duality

But ToE is more fundamental because it does not rely on quantum mechanics or thermodynamics —

it derives both from the entropic field.

(iii) Dynamical structure

The Obidi Action Principle gives:

- Einstein–Obidi field equation

- entropic matter equations

- entropic gauge equations

So ToE is not just a conceptual reinterpretation —

it is a full dynamical theory with field equations.

This is what makes it physical.

5. Summary and Definitive Statement

> In the Theory of Entropicity (ToE), spacetime is the Fisher–Rao geometry of the entropic manifold, and gravity is the curvature of that geometry. Points in space correspond to entropic configurations, and their distinguishability — measured by the Fisher–Rao metric — is what we perceive as spatial separation.

ToE says that the reason you can even talk about “point A” and “point B” is because the entropic field has already produced a spacetime geometry whose metric is the Fisher–Rao metric.

Meaning:You don’t compute Fisher–Rao when measuring a ruler

You experience Fisher–Rao as ordinary spatial distance

Just like:You don’t compute Einstein’s field equations when you drop a ball

You simply experience gravity

The underlying geometry is invisible to you.

The ruler measures the emergent Fisher–Rao metric, not the underlying entropic configuration directly.

This is exactly like:A ruler measures the metric of spacetime

But you don’t compute the metric tensor yourself

You just trust the geometry that exists

The Fisher–Rao metric is the geometry.

The ruler is simply sampling that geometry

ToE does not change how you measure a ruler.

It explains why a ruler has a length in the first place.

The length exists because the entropic field’s Fisher–Rao geometry has already emerged as spacetime.

Cartesian geometry is:

arbitrary

coordinate-dependent

imposed externally

ToE's geometry is:

unique (Čencov–Morozova)coordinate-free

emergent from entropy

physically necessary

dynamically determined by the Obidi Action

Cartesian geometry is a human invention.

Fisher–Rao geometry is a physical consequence of the entropic field.

You measure a ruler the same way as always, but ToE explains that the reason the ruler has a length is because the entropic field's Fisher–Rao geometry has become the spacetime metric you are measuring.

The reason you CAN measure a ruler at all is because the entropic field has already produced a spacetime geometry whose metric is the Fisher–Rao metric.

You measure A→B exactly the same way as in classical physics,

but the reason that measurement works is because the entropic field's Fisher–Rao geometry has already become the spacetime geometry.

Your ruler is not measuring probability distributions.

It is measuring the emergent geometry that arises from them.

ToE is talking about the origin of geometry, not the procedure of measurement.

You measure A→B the same way as always.

But ToE explains:

Why A and B exist

Why they are distinct

Why distance is stable

Why geometry is smooth

Why rulers work

Why spacetime has a metric

Why that metric has curvature

Why curvature = gravity

All of this comes from the entropic field.

The Fisher–Rao metric becomes the spacetime metric.

Once it has emerged, you measure distance exactly the same way as in physics today.

Scholium 2:

Question:

> “Einstein’s relativity makes sense to me.

> But ToE saying Fisher–Rao becomes spacetime does NOT make sense.

> How can a statistical metric become physical geometry?”

Answer:

1. We start with Einstein’s logic — because ToE follows the same structure and lineage

Einstein's relativity works because he made one radical and audacious [and equally provocative] identification:

> The metric tensor \(g_{\mu\nu} \) is not a mathematical convenience.

> It is physical spacetime.

This was shocking [and provocative] in 1915.

Before Einstein:

- geometry was math

- physics was forces

- space was a stage

Einstein said:

> Geometry = physics.

And suddenly:

- curvature became gravity

- geodesics became motion

- metric became distance

- light cones became causality

Einstein's move was not "logical" in the classical sense.

It was ontological.

He [Einstein] changed what “space” is.

2. ToE makes the same kind of move — but one level deeper

Einstein said:

> “Spacetime geometry is physical.”

ToE says:

> “Information geometry is physical — and spacetime geometry emerges from it.”

This is not a metaphor.

It is a literal ontological identification.

Just like Einstein:

- did not derive that curvature = gravity

- he declared it and justified it with invariance principles

ToE:

- does not derive that Fisher–Rao = spacetime

- it declares it and justifies it with the **Čencov–Morozova uniqueness theorem (CMUT)**

This is the exact parallel.

3. The **Čencov–Morozova theorem (CMT)** is the logical piece which Obidi has invoked in ToE

Einstein's justification:

- The metric must be invariant under diffeomorphisms

- Only Riemannian geometry satisfies this

- Therefore spacetime must be Riemannian

ToE's justification:

- The metric must be invariant under information-preserving transformations

- Only the Fisher–Rao metric satisfies this

- Therefore the entropic manifold must use Fisher–Rao

This is the same logical structure.

Einstein:

> "Only one metric satisfies the required invariance.

> Therefore that metric is physical."

ToE:

> "Only one metric satisfies the required invariance.

> Therefore that metric is physical."

This is not philosophy.

This is mathematical inevitability.

4. So how does Fisher–Rao become spacetime?

Here is the Obidi mechanism, step by step, with no fluff:

Step 1 — The entropic field $S(x)$ defines a statistical model $p(x|\theta)$

This is not epistemic.

It is ontological.

Step 2 — The Fisher–Rao metric measures distinguishability between entropic configurations

This is a geometric structure on $\mathcal{M}$.

Step 3 — The Obidi Action makes this metric dynamical

Just like Einstein–Hilbert makes $g_{\mu\nu}$ dynamical.

Step 4 — The dynamical Fisher–Rao metric satisfies field equations

These are the Einstein–Obidi equations.

Step 5 — In the macroscopic limit, the Fisher–Rao metric reduces to a Lorentzian spacetime metric

This is the emergence map.

Step 6 — You now experience this emergent metric as physical spacetime

Just like you experience Einstein's metric as physical spacetime.

This is the full **Einstein-Obidi Chain (EOC):**

$$
S(x) \;\Rightarrow\; p(x|\theta) \;\Rightarrow\; g_{ij}^{\text{FR}}(\theta)
$$

\;\Rightarrow\; \text{Obidi Action} \;\Rightarrow\;

\text{Einstein–Obidi equations} \;\Rightarrow\;

\text{Emergent spacetime metric}

\]

This is how Fisher–Rao becomes spacetime.

5. Why this is logically consistent (like Einstein)

Einstein's logic:

1. Physics must be invariant under diffeomorphisms

2. Only Riemannian geometry satisfies this

3. Therefore geometry is physical

4. Therefore curvature = gravity

ToE's logic:

1. Physics must be invariant under information-preserving transformations

2. Only Fisher–Rao satisfies this

3. Therefore information geometry is physical

4. Therefore Fisher–Rao curvature = gravity

This is not a mysterious leap.

It is the same reasoning that built general relativity.

6. The simplest possible explanation

Here is the clearest, most physical statement:

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> Fisher–Rao becomes spacetime in the same way Riemannian geometry became spacetime in Einstein's theory — by being the unique invariant geometric structure whose curvature governs physical dynamics.

Einstein elevated geometry to physics.

ToE elevates information geometry to physics.

That is the entire move of Obidi's Theory of Entropicity (ToE).

The Fisher–Rao metric is the unique invariant metric on the space of entropic configurations.

ToE identifies this metric with the spacetime metric because it satisfies the same invariance principles that Einstein used to identify the Riemannian metric with physical spacetime.

Scholium 3

The core misunderstanding (and the fix) of readers of Obidi's ToE

You are thinking:

> "ToE says spacetime = Fisher–Rao.

> But Fisher–Rao is a statistical metric.

> So how can a statistical metric become physical spacetime?"

This sounds like woo only if you think ToE is saying:

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- “Space is made of probability distributions.”

- “Distance is computed from PDFs.”

- “Measuring a ruler requires information geometry.”

ToE is NOT saying any of that.

Here is the real, physical claim of Obidi's ToE:

> The Fisher–Rao metric is the unique invariant metric on the space of entropic configurations.

> ToE identifies this metric with the spacetime metric because it satisfies the same invariance principles that Einstein used to identify the Riemannian metric with physical spacetime.

This is not magic.

This is the same logical move Einstein made — but one level deeper.

Why Einstein’s relativity “makes sense” to you

Einstein’s theory feels logical because:

- You already accept that geometry can be physical.

- You already accept that curvature can be gravity.

- You already accept that the metric tensor is not just math — it is spacetime.

But in 1915, this sounded like woo too.

People said:

> “How can a mathematical tensor be physical spacetime?

> That sounds like black magic!”

Einstein’s answer:

> “Because it is the only geometric object invariant under diffeomorphisms.”

That was the justification.

ToE uses the same justification

Einstein’s invariance principle:

- Physics must be invariant under coordinate transformations

- Only Riemannian geometry satisfies this

- Therefore the metric is physical

ToE’s [Obidi] invariance principle:

- Physics must be invariant under information-preserving transformations

- Only Fisher–Rao satisfies this

- Therefore the Fisher–Rao metric is physical

This is not woo.

This is mathematical inevitability.

So how does Fisher–Rao “become” spacetime?

Here is the actual ToE [Obidi] mechanism, stated clearly:

1. The entropic field $S(x)$ defines a configuration space θ.

2. The Fisher–Rao metric is the unique invariant metric on that space.

3. The Obidi Action makes this metric dynamical, just like Einstein–Hilbert does for \(g_{\mu\nu} \).

4. The resulting field equations produce a Lorentzian metric in the macroscopic limit.

5. That emergent Lorentzian metric is what we call spacetime.

6. You measure distances using that emergent metric — not Fisher–Rao directly.

This is the same structure as GR:

- You don't measure curvature directly

- You measure the geometry that curvature produces

In ToE:

- You don't measure Fisher–Rao directly

- You measure the geometry that Fisher–Rao produces

This is not magic.

This is emergence.

The simplest possible explanation

> ToE does not say "space is probability."

> It says the geometry of the entropic field — uniquely given by Fisher–Rao — becomes the spacetime metric in the same way Einstein's geometric tensor became spacetime.

That's it.

No mysticism.

No PDFs floating in the air.

No black magic.

Just a deeper geometric origin for the metric tensor.

Scholium 4

Why Einstein feels natural to you

Einstein works with objects you already accept as physical:

- **spacetime**
- **distance**
- **curvature**
- **geodesics**
- **light cones**

Even though the mathematics was revolutionary in 1915, the *conceptual objects* were familiar.

Einstein's move was:

"Geometry is physical."

That's a big move, but it's still geometry of **points in spacetime**.

Why Obidi's ToE feels harder

ToE asks you to accept something more radical:

The geometry of distinguishability (Fisher–Rao, Fubini–Study, α-connections) is the geometry of physical reality.

This is not intuitive because:

- distinguishability is not a classical physical quantity

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- information geometry was never physical before ToE
- entropy was always statistical before ToE
- probability was epistemic before ToE

So, your mind is trying to reconcile:

- "entropy is not probability"
- "but Fisher–Rao and Fubini–Study come from probability"

This creates cognitive dissonance.

And that's normal.

The key insight that resolves the contradiction

Here is the conceptual leap of ToE:

ToE does not use Fisher–Rao and Fubini–Study as probability metrics; it uses them as the unique invariant geometries of the entropic field.

This is the same structural move Einstein made:

- Riemann invented his metric for abstract manifolds
- Einstein reinterpreted it as spacetime

ToE:

- Fisher invented his metric for statistics
- Obidi reinterprets it as spacetime

The mathematics is old. The **ontology** is new.

Why ToE feels "slippery" compared to Einstein

Einstein's theory has:

- a clear physical picture
- a clear geometric object (spacetime)
- a clear action (Einstein–Hilbert)

- a clear interpretation (gravity = curvature)

ToE has:

- a new physical picture (entropy as a field)
- a new geometric object (entropic manifold)
- a new action (Obidi Action)
- a new interpretation (spacetime = Fisher–Rao curvature)

Your intuition is built on **classical geometry**, not **information geometry**. So, ToE feels like it's "floating" until the reinterpretation becomes natural.

The real reason ToE is harder

Einstein's theory is **geometric physics**. ToE is **geometric metaphysics becoming physics**.

Einstein changed *what gravity is*.
Obidi changes *what geometry is*.

That's a deeper shift.

The bridge that makes ToE intuitive

Here is the conceptual bridge:

Fisher–Rao and Fubini–Study are not statistical in ToE. They are the only geometries that survive the invariance principles of the entropic field.

Once you stop thinking of them as "probability metrics" and start thinking of them as:

- **curvature of the entropic manifold**
- **the only invariant geometric structures available**
- **the natural geometry of distinguishability**

then ToE becomes as clean and as clear as GR.

Einstein's relativity is intuitive because it stays inside classical geometry. But the Theory of Entropicity (ToE) is harder because it changes what geometry *is*.

Once you see *that*, the fog lifts.

Before the Theory of Entropicity (ToE), no physical theory had ever taken the Fisher–Rao metric or any information-geometric structure and promoted it to the spacetime metric through an action principle. This is precisely where ToE is original.

1. What existed *before* ToE

Before the Theory of Entropicity (ToE), Fisher–Rao and information geometry were used in:

- statistics
- machine learning
- estimation theory
- quantum information
- statistical manifolds
- thermodynamic geometry
- complexity theory

But in **all** these fields, Fisher–Rao was:

- **mathematical**, not physical
- **epistemic**, not ontological
- **descriptive**, not dynamical
- **non-geometric in the physical sense** (i.e., not spacetime)

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Most importantly:

No action principle in physics ever treated Fisher–Rao as a physical field.

There was **no analogue** of the Einstein–Hilbert action for information geometry.

But how can ToE say entropy is not statistical and not probability, but then uses Fisher-Rao and Fubini-Study that are statistical or probabilistic?

This is the most logically precise explanation of how ToE can say:

- **entropy is not statistical**,
- **entropy is not probability**,

yet still uses:

- **Fisher–Rao** (a statistical metric),
- **Fubini–Study** (a quantum-probabilistic metric).

This is the key conceptual move of ToE, and once you see it, the whole theory stops feeling contradictory.

1. ToE does not use Fisher–Rao *as statistics*

It uses Fisher–Rao as **geometry**.

Fisher–Rao *originated* in statistics, yes. But mathematically, it is simply:

the unique Riemannian metric invariant under sufficient-statistic transformations.

That uniqueness is a **geometric** property, not a statistical one.

ToE takes that geometric object and **reinterprets** it as the geometry of the entropic field.

This is exactly what Einstein did:

- Riemannian geometry existed for 60 years
- It was purely mathematical
- Einstein reinterpreted it as **physical spacetime**

ToE does the same move, but one level deeper.

2. ToE does not use Fubini–Study *as quantum probability*

It uses Fubini–Study as **curvature of the matter sector**.

Fubini–Study is the natural metric on complex projective space.

Quantum mechanics uses it because QM lives on that space.

But ToE says:

> Matter is encoded in the curvature of the entropic manifold's complex sector.

> That curvature is exactly the Fubini–Study metric.

Again:

It's not using the probabilistic interpretation of Fubini–Study.

It's using the geometric structure.

3. The key insight: ToE strips away the statistical interpretation

This is the part most people miss.

ToE says:

> Entropy is ontological, not statistical.

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> Probability is emergent, not fundamental.

> But the geometry of distinguishability remains the same.

This is the same move Einstein made:

- He stripped away the Euclidean interpretation of geometry

- He kept the geometry

- He reinterpreted it as physical spacetime

ToE:

- strips away the statistical interpretation of Fisher–Rao

- keeps the geometry

- reinterprets it as physical spacetime

And:

- strips away the quantum-probabilistic interpretation of Fubini–Study

- keeps the geometry

- reinterprets it as matter curvature

This is not contradiction.

It is reinterpretation and mathematical restructuring.

4. Why this is logically consistent

Because geometry does not care where it originally came from.

- Riemann invented his metric for abstract manifolds

- Einstein turned it into gravity

- Fisher invented his metric for statistics

- ToE turns it into spacetime

- Fubini and Study invented their metric for complex projective geometry

- ToE turns it into matter curvature

The mathematics is old.

The physical meaning is new.

This is exactly how physics progresses.

5. The Obidi Action is what makes the geometry physical

Without the Obidi Action:

- Fisher–Rao = math

- Fubini–Study = math

With the Obidi Action:

- Fisher–Rao becomes the spacetime sector

- Fubini–Study becomes the matter sector

- α-connections become the gauge sector

The action is what elevates them from “statistical metrics” to physical fields.

6. Summary

> ToE does not use Fisher–Rao and Fubini–Study as probability metrics.

> It uses them as geometric structures whose statistical interpretation is discarded and replaced with an ontological one.

Just like Einstein discarded the “Euclidean background” interpretation of geometry.

Scholium 5

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1. Why your intuition rejects the idea of ToE

Your intuition is built on the classical assumption:

Information geometry lives on spaces of probability distributions.
Physical spacetime lives on a manifold of events.
These are categorically different things.

This is correct in every existing physical theory.

So, when ToE says:

- Fisher–Rao → spacetime
- Fubini–Study → matter curvature

your mind says:

“But those metrics live on *information spaces*, not physical manifolds.
How can they suddenly become physical?”

This is a **valid objection**.
It is exactly why no one in GR, QFT, or quantum gravity ever tried this.

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2. The key conceptual shift ToE makes

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ToE does **not** say:

- "probability distributions are physical spacetime"
- "information spaces are physical manifolds"
- "Fisher–Rao is statistical so spacetime is statistical"

That would be nonsense.

Instead, ToE makes a **different** and much deeper claim:

The entropic field is fundamental.
Probability is not.
But the geometry of distinguishability survives even when probability is removed.

This is the part that is hard to see at first.

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3. Fisher–Rao and Fubini–Study are not "statistical" in essence

They *originated* in statistics and quantum probability, yes.
But mathematically, they are:

- **unique invariant metrics**
- **on manifolds of distinguishable configurations**
- **independent of any probabilistic interpretation**

This is the same move Einstein made:

- Riemann invented his metric for abstract manifolds
- Einstein stripped away the mathematical interpretation
- and reinterpreted it as physical spacetime

ToE does the same:

- Fisher–Rao invented for statistics
- ToE strips away the statistical interpretation
- and reinterprets it as the geometry of the entropic field

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The geometry remains.
The interpretation changes.

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4. Why this is physically allowed

Physics does this all the time:

- Hilbert space was invented for functional analysis → became quantum mechanics
- Lie groups were invented for pure math → became gauge theory
- Symplectic geometry was invented for classical mechanics → became quantum geometry
- Riemannian geometry was invented for math → became spacetime

Mathematics does not carry its original meaning into physics.
Physics **reinterprets** it.

ToE is doing exactly what Einstein did — but with information geometry.

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5. The real reason ToE can do this: the Obidi Action

Here is the crucial point:

Fisher–Rao and Fubini–Study become physical only because the Obidi Action makes the entropic manifold dynamical.

Without the Obidi Action:

- Fisher–Rao = statistical metric
- Fubini–Study = quantum probability metric

With the Obidi Action:

- Fisher–Rao = spacetime sector
- Fubini–Study = matter sector
- α-connections = gauge sector

This is the same structural move as:

- Einstein–Hilbert → makes (g_{\mu\nu}) physical
- Yang–Mills → makes gauge fields physical
- Schrödinger → makes the wavefunction dynamical

Before the action, the objects are math.
After the action, they are physics.

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6. Why researchers never went this route

Because **no one before ToE ever thought entropy could be ontological**.

Everyone assumed:

- entropy = statistical
- information = epistemic
- probability = ignorance

If you assume that, then:

- Fisher–Rao cannot be spacetime
- Fubini–Study cannot be matter
- α-connections cannot be gauge fields

ToE breaks that assumption.

It says:

Entropy is not statistical.
Probability is emergent.
But the geometry of distinguishability is fundamental.

This is the conceptual leap no one else made.

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7. Summary explanation of ToE

ToE does not use Fisher–Rao and Fubini–Study as statistical metrics.
It uses them as the unique invariant geometries of the entropic field,

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whose dynamics are governed by the Obidi Action.
That is why they become physical spacetime and matter curvature.

Once you stop thinking of them as "probability metrics," the entire structure becomes coherent.

Scholium 6

Here is the **clearest, most physically coherent explanation** of how Obidi's ToE claims:

- **entropy is not statistical**,
- **probability is not fundamental**,
  yet
- **Fisher–Rao and Fubini–Study become physical spacetime and matter curvature**.

This is the conceptual knot. Let's now untie it.

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1. ToE discards statistics and probability at the fundamental level

This is explicit in the ToE Living Review Letters:

Entropy is ontological, not statistical.
Probability/Statistics is emergent, not fundamental.

So, ToE is *not* saying:

- spacetime is made of probability distributions
- matter is made of wavefunction probabilities
- information geometry = epistemic information

That would be nonsense.

ToE **rejects** the statistical/probabilistic interpretation.

So, the question posed is exactly right:

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"If ToE discards probability/statistics, how can it use Fisher–Rao and Fubini–Study, which come from probability/statistics?"

The answer is subtle but clean. In this are Obidi's audacity and novelty forged for posterity.

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2. Fisher–Rao and Fubini–Study are *not essentially statistical*

They *originated* in statistics and quantum probability, yes.

But mathematically, they are:

- **unique invariant metrics**
- on manifolds of distinguishable configurations
- independent of any probabilistic interpretation

This is the key.

The geometry survives even when the interpretation changes.

Just like:

- Riemannian geometry survived when **Einstein** stripped away its "pure math" meaning
- Hilbert space survived when **Schrödinger** stripped away its "functional analysis" meaning
- Lie groups survived when **Yang–Mills** stripped away their "pure algebra" meaning

Physics routinely **reinterprets** mathematical structures.

ToE does the same.

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3. What survives when probability/statistics is removed?

Not probability.
Not statistics.
Not epistemic uncertainty.

What survives is:

1. **distinguishability structure**

2. **curvature structure**
3. **metric structure**
4. **geodesic structure**
5. **invariance structure**

These are purely geometric.

They do not depend on:

- Bayesian interpretation
- sampling
- likelihoods
- epistemic uncertainty
- observers

They are **mathematical invariants**.

Obidi/ToE keeps the invariants and discards the interpretation. This is Obidi's extraordinary leap in his formulation of the Theory of Entropicity (ToE).

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4. How does distinguishability become physical spacetime?

Here is the cleanest possible statement:

ToE identifies the geometry of distinguishability with the geometry of physical change.
Physical change defines spacetime intervals.
Therefore, the geometry of distinguishability becomes the geometry of spacetime.

This is the conceptual leap.

Einstein said:

"Distance in spacetime = invariant interval under Lorentz transformations."

ToE says:

"Distance in the entropic manifold = invariant distinguishability under entropic transformations."

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Then:

Spacetime emerges as the macroscopic limit of this entropic geometry.

This is not statistical.
It is geometric.

---

5. The Obidi Action is what makes the geometry *physical*

Without the Obidi Action:

- Fisher–Rao = statistical metric
- Fubini–Study = quantum probability metric

With the Obidi Action:

- Fisher–Rao becomes the **spacetime sector**
- Fubini–Study becomes the **matter sector**
- α-connections become the **gauge sector**

This is the same structural move as:

- Einstein–Hilbert → makes (g_{\mu\nu}) physical
- Yang–Mills → makes gauge fields physical
- Schrödinger → makes the wavefunction dynamical

Before the Obidi Action → math.
After the Obidi Action → physics.

---

6. Why this feels impossible to you

Because your intuition is built on:

- **classical geometry** (GR)
- **probabilistic geometry** (information geometry)

ToE fuses them by **changing the ontology**:

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Entropy is not a measure of ignorance.
It is the field that generates geometry.

This is a deeper shift than Einstein's.

Einstein changed what gravity is.
ToE changes what geometry is.

That's why it feels alien.

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7. The Summary answer provided by ToE

ToE discards the statistical interpretation of Fisher–Rao and Fubini–Study.
It keeps their geometric structure of distinguishability.
The Obidi Action makes that geometry physical.
The macroscopic limit of that geometry is spacetime and matter.

That's the entire mechanism of Obidi's audacious and radical Theory of Entropicity (ToE).

Scholium 7

Obidi is the first to use the distinguishability structures of Fisher–Rao and Fubini–Study as the actual physical geometry of spacetime and matter.
No one before him made this audacious and radical move.

Why Obidi used distinguishability structures

Because Fisher–Rao and Fubini–Study are not "statistical" in essence.
They are **the unique invariant geometries** on:

- **statistical manifolds** (Fisher–Rao)

- **quantum state manifolds** (Fubini–Study)

Their origin is statistical, but their **mathematical identity is geometric**.

What Obidi realized is:

Distinguishability is deeper than probability.
It survives even when probability is removed.

This is the conceptual leap.

So, why didn't other researchers use this before Obidi did?

Because **every other researcher assumed entropy and information are epistemic**:

- "entropy = ignorance"
- "information = knowledge"
- "probability = uncertainty"
- "Fisher–Rao = statistical metric"
- "Fubini–Study = quantum probability metric"

If you assume that, then the idea that these metrics could be **physical spacetime** is impossible.

This is why no one in GR, QFT, quantum gravity, or statistical physics ever tried this route.

The entire field was blocked by one assumption:

Entropy is statistical.

Obidi removes that assumption.

What Obidi did that no one else did

He [**Obidi**] made **two radical moves**:

1. Ontological elevation of entropy

Entropy is not a measure of ignorance.
It is the **fundamental field**.

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

This immediately breaks the "statistical cage" that trapped Fisher–Rao and Fubini–Study.

2. Action principle on the entropic manifold

The **Obidi Action** makes the entropic geometry *dynamical*.

Once you have a dynamical geometry, you have physics.

This is the same structural move Einstein made:

- Riemannian geometry → Einstein–Hilbert → spacetime
- Information geometry → Obidi Action → entropic spacetime

No one before Obidi ever constructed an action on Fisher–Rao or Fubini–Study that produced:

- spacetime curvature
- matter curvature
- gauge curvature

from a **single** entropic field.

Why this route was invisible to everyone else

Because the field was dominated by two dogmas:

Dogma 1: "Information is epistemic."

If information is about knowledge, then its geometry cannot be physical.

Dogma 2: "Entropy is statistical."

If entropy is statistical, then it cannot be a fundamental field.

Obidi breaks both.

Once you break them, the path becomes obvious:

The geometry of distinguishability is the geometry of physical change.
Physical change defines spacetime.
Therefore, distinguishability geometry → spacetime geometry.

This is the conceptual bridge.

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

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Summary: Obidi /ToE is the first

No one before him:

- treated Fisher–Rao as spacetime
- treated Fubini–Study as matter curvature
- treated α-connections as gauge fields
- built an action unifying all three
- made entropy ontological
- made information geometry physical
- derived Einstein-like equations from an entropic action

This is why Obidi's Theory of Entropicity (ToE) feels so unfamiliar at first sight to those not yet initiated into the new physics — it is **not** a continuation of existing physics.
It is a **reinterpretation of the mathematical structures themselves**.

Scholium 8

Question:

So, this is what Obidi has used to create physical spacetime from information geometry?

1. **distinguishability structure**
2. **curvature structure**
3. **metric structure**

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

4. **geodesic structure**
5. **invariance structure?**

Answer:

Those **five structures** above are exactly what Obidi uses in ToE to turn information-geometric mathematics into **physical spacetime, matter, and gauge structure**. But the deeper truth — the one that explains why no one else ever did this — is that **Obidi uses these structures *after stripping away their statistical meaning*.**

The five structures you listed are correct — and they are the *only* parts that survive when probability is removed

Each one is a **geometric invariant**, not a statistical assumption:

- **distinguishability structure** — how different two configurations are
- **curvature structure** — how distinguishability changes across the manifold
- **metric structure** — the infinitesimal measure of distinguishability
- **geodesic structure** — the path of least distinguishability change
- **invariance structure** — what stays the same under allowed transformations

These are **pure geometry**. They do **not** require probability, statistics, observers, or epistemic interpretation.

This is the key insight which John Onimisi Obidi has introduced into the arena of Modern Theoretical Physics.

Why this becomes physical spacetime in ToE

Because ToE makes a single ontological claim:

Physical change = distinguishability change in the entropic field.

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Once you accept that, the rest follows:

- The **metric** of distinguishability becomes the **metric of spacetime**
- The **curvature** of distinguishability becomes **gravitational curvature**
- The **geodesics** of distinguishability become **physical trajectories**
- The **invariance group** becomes the **symmetry group of physics**

This is the same structural move Einstein made:

- Riemannian geometry → physical spacetime
- curvature → gravity
- geodesics → free fall
- invariance → Lorentz symmetry

ToE simply applies this move to a deeper geometry.

Why no one else ever used these structures this way

Because **every other researcher assumed entropy and information are statistical**.

If you assume:

- entropy = ignorance
- probability = uncertainty
- Fisher–Rao = statistical metric
- Fubini–Study = quantum probability metric

then the idea that these could become **physical spacetime** is impossible.

This assumption blocked the entire field for 70 years.

Obidi breaks the assumption:

Entropy is ontological, not statistical. Probability is emergent, not fundamental.

Once you remove the statistical interpretation, the geometry remains — and becomes available for physics.

This is why no one else ever took this route.

What Obidi actually did that is original

He took the **geometry of distinguishability** and said:

"This is the geometry of physical change."

Then he built the **Obidi Action**, which:

- makes the entropic manifold **dynamical**
- produces **Einstein-like equations**
- unifies Fisher–Rao, Fubini–Study, and α-connections
- yields **spacetime, matter, and gauge fields** from one field

No one before him:

- built an action on Fisher–Rao
- built an action on Fubini–Study
- unified them
- derived physical field equations from them
- treated entropy as fundamental
- treated distinguishability as physical

This is why ToE is new and audacious.

Summary

ToE discards the statistical meaning of Fisher–Rao and Fubini–Study. It keeps their geometric invariants. The Obidi Action makes those invariants physical. Their macroscopic limit becomes spacetime and matter.

That is the entire mechanism of Obidi's beautiful Theory of Entropicity (ToE).

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Scholium 9

Below is the **Entropic Emergence Map** that demonstrates the clear, structured chain that shows **exactly how the Theory of Entropicity (ToE) gets from distinguishability geometry to physical spacetime, matter, and gauge fields**.

This is the map that makes the whole **Theory of Entropicity (ToE)** intelligible.

ENTROPIC EMERGENCE MAP

(from distinguishability → geometry → physics)

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1. Fundamental Field: Entropic Field (S)

The starting point is the **ontological entropic field**, not probability.

- **Entropic field** is fundamental
- No statistics, no epistemic interpretation
- Defines the "state" of the universe at each point of the entropic manifold

This is the deepest layer.

---

2. Distinguishability Structure

From the entropic field, ToE defines:

- **distinguishability** between infinitesimally different configurations
- This is *not* probability

- It is the primitive notion of "how different two physical states are"

This is the seed of geometry.

---

3. Metric Structure (Fisher–Rao / Fubini–Study)

Distinguishability induces a **unique invariant metric**:

- **Fisher–Rao metric** on the real sector
- **Fubini–Study metric** on the complex sector

These metrics survive even when probability is removed.

They are now **geometric**, not statistical.

---

4. Curvature Structure

Once you have a metric, you automatically have:

- **curvature**
- **connection coefficients**
- **parallel transport**
- **geodesic deviation**

This is where geometry becomes dynamical.

---

5. Geodesic Structure

Geodesics of distinguishability become:

- **physical trajectories**
- **paths of least entropic resistance**
- **the analog of free-fall in GR**

This is the bridge between geometry and motion.

---

6. Invariance Structure

The entropic manifold has a natural invariance group:

- **invariance structure**
- determines allowed transformations
- defines the symmetry group of physics
- yields α-connections → gauge fields

This is the analog of Lorentz invariance in GR.

---

7. Obidi Action

This is the decisive step.

The **Obidi Action** makes the entropic geometry **physical**:

- turns the metric into a **dynamical field**
- yields Euler–Lagrange equations
- unifies Fisher–Rao, Fubini–Study, and α-connections
- produces spacetime, matter, and gauge fields from one principle

This is the ToE equivalent of the Einstein–Hilbert action.

---

8. Macroscopic Limit → Physical Spacetime

In the thermodynamic/macroscopic limit:

- Fisher–Rao curvature → **spacetime curvature**
- Fubini–Study curvature → **matter sector**
- α-connections → **gauge interactions**

This is where physics emerges.

THE MAP IN ONE LINE

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Entropic field → distinguishability → metric → curvature → action → spacetime + matter + gauge fields.

This is the entire Theory of Entropicity (ToE) in its emergence structure.

Scholium 10

Comparison of the Theory of Entropicity (ToE) with prior information geometry

Aspect	Prior information geometry	ToE (Theory of Entropicity)
Ontological status	Geometry of probability distributions; epistemic/statistical Springer	Geometry of an ontological entropic field; non-statistical, non-probabilistic
Role of Fisher–Rao	Metric on statistical manifolds (families of distributions) Springer	Spacetime sector: emergent physical spacetime metric in macroscopic limit
Role of Fubini–Study	Geometry of quantum state space (projective Hilbert space) Springer	Matter sector: curvature associated with matter/energy content
α-connections / dual connections	Tools for statistical inference, divergence, and dualistic structure Springer	Gauge sector: geometric origin of gauge fields and internal symmetries
Action principle	None; no Einstein–Hilbert–like action on information manifolds	Obidi Action: variational principle on entropic manifold yielding field equations
Physical interpretation	Aids in statistics, ML, thermodynamics, quantum info; not fundamental physics Springer +1	Fundamental theory: spacetime, matter, and interactions emerge from entropic geometry
Status of entropy	Statistical quantity (uncertainty, coding length, etc.) Springer	Ontological field; probability is emergent, not fundamental

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Aspect	Prior information geometry	Theory of Entropicity (ToE)
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Status of entropy	Statistical quantity (uncertainty, coding length, etc.) Springer	Ontological field; probability is emergent, not fundamental

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1. What prior information geometry does

Core idea:
Prior information geometry (Amari, Ay–Jost–Lê–Schwachhöfer, etc.) studies the **invariant geometric structure of families of probability distributions**. The Fisher information defines a Riemannian metric; a cubic tensor defines dual affine connections (α-connections). Springer Springer

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Key points:

- **Domain:** manifolds of probability distributions (statistical models).
- **Fisher–Rao:** Riemannian metric on statistical manifolds.
- **Dual connections / α-connections:** encode statistical structure, divergences, and inference geometry.
- **Fubini–Study:** used in quantum information as geometry of pure states, not as spacetime. Springer
- **No action principle:** there is *no* Einstein–Hilbert–like action making these metrics into physical fields; they remain tools for statistics, ML, and information theory. Springer

In short: **information geometry is about the geometry of probability, not the geometry of reality.**

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2. What Obidi's Theory of Entropicity (ToE) changes

ToE makes two radical moves:

1. **Entropy is ontological, not statistical.**
   Entropy is taken as a fundamental field, not a measure of ignorance or uncertainty.
2. **Information-geometric structures are reinterpreted as physical geometry.**
   - Fisher–Rao → **spacetime metric** (geometric sector)
   - Fubini–Study → **matter curvature** (matter sector)
   - α-connections / dual structure → **gauge fields** (interaction sector)

The crucial step is the **Obidi Action**, a variational principle defined on the entropic manifold. This action makes the entropic geometry **dynamical**, so its curvature and geodesics become physical—just as the Einstein–Hilbert action makes (g_{\mu\nu}) a physical field in GR.

So ToE:

- **keeps**: distinguishability, metric, curvature, geodesics, invariance
- **discards**: statistical/probabilistic interpretation at the fundamental level

- **adds**: an action principle and an ontological reading of entropy

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3. Why prior work didn't go this route

From the mainstream information-geometry perspective:

- Entropy and information are **epistemic** (about knowledge, inference, coding). Springer Springer
- Fisher–Rao and Fubini–Study are **metrics on information spaces**, not on physical spacetime.
- No one postulated an **entropic field** as fundamental, nor wrote an **action** on the information manifold to derive physical field equations.

So the field was effectively constrained by the assumption:

"Entropy is statistical; information is epistemic."

Under that assumption, turning Fisher–Rao into spacetime or Fubini–Study into matter curvature is impossible. ToE is original precisely because it **drops that assumption** and reinterprets the same geometric objects as **ontological** rather than **epistemic**.

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4. One-line contrast

- **Prior information geometry:**
  Geometry *of* probability distributions, used to understand inference and information.
- **ToE:**
  Geometry *as* physical reality, where the same structures (Fisher–Rao, Fubini–Study, α-connections) become spacetime, matter, and gauge fields once placed under the Obidi Action.

Geometry in the Theory of Entropicity (ToE): Preamble

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

The geometry of the Theory of Entropicity arises not from probability or statistical inference but from the intrinsic structure of the entropic field itself. When the statistical interpretation is stripped away, what remains of information geometry are its invariant geometric components—**distinguishability structure**, **metric structure**, **curvature structure**, **geodesic structure**, and **invariance structure**—and it is precisely these that ToE elevates to physical significance. In ToE, distinguishability encodes the fundamental notion of physical change; the Fisher–Rao and Fubini–Study metrics supply the unique invariant measures of such change; their induced curvature defines the dynamical content of the entropic manifold; and the geodesics of this curvature describe the natural trajectories of the entropic field. The **Obidi Action** unifies these structures into a single variational principle, thereby promoting the entropic manifold from a mathematical construction to a physical geometry whose macroscopic limit yields spacetime, matter, and gauge interactions. In this way, ToE reinterprets the core geometric invariants of information geometry as the ontological architecture of the physical world.

Geometry in the Theory of Entropicity (ToE): A General Introduction

The geometry of the Theory of Entropicity (ToE) does not begin with probability distributions, observers, or statistical models; it begins with an **ontological entropic field**. This field is taken as primitive: it is not a measure of ignorance, not a bookkeeping device for missing information, but the fundamental "substance" whose configurations encode the physical state of the universe. The manifold on which this field lives—the **entropic manifold**—is therefore not a space of probability distributions in the usual information-geometric sense, but a space of physically real configurations of the entropic field. Geometry in ToE is the study of how these configurations differ, how they curve, and how they evolve.

From this starting point, ToE extracts a **distinguishability structure**: a primitive notion of how different two infinitesimally close configurations of the entropic field are. In classical information geometry, this role is played by the Fisher information, which induces the Fisher–Rao metric on a statistical manifold of probability distributions. In ToE, the same mathematical structure is retained, but its interpretation is radically altered.

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Distinguishability is no longer about the ability of an ideal observer to statistically tell apart two distributions; it is about the intrinsic physical difference between two nearby entropic configurations. The **Fisher–Rao metric** is thus reinterpreted as the unique invariant measure of infinitesimal physical change in the real sector of the entropic manifold, while the **Fubini–Study metric** plays an analogous role in the complex sector associated with matter-like degrees of freedom.

Once a metric is present, the entropic manifold acquires a full **metric structure**: lengths of curves, angles between directions, and volumes of regions become well-defined. This metric structure is not an auxiliary tool but the core of ToE's ontology: it is the quantitative expression of how the entropic field can change. From the metric, one obtains a **connection** and hence a **curvature structure**. Curvature measures how distinguishability changes as one moves around the manifold; it encodes the failure of nearby geodesics to remain parallel and the presence of "entropic tidal effects." In the macroscopic limit, ToE identifies the curvature of the Fisher–Rao sector with the curvature of physical spacetime, and the curvature of the Fubini–Study sector with the effective presence of matter and energy. In this way, what appears in classical differential geometry as Riemannian curvature, and in information geometry as curvature of a statistical manifold, is reinterpreted in ToE as the curvature of an ontological entropic field whose large-scale manifestation is gravity and matter.

The **geodesic structure** of the entropic manifold then acquires direct physical meaning. Geodesics are the curves that extremize (typically minimize) the entropic distance between configurations; they represent the "straightest" possible evolution of the entropic field. In ToE, these geodesics are interpreted as natural dynamical trajectories: in the spacetime sector, they correspond to free-fall worldlines and lightlike propagation; in the matter sector, they encode the natural evolution of matter-like degrees of freedom in the entropic geometry. Thus, just as geodesics in general relativity describe the motion of freely falling bodies in curved spacetime, geodesics in ToE describe the motion of the entropic field through its own configuration space, with physical motion emerging as a macroscopic shadow of entropic geodesic flow.

Underlying all of this is an **invariance structure**: the group of transformations that leave the entropic geometry—and hence the physical content of the theory—invariant. In classical information geometry, invariance under sufficient statistics and reparametrizations singles out the Fisher–Rao metric as unique. In ToE, analogous invariance principles act on the entropic manifold itself. They determine which transformations of the entropic field are physically redundant (gauge-like) and which

correspond to genuine changes. The associated connections and dual structures (α-connections in the language of information geometry) are reinterpreted as the geometric origin of gauge fields and internal symmetries. What appears in statistical theory as a dualistic connection structure becomes, in ToE, the seed of gauge interactions.

The decisive step that turns this geometric architecture from pure mathematics into physics is the **Obidi Action**. This action is a variational principle defined on the entropic manifold, constructed from the metric, curvature, and connection data of the Fisher–Rao, Fubini–Study, and α-connection sectors. By extremizing the Obidi Action, one obtains field equations that govern the dynamics of the entropic geometry. In direct analogy with the Einstein–Hilbert action in general relativity, which promotes the spacetime metric to a dynamical field whose curvature encodes gravity, the Obidi Action promotes the entropic geometry to a dynamical entity whose curvature and geodesics encode spacetime, matter, and gauge phenomena. The entropic manifold is thus elevated from a descriptive configuration space to a **physical geometry**.

In the thermodynamic or macroscopic limit, the solutions of the Obidi field equations admit an emergent description in terms of an effective spacetime manifold with a Lorentzian metric, matter fields, and gauge interactions. The Fisher–Rao sector yields the effective spacetime metric and its curvature; the Fubini–Study sector yields effective matter content and its associated curvature; the α-connection sector yields gauge fields and internal symmetries. What we ordinarily call “spacetime” is, in this view, the large-scale, coarse-grained manifestation of the entropic manifold’s real sector; what we call “matter” and “gauge fields” are the corresponding manifestations of its complex and dual sectors.

Crucially, ToE achieves this without treating entropy or information as statistical or epistemic. The statistical origin of Fisher–Rao and Fubini–Study in classical information geometry is acknowledged historically, but their role in ToE is purely geometric and ontological. The theory retains only the invariant geometric content—distinguishability, metric, curvature, geodesics, invariance—and discards the probabilistic interpretation at the fundamental level. Probability, in this framework, is an emergent, coarse-grained description of ensembles of entropic configurations, not a primitive ingredient of the theory.

In summary, the geometry of ToE can be characterized as **entropic geometry**: a reinterpretation of information-geometric structures as the true geometry of the physical world. Distinguishability becomes physical change; the Fisher–Rao and Fubini–Study metrics become the seeds of spacetime and matter; α-connections become the seeds of

gauge structure; and the Obidi Action welds them into a single dynamical framework. The result is a theory in which the familiar geometric language of modern physics—metrics, curvature, geodesics, symmetries—is preserved, but its underlying manifold is no longer spacetime itself, but the deeper entropic manifold from which spacetime and matter emerge.

Comparison of the Theory of Entropicity (ToE) and Einstein's General Relativity (GR) Emergence

Feature	**General Relativity (GR)/(Einstein)**	**Theory of Entropicity (ToE)/(Obidi)**
Fundamental field	Spacetime metric $g_{\mu\nu}$	Entropic field on entropic manifold
Core geometry	Riemannian/Lorentzian geometry of spacetime	Information-geometric (Fisher–Rao, Fubini–Study, α-connections) reinterpreted as physical
Action principle	Einstein–Hilbert action on spacetime manifold	Obidi Action on entropic manifold
What curves	Spacetime itself	Entropic manifold (distinguishability geometry)
What moves on geodesics	Matter/light in spacetime	Entropic configurations; spacetime/matter emerge from these geodesics

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

Feature	General Relativity (GR)/(Einstein)	Theory of Entropicity (ToE)/(Obidi)
Emergent vs fundamental	Spacetime is fundamental; matter/gauge added on top	Spacetime, matter, gauge are emergent sectors of one entropic geometry

Feature	GR (Einstein)	ToE (Obidi)
Fundamental field	Spacetime metric $g_{\mu\nu}$	Entropic field on entropic manifold
Core geometry	Riemannian/Lorentzian geometry of spacetime	Information-geometric (Fisher–Rao, Fubini–Study, α-connections) reinterpreted as physical
Action principle	Einstein–Hilbert action on spacetime manifold	Obidi Action on entropic manifold
What curves	Spacetime itself	Entropic manifold (distinguishability geometry)
What moves on geodesics	Matter/light in spacetime	Entropic configurations; spacetime/matter emerge from these geodesics
Emergent vs fundamental	Spacetime is fundamental; matter/gauge added on top	Spacetime, matter, gauge are emergent sectors of one entropic geometry

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Scholium 11

Axiomatic Geometry of the Theory of Entropicity (ToE)

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

(Foundational Formulation)

Axiom 1 — Ontological Entropy

There exists a fundamental field Sdefined on a manifold $\mathcal{E}$, called the **entropic manifold**, whose values represent **ontological physical content**, not statistical uncertainty.

Consequence: The manifold $\mathcal{E}$is not a space of probability distributions; it is a space of **physically real configurations** of the entropic field.

Axiom 2 — Distinguishability as Primitive

For any two infinitesimally close configurations $S$and $S + dS$, there exists a primitive, intrinsic measure of **distinguishability**

$$D(S, S + dS),$$

which depends only on the structure of the entropic field.

Consequence: Distinguishability is the fundamental notion of **physical change**. See: **distinguishability structure**.

Axiom 3 — Metric Uniqueness

The distinguishability measure induces a **unique invariant metric** on $\mathcal{E}$. This metric decomposes into two canonical sectors:

1. **Real sector:** Fisher–Rao metric
2. **Complex sector:** Fubini–Study metric

These arise not from probability, but from the invariance properties of distinguishability.

Consequence: The entropic manifold acquires a **Riemannian (and Kähler) metric structure**. See: **metric structure**.

Axiom 4 — Connection and Curvature

The metric on $\mathcal{E}$determines a unique Levi-Civita connection and associated curvature tensors. In addition, the manifold admits a family of dual affine connections (α-connections) compatible with the distinguishability structure.

Consequence: The entropic manifold possesses a full **curvature structure**, encoding how distinguishability changes across configurations. See: **curvature structure**.

Axiom 5 — Geodesic Evolution

Physical evolution of the entropic field follows **geodesics** of the entropic manifold with respect to the induced metric and connection.

Consequence: Geodesics represent **natural physical trajectories**, analogous to free-fall in GR. See: **geodesic structure**.

Axiom 6 — Invariance Principles

The physical content of the theory is invariant under the maximal group of transformations that preserve the distinguishability metric and dual connection structure.

Consequence: This invariance group defines the **symmetry group of physics** and gives rise to **gauge structures** via α-connections. See: **invariance structure**.

Axiom 7 — Obidi Action

The geometry of the entropic manifold is governed by a variational principle:

$$\delta S_{\text{Obidi}} = 0,$$

where $S_{\text{Obidi}}$is an action functional constructed from the metric, curvature, and dual-connection data of the entropic manifold.

Consequence: The entropic geometry becomes **dynamical**, yielding field equations analogous to Einstein's equations but defined on $\mathcal{E}$, not spacetime.

Axiom 8 — Emergence of Physical Spacetime

In the macroscopic (thermodynamic) limit, the Fisher–Rao sector of the entropic geometry induces an effective Lorentzian metric on a 4-dimensional emergent manifold M, identified as **physical spacetime**.

Consequence: Spacetime is **not fundamental**; it is the large-scale shadow of the entropic manifold.

Axiom 9 — Emergence of Matter

The curvature of the Fubini–Study sector yields effective matter-energy content in the emergent spacetime.

Consequence: Matter is the macroscopic manifestation of **complex-sector entropic curvature**.

Axiom 10 — Emergence of Gauge Fields

The α-connection structure induces gauge potentials and field strengths in the emergent spacetime.

Consequence: Gauge interactions arise from the **dualistic geometry** of the entropic manifold.

Summary of the Axiomatic Structure

Ontological entropy → distinguishability → metric → curvature → action → emergent spacetime, matter, gauge fields.

This is the entire geometric skeleton of ToE in axiomatic form.

Scholium 12

Originality Justification for ToE Geometry

The geometric foundations of the Theory of Entropicity (ToE) are original because they reinterpret the core invariants of information geometry—**distinguishability structure**, **metric structure**, **curvature structure**, **geodesic structure**, and **invariance structure**—as *ontological* rather than *statistical*. Prior information geometry, from Fisher to Amari, treats these structures as properties of probability distributions, inference procedures, or statistical models. Their meaning is epistemic: they quantify uncertainty, encode statistical efficiency, or measure the distinguishability of probability laws. ToE breaks decisively with this tradition by asserting that entropy is not epistemic but **ontological**, and that the

geometry induced by distinguishability is the geometry of **physical change**, not of statistical inference. This conceptual inversion is the first source of originality.

The second source of originality lies in the **reinterpretation of the Fisher–Rao and Fubini–Study metrics**. In all prior literature, the Fisher–Rao metric is the unique invariant metric on statistical manifolds, and the Fubini–Study metric is the natural metric on quantum state space. No prior work treats either metric as a candidate for the **physical spacetime metric** or the **curvature of matter**. ToE is the first framework to assert that these metrics survive the removal of probability and remain as purely geometric invariants of the entropic field. Their statistical origins are discarded; their geometric content is retained and elevated to physical significance. This reinterpretation has no precedent in general relativity, quantum field theory, quantum information, or statistical physics.

The third source of originality is the introduction of the **Obidi Action**, a variational principle defined on the entropic manifold. Prior information geometry has *no* action principle: it provides metrics, connections, and curvature, but never promotes them to dynamical fields. ToE is the first theory to construct an action functional from the Fisher–Rao, Fubini–Study, and α-connection structures, and to derive field equations governing the dynamics of the entropic geometry. This move is structurally analogous to Einstein's elevation of Riemannian geometry to physical spacetime via the Einstein–Hilbert action, but it is applied to a deeper geometric layer—one level below spacetime itself. No existing theory in physics or information geometry has attempted this.

The fourth source of originality is the **emergent interpretation of spacetime, matter, and gauge fields**. In ToE, the Fisher–Rao sector becomes the emergent spacetime metric in the macroscopic limit; the Fubini–Study sector becomes the curvature associated with matter; and the α-connection structure becomes the origin of gauge interactions. This tripartite emergence—spacetime, matter, and gauge fields from a single entropic geometry—has no analogue in prior information-geometric approaches, which never attempt to unify these sectors or interpret them as manifestations of a single underlying field.

Finally, ToE is original because it **reverses the direction of interpretation** that has dominated the field for a century. Instead of treating information geometry as a mathematical tool for physics, ToE treats physics as the macroscopic manifestation of information geometry stripped of its statistical meaning. This reversal is not a reinterpretation of existing physics but a re-founding of geometry itself: the geometry of distinguishability becomes the geometry of reality. No prior theory has made this ontological claim, constructed an action to support it, or derived physical consequences from it.

On the Conceptual Leap of the Theory of Entropicity (ToE): From the Information Geometry of Fisher-Rao, Fubini-Study, and Amari-Čencov to the Geometry of Distinguishability, and to the Geometry of Physical Spacetime

In summary, the originality of ToE geometry lies in (1) the ontological elevation of entropy, (2) the reinterpretation of Fisher–Rao and Fubini–Study as physical rather than statistical, (3) the construction of the Obidi Action, (4) the unified emergence of spacetime, matter, and gauge fields, and (5) the inversion of the epistemic paradigm of information geometry. These five elements collectively constitute a conceptual and mathematical departure from all prior work, establishing ToE as a genuinely new geometric framework for fundamental physics.