Reality Re-Envisaged

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"Scientific thought is fed by the capacity to 'see' things differently than they have previously been seen" Carlo Rovelli [1]

1. Introduction

The Foundational Questions Institute's 2016 essay contest invites authors to discuss **how aims and intentions arose from mindless mathematical laws** ("the Problem"). The Problem hinges on an ancient issue: how to reconcile the subjectivity of minds with the objectivity of physical law.

Since the 17th century, issues touching on the immaterial have been regarded as outside the scope of science. Francis Bacon [23] and others came to the view that non-measurables such as aims, intentions, and the state of one's soul, were best left to the church. They established science's domain on the firm ground of physical observables. This scope definition, tentative when proposed, is now taken as fundamental. The stunning successes of science were accompanied by a creeping intellectual hubris, to the extent that today reality itself has become synonymous with the physical world; the immaterial has been excluded[i]. Thus we have the much discussed "mind-body" problem which continues to evade solution [2-21]. But as humans we spend a great deal of our time in the immaterial domain: thinking, forming aims and intentions, worrying about relationships, and wondering about our place in the universe. This dichotomy implies that ultimately we don't know what we are. Are we simply neuro-bio-mechanisms, and our thoughts a meaningless side effect? This is one view [6]. Are we just high-performing apes [5]? Competing economic agents? Beloved creations of an omniscient Creator [25]? Spiritual beings inhabiting animal bodies [26]? Our existential confusion and lack of progress on the mind-body problem may be the result of an inappropriate starting point. We may need to completely re-envisage reality before we can move forward. This work explores that possibility.

The remainder of this paper is divided into three parts. In section 2 we re-envisage reality as a three-part system, consisting of the physical world, the world of ideas and concepts, and minds connecting the two. In section 3 we apply this new Model of Mind to the Problem to identify a possible solution. Finally section 4 states conclusions and identifies some topics for further exploration.

2. Model of the Mind

Before we can begin to discuss how aims and intentions arose, we need to know what they are and what kind of entities it is that can have them[ii]. These starting point requirements can only be met with a clear model of the mind. Providing that is the aim and intention of this section.

Today's physics is framed on the assumption that the only things that truly exist are material in nature. Yet it is undeniable that ideas and concepts (including aims and intentions) are an aspect of reality. Although they cannot be seen or weighed or have particles bounced off them, they govern our lives. Laws, language, manners, mathematics, maps, literature; we live in a rich tapestry of abstractions. Thus, if we are to address the Problem, we will need to find a more general frame, one that admits the existence of an immaterial "field" of ideas and concepts[iii].

This raises many questions: What is this field? Where, and when, and how does it exist? How does it affect physical objects? We need a model broad enough to encompass both the material and immaterial aspects of reality, rich enough to yield useful insights into the Problem, and precise enough to support empirical analysis.

2.1 The Ideas Field

Let us use "Ideas field[iv]" to refer to the immaterial aspect of reality. We continually engage with our Ideas Field, exploring it, developing it, contending with others about it, evaluating it, voting on it, and so on. No other species does this, as far as we know[v]. Physicists model the physical world as a set of objects with relationships in space-time; analogously we will model the Ideas Field as a set of items of shared information with relationships of a different kind.

An item exists in the Ideas Field if two or more people share it. Two examples:

A word that children invent. It could refer to anything, from a made-up game to a particular type of weather. As long as they remember it they can use the word to bring its meaning into their play, acting on its possibilities in the context of the moment. With the word the play goes in one direction; without it a different one. What is essential is that items in the Ideas Field affect events in the physical world, through the agency of minds. Minds recognise ideas and concepts and use them to guide their actions in the situations they face.

The second example: a stop sign. No animal regards it with interest, but drivers (nearly) always halt their vehicles as they near one. What is the causal logic here? It is not the stop sign itself that causes the vehicle's space-time trajectory to change, but the driver's recognition of the concept attached to the symbol on the sign. Drivers share an association of the symbol with driving behaviours and a host of related ideas and concepts, such as law, danger and speed. Once again, we see minds recognising ideas and concepts relevant to their situation and using them to guide action in the physical world.

As well as shaping the physical world in response to the Ideas Field, minds also generate new ideas and concepts and introduce them into the Ideas field. This essay itself is an illustration of that point.

With these foundations established, we can state the first two tenets of our model of mind:

1. Reality has two aspects: a physical aspect, which holds material[vi] objects with specific space-time coordinates, and a conceptual aspect, the Ideas Field, which holds information shared between minds and has a different relationship with space and time.

2. Minds are entities capable of operating in both the immaterial and material domains and connecting the two. Human[vii] minds translate concepts such as aims and intentions into physical actions through their senses and bodies, and act in the Ideas Field through language, art, science, etc.

Sections 2.2 and 2.3 provide more detail on our Model of Mind. Readers may wish to scan section 3 first to see the broad outline of our argument.

2.2 Mind as an Information Pattern

We now turn to the mind itself, and our third tenet: **the mind is a pattern of information**. This is an imaginative ansatz, but a substantive one.

To connect the physical and conceptual domains, we need something that is both physical and conceptual. A pattern is such an entity. Static patterns are woven in cloth and painted on surfaces. They could not exist in the physical world without some medium, but the same pattern can be expressed on many different media. Their essence is the shape they make and the idea that it conveys. These words, for example, express the same idea whether rendered on paper or screen; it is their pattern, not the medium, which is central.

When we picture the mind as an information pattern, we see that it is not static but continually changing. Brain monitoring technology reveals transient waves of neural activation with specific spatiotemporal forms that relate to particular cognitive tasks. These waves of activation are packets of information and form the internal vocabulary of the mind. We will refer to them as "idea gestures", generalising from the fact that physical gestures are generated by waves of activation in the motor cortex and cerebellum. We now explore some of the ways idea gestures interact with and shape the Information Pattern:

1) Idea gestures in one region of the pattern provide inputs to others. For example, light on the retina initiates a cascade of idea gestures: edge detection, symbol classification, word recognition, language processing, on up and up to options evaluation and eventually a choice. Each person's pattern has a set of idea gestures it can perform, and these constitute the language it uses to decide its next move[viii]. One person plays the violin, another cricket, and another writes essays on the nature of consciousness.
2) When novel conceptual information is received, the pattern absorbs the information with idea gestures that mirror (sometimes imperfectly) the form in which it was received, then it processes them with more and more abstract idea gestures to evaluate, generalise and perhaps apply the concept. Eventually, the pattern may incorporate the concept into itself by creating new gestures that encapsulate it. This is the nature of learning.
3) We reflect the words, expressions and movements of others (their *physical* gestures) with our thoughts and emotions (our idea gestures), and we respond with physical gestures, as in a conversation, a creative effort, or even a fit of rage. In each moment, we trade back and forth between the Ideas Field and the physical world around us, ignoring the stop sign in an emergency, or damping out distractions as we perform a difficult feat of reasoning or art. This is the nature of acting in the world.

4) In common with the brains of non-conscious animals, our brains use gestural mechanisms for a host of automatic calculations, such as those required to maintain balance while walking or form sounds when speaking. The distinctive feature of minds, we claim, is their capability to generate new information, which emerges at a systems level. When we think, our pattern forms ideas as sequences of idea gestures, each corresponding to an element of the Ideas Field, the physical world, or our pattern itself. We can form aims and intentions because, as living patterns interacting dynamically with the Ideas Field, we can evaluate our own state, treating our idea gestures as objects to be considered [11].

In summary, **minds are living patterns of information connecting the Ideas Field with the physical world**. They:

- give physical form to concepts (e.g., architecture, engineering)
- develop concepts based on experience of the physical world and the Ideas Field (e.g., physics, philosophy, literature)
- and play back and forth between the two (e.g., music, art)

In the next subsection, we identify a unifying principle connecting physical world, the Ideas Field, and minds: information symmetries.

2.3 Concepts and Ideas as Symmetries

We understand the physical world to be everything that has space-time coordinates. The Ideas Field does not fit into that category; nevertheless it is an important aspect of reality. Minds seem to sit somewhere in between. So what is the connection between the Ideas Field, minds, and the physical world? We need to understand this to connect aims and intentions to the laws of physics.

The Ideas Field consists of symmetries among information patterns (minds). Language is perhaps the best example. Within the brains of each speaker of a language, there are learned mechanisms that reflect the terms and syntax of the language, enabling them to express their thoughts through neuro-muscular idea gestures and understand others' speech through mirroring idea gestures. Among different people, the specific idea gestures that represent a shared concept or idea (e.g., a word) will vary; but they will all "point" to the same element in the Ideas Field. This symmetry among information patterns connects the physical world with the Ideas Field. The Ideas Field, as a set of relationships among information patterns, is an aspect of the physical world even though it lacks the specific space-time coordinates of a physical object.

The symmetry evolves from tangible to abstract. We illustrate with a story. In the tangible stage, people see something and note it – perhaps they might enjoy eating it later when they are hungry. In that moment, they create a symmetry between their minds, pointing to the object in the physical world, but also to an aim in their Ideas Field – to gain that enjoyment. Soon they move on - the object is no longer in view, but the symmetry persists. When they become hungry, they discuss the idea of returning and compare that idea with other options. Then they decide, turning the aim into an intention and acting in the physical world to get that meal. In the next stage, they talk about the experience, evaluating it and

considering what they might do next time. Now they are creating symmetries that refer to physical possibilities – shaping their future meals. In yet a higher stage, they compete, betting on who can bring the best meal home. They have moved up a level of abstraction, to the idea of comparison, referring not to specific objects but to their relative enjoyment, a different symmetry. The evolution continues on to counting games, up another level to number, which exists only in the Ideas Field, and so on to stages of abstraction like higher mathematics and FQXi.

The individual mind takes its shape, i.e. learns its vocabulary of idea gestures, from the patterns it experiences: speech from the speech it hears, behaviours from the behaviours it sees, and ideas from the ideas it encounters. Using these, it forms its aims and intention: concepts and ideas about its future. As groups develop mutual understanding, they build symmetries between aspects of their information patterns. The strength of these symmetries bears on how well they co-operate, and thus on the chance their shared aims and intentions will bear fruit.

3. Applying the Model of Mind to the Problem

We can now apply our model of mind to explain how aims and intentions arose from mindless mathematical laws.

We begin by looking at the broad trajectory of time, as through the wrong end of a telescope. This gives useful perspective and reveals the essential nature of aims and intentions. We then go on to describe how aims and intentions arose synergistically with early technologies, using two archaeological artefacts to build our case.

3.1 The Trajectory of Time

If we consider Earth's history from its formation to the present, we can distinguish three broad eras, based on how its state vector[ix] varies.

In the first era, before life appeared, the future depended only on the current state and the laws of physics. We call this period the "Machine Era" because in it everything behaved like a stateless machine, for which history is irrelevant. In this era, mindless mathematical laws ruled completely.

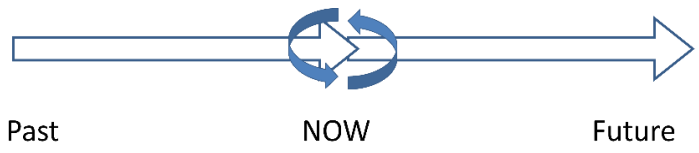

Figure 1: Trajectory of time in the Machine Era

Figure 1[x] represents the fact that in the Machine Era, past and future were equal in terms of the possibilities they held. The circular arrow symbolises a future state computation depending only on information generated in the immediately previous state.

In the Machine Era, the state vector could only range over a fixed set of possibilities; it moved in orderly channels within fixed boundaries set by the laws of physics. Mathematically, it was confined to a box.

In the "Biological Era" the future became dependent on information generated in the past, as well as the laws of physics. Organisms developed according to genetic patterns set down in the past, and remembered experience guided behaviour. Improbable state vector configurations became more common via natural selection [27]. New things appeared: cells that could reproduce, plants that could alter the composition of atmospheres, animals that could eat plants and one another, and brains that could learn to gain advantage.

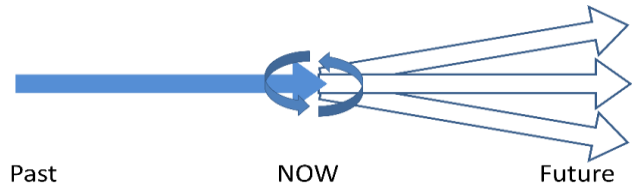

Figure 2: Trajectory of time in the Biological Era

As figure 2[xi] illustrates, biology broke the symmetry of past and future as information from the past flowed into the calculation of the future state. As a result, the state vector's range began expanding, no longer moving in orderly channels within fixed boundaries, but branching in unexpected directions.

The future no longer had to be like the past; the number of possible states increased with time. Mindless mathematical laws were no longer in complete control; the future became unpredictable.

When humans[xii] appeared, the "Conscious Era" dawned and the state vector's dynamics altered again. In the Conscious Era, rather than everything being governed by fixed laws and information from the past, minds began to discover and exploit the principles connecting the present with the future. They learned to transmit ideas across time and space, with tools such as writing. They began uncovering and applying nature's laws, and creating laws of their own.

In the Conscious Era, minds play an important part in the unfolding of reality. By sharing information, they develop deeper and more precise understandings of the world, and they use this power to select futures they prefer. The state vector is no longer passive, but selects its future. Each of us manages our part of the state vector, and our collective choices define the overall trajectory.

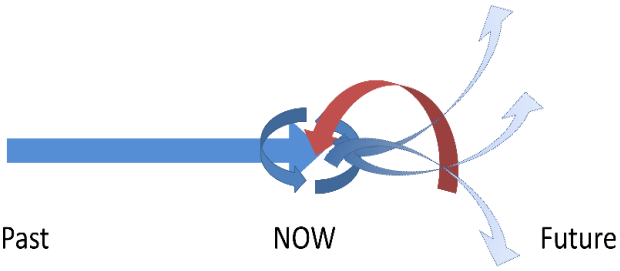

Figure 3: Trajectory of time in the Conscious Era.

The red arrow in figure 3[xiii] represents the new feature of the Conscious Era: information about possible futures influencing choices in the present moment. As we become more and more competent at seeing into the future, making choices (aims), and following them through (intentions), the set of possibilities expands with ever more deliberateness, specificity, and velocity.

We can see this in the changing skyline of our cities. Many of today's designs were unfeasible only a few years ago. Our expanding body of shared ideas and concepts: materials, structures, finance, administration, politics, and many other domains makes this possible. Generalising, it is not matter, but living knowledge, the Ideas Field, which enables conscious beings like ourselves to design their future.

To summarize, the time-pattern of the world's state vector changes radically over time. In the Machine Era, it is confined to the box mathematical laws allow. In the Biological Era the box begins expanding slowly. But in the Conscious Era, the expansion becomes explosive. The three eras help us see what aims and intentions are: a looking into the many possibilities the future holds, a deciding on which of these are preferable (aims), and a selection of measures to help ensure preferred futures come to be (intentions). Humanity's efforts to limit the impact of climate change is an example.

3.2 How Aims and Intentions Arose

But we have not yet solved the Problem. We need to know how humans came to create an Ideas Field capable of supporting aims and intentions. How did we change from being just another forest creature into the planet rulers and knowledge authors we now are? This section argues that technology was a key driver, using two examples.

Figure 4: The Olduvai stone chopping tool [31]

Figure 4 shows the Olduvai stone chopping tool [30], collected by the Louis Leakey East Africa Archaeological Expedition in 1931. Dated 1.8 million years ago, it was shaped from volcanic rock by early humans.

The first known technology, it is an end-user device for projecting force with precision. It was used to cut branches from trees, kill game, carve meat, smash bones for marrow, and other practical tasks.

In order for people to use chopping stones effectively, various concepts and ideas had to exist. We notice two groups. The first is associated with kinaesthetic technique, and seems likely to have been shared through mimicry:

- To create a chopping stone, the right kind and shape of rock must be found. Then it must be struck just the right way, with a suitable hammer stone. The process is demanding; many things can go wrong before sharp edges emerge and the tool fits the hand as it should.
- Then to use the stone, it must be held correctly and struck against the target with precision and the right amount of force for the task.
- The way it is used varies with the task: smashing marrow requires a different motion than stripping bark.

The second group is associated with relationships, and here we find concepts and ideas likely to have been present in the earliest Ideas Field:

- Quality: the size, shape, weight and sharpness of the stone relative to other objects that might be used for a particular task.
- Danger: avoiding provoking anyone holding a chopping stone.
- Group: seeking to become an ally of tool makers and owners.
- Knowledge: learning how to make these powerful objects.
- Commerce: trading with them.

Many of these have associated aims/intentions:

- The aim/intention to enhance one's status and survival odds by gaining skill in selecting and applying the technology.
- The aim/intention to minimize risk by being careful near people wielding the stone.
- The aim/intention to find security in the company masters of the technology.
- The aim/intention to learn the craft of making chopping stones.
- The aim/intention to accumulate resources through trading valuable items such as these.

The chopping stone demonstrates the criticality of the Ideas Field to human societies. Chopping stone knowledge can be discovered by individuals, but discovery is rare and knowledge can be lost. Sharing reduces that risk. Furthermore, sharing often leads to improvement. Groups that develop a robust Ideas Field to support the growth of knowledge gain a survival advantage.

We can add detail to this picture by identifying likely paths for the transition from mimicry to aims and intentions. Here is one among many that may be reasonably conjectured[xiv].

Picture a family group coming to where the right type of stones are found, and working together to shape them. The young mimic the moves of the older experts, and their rhythms synchronize, with vocalization[xv] adding colour. Over time, the vocalisations become song, and the song tells a story – first of what was, and then of what could be: a plan for the next hunt, perhaps.

The association of concepts with practical objects such as chopping stones marked a first step in the development of the Ideas Field. Later, concepts became associated with objects of purely symbolic significance.

Figure 5: The Ain Sakhri lovers

The Ain Sakhri lovers, a sculpture dated at 9000 BC and found near Bethlehem [32], is one of the first examples of a human experience captured in stone. Only 10 cm high, it conveys a powerful message. Unlike the chopping tool, it is not practical; it does something subtler. It captures and communicates the experience of a transient event: it freezes time like a photograph.

The chopping stone worked on plants and animals in the physical world, but the sculpture's work is in the Ideas Field. Its purpose is to influence aims and intentions – arousing people and drawing their minds towards particular possibilities and actions. Advertising has entered the Ideas Field.

Like the Ain Sakhri lovers, the words on this page freeze a transient event (my thoughts) and make them available at different times and places. The sculpture and the words both insert content into the Ideas Field. They both advertise the notions they want to communicate, so that others can evaluate them and act on them or perhaps incorporate them into their own patterns.

Conclusions

In this essay, we have re-envisaged reality as a system in which information flows back and forth between the physical world and the Ideas Field, driven by the activity of minds. On that basis, we have discussed how the emergence of the Ideas Field, with aims and intentions a key aspect of it, was fostered by technological development.

This work suggests several avenues for future development:

1. The idea of self-aware information patterns is one which seems amenable to an IT implementation. Interesting progress in this direction is already evident [29]. The architectural features this essay identifies may be useful in that regard.
2. Our model suggests a litmus test for consciousness: an expanding Ideas Field[xvi].
3. Symmetries in the Ideas Field seems to represent a new challenge for physics. In the physical world, symmetries correspond with conservation laws, and we can manipulate these, creating interesting effects such as entanglement [22]. How to manipulate symmetries in the Ideas Field of humans is not clear. However, it may be possible with symmetries in the Ideas Field of future artificial minds.
4. We have a rich and growing body of knowledge regarding physical entities, but our understanding of entities in the Ideas Field and their relationships is at an early stage. Rectifying this seems likely to enhance our ability to guide the future more reliably.

One final thought: If eventually a re-envisaged reality along these lines comes to be accepted, humanity's place in the grand scheme of things will have changed: from meaningless insignificance into lead authors (or at least contributing authors) of one of its most interesting and dynamic aspects: The Ideas Field.

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Endnotes

[i] "Mindless mathematical laws" are immaterial, nevertheless are regarded as a fundamental aspect of reality. We note this contradiction but will not explore it here.

[ii] We avoid focusing on goal-oriented systems, because these need not have aims and intentions. A migrating bird has a goal, but its goal is not something it can consider or alter. This is the essential characteristic of aims and intentions – they are chosen, and may be altered. Harry Frankfurt [22] makes this point compellingly

[iii] We are thinking of concepts as nouns, e.g., justice; and ideas as sentences connecting concepts, e.g., revenge is not justice.

[iv] Our use of the term "field" for ideas and concepts is by analogy with physical fields such as gravity and the electromagnetic field. The analogy is imperfect. Physical fields have extents in space and time; ideas and concepts are different.

[v] We take no position on whether or not animals may have ideas. We do contend that they lack a Field of Ideas which develops over time.

[vi] We include fields such as gravity and packets of energy such as photons under the material objects heading.

[vii] Other kinds of minds is a possibility our model allows for

[viii] This is somewhat analogous to the way cellular automata use rules to compute their next state [28]

[ix] The state vector is a conceptual tool physicists use, consisting of the set of quantities that completely specify a system. The common dice game's state vector consists of two numbers, one for each of the top faces. That of an enclosed quantity of a pure gas consists of 6N numbers, where N is the number of molecules: 3 for the coordinates of each molecule, and 3 for the velocities along each coordinate. The state vector of a world holds all the information there is about that world.

[x] Original image

[xi] Original image

[xii] And possibly other equally or more competent species.

[xiii] Original image

[xiv] Others spring readily to mind, and this supports our argument. The more possible paths there are to a destination, the more likely the destination will be reached.

[xv] We say nothing about the kinds of sounds produced.

[xvi] Whale song changes over time, and this may indicate an evolving ideas field.