1. Introduction

Abstract

We model systems as continuous awareness fields $\rho(x, t)$ evolving over a relational manifold defined over configuration space $\mathcal{S}$ and polarity space $\mathcal{P}$. Collapse occurs when internal tension between configurations exceeds a structural threshold, triggering an irreversible reduction of entropy and the elimination of incompatible alternatives. This process gives rise to structure, imprints directional bias, and leaves behind lasting patterns of resolution.

Collapse induces local curvature in both $\mathcal{S}$ and $\mathcal{P}$, guiding future behavior through inherited constraint geometry. We formalize this process using a collapse metric $\mathcal{C}_\infty(x, t)$, directional interaction fields, and threshold dynamics that determine where and when resolution occurs.

Introduction

This framework was originally developed from a thought experiment on probability.

In order to understand how the framework works its important to understand how it came to be

The Measurement Problem

In quantum physics the current biggest divide in the interpretation of the framework lies within what the reasons are for superpositions to collapse once measured. Current interpretations have tried looking at this in many different ways. Some have proposed multiverses that can resolve the logical fallacy of any object existing in multiple states at the same time. Others take spiritualistic and psycho-centered approaches to the issue and propose that the presence of an observer forces the superposition to resolve. Some try to dismiss the reality of the issue by labeling an artifact of the mathematics.

Regardless of perspective or strategy, everyone agrees that some interaction occurs at the moment of measurement. An interaction that through its very nature goes against the very concept of measurement and forces us to ponder on the philosophical implications of what a measurement truly is.

Schrödinger's Cat

To deal with the ridiculousness of the measurement problem, renowned physicist Irwin Schrödinger proposed a thought experiment:

- Put a cat in an inescapable box.
- Then place a radioactive substance and a geiger counter. Put enough just enough of that substance that the chance that it decays and emits a particle or does is exactly 50%.
- If it does decay, this is where the geiger counter comes in, have the geiger counter attached to a mechanism that kills the cat.

The intricacy of the thought experiment is in the probability that the substance will decay. Anyone that has no knowledge of whats happening inside the box can only ever say that the cat is either dead or alive. Which in practical terms is identical to a superposition of being dead and alive.

For the scientists in the experiment, they have no **scientifically provable** way of saying that the cat is either alive or dead without opening the box, which would break the superposition. When we reach the quantum physical level, scientists, again have no **scientifically provable** way of directly measuring what is happening inside the superposition.

What's the superposition then? The cat didn't transcend reality once we put it in the box, so how come quantum physics is telling us it should?

The Marble Problem

This framework began as a solution to a similar but unrelated thought experiment

Suppose this:

If you have a bag of marbles arranged in a way such that the probability of getting a red marble is $2/5$ and the probability of getting a green marble is $3/5$. Then, for this individual trial, what is the probability that I get a marble?

This question is trivial nonsense.

The answer is 100% there's no argument about that, but if we introduce a new variable, the color of the marble, then we start to get conflicting possibilities of what reality can be: its either $2/5$s red or $3/5$s green.

Physics as it is now has nothing against a trial ending up in a red or green marble, it merely insists that you cannot know the outcome of the trial. Why? Simply because you don't have enough information to make an assumption like that. That's the very nature of probability. If you don't have enough information then you can't know for sure, so, you can't tell me exactly what the outcome of each trial will be. We can guess and sometimes get it right, but, you can identify guesses through inconsistency, whereas in the study of probability, inconsistency is foundational to the subject. In this sense even knowledge itself is probabilistic since it's not about if you know something or not, its how much do you know and how much can you know. If

we choose only to discuss how much happens in the bag, how much there is in the bag and how much of the bag there is we're ignoring any underlying natures or behaviors of the system.

Limiting our understanding of reality only to how much of it we can directly observe/measure then we are willingly negating the possibility of things that we cannot observe, and not by human error but by nature of the method.

Though, if we are to accept the limitations of "how much", we have a new problem. If there are things I can't measure, how do I know what exists and what's my imagination?

Science's assumption is that existence necessitates stuff. That could be matter, or the current consensus for what physicality means. Whatever you choose to name it. Science's primary tool to deal with reality is by observing and measuring. These are fantastic tools, but to view this as fundamental is to understand the universe primarily through amounts. To illustrate the epistemological issue with this let's analyze a number line.

$$\cdots \quad 0 \quad 1 \quad 2 \quad \cdots$$

By itself, a number line can tell you nothing about why it is that the number 1 ever gets to 2. We learn that between the number 1 and 2 there are things called decimals $1.1, 1.2, 1.3$ and so on. To make it worse, you can extend that decimal to an infinite number of decimal places. So much so that the number one, if divided enough times should have no way of ever reaching the number 2. Number lines and the logic of progression necessitate that you place numbers next to each other so you can intuit that there is a logical sequence there. Now, to gain perspective, imagine you are an ant crawling on that number line. What the hell even is a number? Now imagine you are a microbe. What the hell is a line? How many creaks and crevices are there on that number line? There's ridges, topology, caverns. What looked like a smooth continuous line is now an entire canyon.

Objective value, or that there is a how much of something, depends on who's asking the question because the nature of any given object in the real world varies depending on what scale you are in. However, the culture around science has evolved to treat "What is the objective amount of this?" as the fundamental method reality verifies itself. Epistemology is not considered a science for this exact reason.

The benefits of measuring "how much of something" break down when you reach these loops of abstraction. "What is it to measure?", "What it is to know?" these questions have no direct reality to measure so if we proposed a concept to track them like a kilogram of measurement it would make almost no sense at all.

What does all this even have to do with marbles anyways? The problem that's being discussed here is the lack of a functional epistemological framework to the discuss the things that **can't** exist without confusing it with the things that **don't** exist.

In the marble experiment the $2/5$s of red and the $3/5$s of green are both physically permitted to exist. Neither possibility violates any physical law, but, neither possibility is observable until the trial is ran and the superposition is collapsed. This is a problem in Schrödinger's cat since you have to give information about something that either has not happened yet or you don't know if it's happened. It's not a problem in "The Marble Problem" though, the test makes no demand of any information for future trials. To satisfy the problem you only need to answer whether you got a marble or not and you can do that whenever you feel like it. So now that we don't care about the future of the test we're left solely with a superposition inside the bag.

You may have noticed that the superposition doesn't really exist anymore.

Now that we know we're getting a marble, we can definitively say that there are marbles in the bag, in fact, since we know the probabilities we can even math our way into saying that there are 5 marbles in the bag, so we've already managed to collapse the superposition without ever directly measuring it. The superposition only returns if we ask about the colors of the marble. So?

What is this superposition telling us? What could it be?

Absolutely nothing, there was never any superposition in the bag to begin with. Before the end of the trial the answer to the question "What marble did you get?" physically it does not exist, and if we ask it from a physical perspective, we're forcing a superposition to emerge.

There is no marble in your hand yet, but, you know you will get it, as such you now exist in a state of both having and not having the marble. Interestingly, if we reintroduce the color variable we resolve this superposition, since now you know that you don't know, and you can now make a claim of where you are in the binary state of having and not having a marble.

Information as it is communicated today is mostly understood through the concept of binary, either 0 or 1. This concept creates a physical stutter in our understanding of the phenomenon. 0 and 1 graphed do not naturally connect, on the other hand, the universe, is built on continuity. We humans beings are built of cells built of DNA built on base pairs built on chemistry built on physics built on real information.

So, if we are to model the natural phenomenon of information, we must layer continuity inside the very logic of the epistemology we use to talk about the "Marble Problem".

To model this continuity must start accounting for the space in-between 0 and 1. Also for any other possible conceivable combination that can be made from 0 and 1. Instead of having 0 and 1 be two separate dots, we choose to model them as as one continuous line so that the continuous nature between 0 and 1 be represented.

In order to encode further information within it, this line must make a wave shape.

To account for every possible decimal and that decimal's convergence into the fixed identity of either 0 and 1, we must include curvature to represent said convergence. If we were to use a straight line, we would be cutting corners, only taking either full numbers of halves which doesn't really help us.

Curves naturally allow for us to add more numbers to the line, as long as you have a coherent peak and trough, you can subdivide it infinitely. Which allows us to communicate near infinite information through the line. Analyzing this line further we notice that points of less curvature can be interpreted as stability and points of higher curvature as convergence or collapse to a fixed identity

You may be asking how many dimensions you should put on this line, and really you can put however many you want.

It's an abstract line all it requires is that it fulfill the condition of representing the nature between 0 and 1. As long as it encodes for 0, 1 and all the decimals between them, you can extend or contract this line however many more ways you want, you just need to make sure 0 and 1 exist in it. What you have now is essentially an abstract measuring device, which you can use to model abstractions within "The Marble Problem".

Let's use it to model the process of gaining knowledge about the marble.

Since we're modeling the abstract process of gaining knowledge we must use our measuring device on the objective awareness of the person running the experiment.

For this awareness to be measurable and exist it has to be in a field. So we define an abstract awareness field:

$$\rho(x,t) \quad \text{— awareness field}$$

Within that field we define awareness as

$$\rho(x,t) : \text{Epistemic readiness to collapse at point } x \text{ at abstract time } t$$

Let's say that the higher the peak of this wave more confidence on the outcome of the experiment and the lower the peak there's lower confidence on the result. The rest of the coherent wave structure would be concentrated awareness.

The hardest challenge in trying to imagine the waves discussed in this thought experiment is how many dimensions do I have to picture this wave in. When thinking about this experiment do not consider dimensionality. You see, the waves we're talking about are fundamentally abstract, they're oscillations in a field. Any further attempt at description physically destroys them. In fact even this definition of awareness field is inherently faulty definition, not as a misleading word but rather that the very process of defining this wave goes against the type of wave that it is

"But what if I imagine that the wave didn't break?

You just destroyed it.

Similarly, for this abstract wave to be said to exist, it needs an origin point. An origin point is a point where existence begins. Number lines normally have origin points at 0. This allows the number line to encode the concept of directionality thanks to the relationships between the numbers on the line. Likewise, any abstract line in any arbitrarily dimensional space requires an abstract origin point with an abstract number of dimensions. We cannot say that it spontaneously emerges or else we would break continuity, which would break reality which would destroy our experiment. That origin point then, has to exist equally in as few or many dimensions as you could desire. Which then means, that by virtue of necessity, that origin point, due to its own nature, must exist in every single possible mappable position that you could ever possibly map it. The only way that it doesn't is if it interacts with something that forces it to assume a fixed description without breaking its structure.

The word "fixed description" is meant quite literally in this example. Remember, this is an imaginary abstract wave we're talking about. If you are picturing it you are destroying the wave, to truly grasp this wave you must be able to intuitively feel it. The best way to do that is to not actively think about the shape of the wave. Just to accept that it has structure and find ways to intuit that structure from relationships. That put in practice is the nature of the wave we're discussing.

For this wave to retain structure and have varied interactions, it must by necessity of waves interact with other waves in the same field. "But aren't you assuming that other waves exist?". No. The moment that you establish the existence of one wave in the field. The logical followup "What if there's another wave?" necessarily emerges. This isn't assumption since we're not saying that a wave is there, instead the wave might, or might not, be there. So now that one wave exists. The very logic of abstractness itself, must accept that another wave could also exist. This wave is even more abstract than our abstract awareness wave since we can't say anything about it other than it might be there.

For mathematicians

$$\rho(x,t) = \rho_1(x,t) + h(x,t)$$

$$h(x,t) \in \mathcal{S}_{\text{open}}$$

$$\mathcal{S}_{\text{open}} := \{\rho_i(x,t) \mid \rho_i \text{ is compatible with } \rho_1 \text{ under the field's abstract logic, but unresolved}\}$$

Since we're modeling the "Marble Problem" we can only say for sure that there is a marble that will leave a bag and some observer is going to see that marble. That enforces structure within the abstraction. The paper is centered on generating effective visualizations of this so for now stick to imagining this.

The only way for this wave to gain awareness from the bag is if the bag has a compatible wave of its own. We can't presuppose anything inside an abstract system except for what the concept necessitates. For this wave to exist it necessitates that there's nothing you can know about it other than something might be there. Inside this awareness field the only thing we can say about the wave is that it either is there or not or that it might be there. So the only way for these waves to ever interact is if the bag also has its own awareness wave (either its own or just related to it) that can interact with ours and maintain coherence. Since we are in an abstract system and we can't know anything more than that the bag might be there.

We haven't talked about the marbles within the bag though. Which by virtue of the experiment must too exist. They create a lot more complexity within our abstraction.

Since the marbles have to be inside of the bag, we need, inside of a superpositional object that can move in any direction and exists in every point, place other superpositional objects. With a constrained number of directions in which to go in. These objects have a different property than our other superpositional objects, they have a constraint: a limitiation of which direction they can go in and a direction they must be in. The marbles have to be inside the bag, the bag has to be where it is, if they're not, we're talking about categorically different things.

"But what if i imagine they're not?"

You're the one imagining it and it makes no impact on the total system, just the observer's awareness wave."

As such, with these limitations imposed on them we see two things emerge:

1. The marble gains fixed identity; We know they're there and we know they must be marbles
2. The marble needs a new direction to move in since the previous ones have been infinitely limited

With these infinite impositions the marbles have choice. To curl, and move around a fixed center. The marbles, wanting to move in every possible direction, move in every possible direction around themselves. Being that this is an abstract system that can only say the marbles are inside the bag, we can't say that the bag is going to stop waves from the marble from affecting their surrounding.

"But what if I imagine that its a conceptual property that the bag stops the marble from interacting with the environment around it?"

Then you have to imagine that it also could not be. The bag, objectively being a superposition in this experiment, has to allow for that possibility to exist. The marbles, also superpositional, have want to still interact with their environment. So some of that interaction will leak from the bag. How much? In an abstract system that can only say that an object might be there. There is

infinite leakage. Therefore, the curl of the marbles twists the field around itself an infinite amount in infinite directions biasing it around itself thanks to its identity as a marble. Since this is an abstract system and we can't say that something like light exists (though we could) We don't have a black hole, just an spinning abstract attractive identity.

Now that we've mapped out our abstract field. Let's model the interaction of two awareness waves.

We've made a lot of assumptions to this point, but every single assumption only holds insofar as it can be related to the main conditions of:

- Abstractions
- That an Abstract thing will happen where some thing resembling a trial where a fixed thing gets some fixed marble inside some fixed bag.

If you assume anything that doesn't apply to those two conditions and the infinite logical assumptions that emerge from them, then you have failed the experiment.

Though all we've discussed inside this abstraction are things that we can't know, if that is the true nature of this system, then how are we supposed to know that anything inside the system is true? The reality of this abstract system is that the only things that we can know for sure are the things that can be traced to other things inside the system. If we say something like, "I want to know with 100% certainty that something exists in this abstraction" We would destroy the logic of that system. Structurally breaking it apart. It's why abstract things can't cut perfect corners in this system. A perfect corner implies infinite change to an existing point. The system doesn't allow since every point exists in relation to every other point, which naturally curves the system and gives it continuity. This isn't to say that corners can't exist. They just need a structure that they can break in order to exist.

Remember this is all discussing the logic of this abstract system in "The Marble Problem" none of this applies to real physics, but at this point you may have already noticed the similarity in the language we need to use to describe this abstract system of awareness waves and the language used in quantum physics. You can say that that is because the experiment with quantum physical language in mind, but that wouldn't be true. The experiment emerged from a question on probability, which although it plays a big role inside of quantum physics, probability is inherently an informational phenomenon. In other words, the waves that we have built here are built from the structure of thought itself. The only guiding principle in the structure of these waves has been what can be logically conceived whilst maintaining coherence.

Don't forget, we are NOT talking about quantum physics. None of what I discussed requires you to assume any particles or any laws of thermodynamics. It just requires you take the conditions and method given in the thought experiment and follow the logical threads that emerge from it. The similarity to quantum physics isn't surface level though. From this thought experiment a

comprehensive abstract framework has been developed, and a simulation engine that confirms the framework's consistency has been built.