





How to Believe in Becoming

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Lee on temporal experience

- “A scientific theory, to be successful, must explain to us the observations that we make of nature. Yet the most elemental observation we make is that nature is organized by time. If science must tell a story that encompasses and explains everything we observe in nature, shouldn't that include our experience of the world as a flow of moments? ”

- **The Heraclitian conception:** The universe is undergoing an absolute and irreversible process of *coming into Being*.
- **The Parmenidean conception;** The universe consists of a fixed four-dimensional block of events

Time as Experienced

- **Asymmetry**; the past is different from the future.
- **Flow**: at any given moment, there seems to be flux, movement, or change.
- **Passage**; when we look back over our histories, time seems to be 'passing us by'; in the sense that what was once future is now past.
- the fixity of the past and **openness of the future**

Carnap

- “That this experience cannot be grasped by science seemed to [Einstein] a matter of painful but inevitable resignation. I [Carnap] remarked that **all that occurs objectively can be described in science**; on the one hand **the temporal sequence of events described in physics**; and, on the other hand, **the peculiarities of man’s experiences with respect to time, including his different attitude towards past, present, and future**, can be described and (in principle) explained in psychology.”



The content of temporal experience

Perspective

- Within a physical framework the manifest image of history is the viewed from the perspective of the embedded embodied participant.
- Can we give an explicit characterization of ‘the human perspective on time’?
- And is there is a *transformation* that takes a static image of a four-dimensional manifold into an evolving image of a universe in the process of Becoming?

The temporally Embedded Momentary Perspective (TEMP)

- This is a representation of time relativized to a particular moment in a psychological history: a snapshot of time, taken from the here and now.
- The representational content of perceptual experience has a small but finite temporal breadth
- Perceptual experience is embedded in a psychological context with memory that has much longer scope
- There are different kinds of memory: e.g., episodic memory (records of past experiences), and autobiographical memory (a more or less coherent narrative of one's personal past).

Looking forward

- We don't just represent the **past**.
- **We also represent the future.**
- This is true even at the level of perception.
- And much more obviously at the level of thought

In sum

- One's view of at any moment is a representation of **history as a whole**, with past and future portrayed in different epistemic castes.

The Temporally Evolving Point of View (TEvPoV)

- This is the progression of views over a life as a whole
- It is **obtained by stringing together temporally embedded points of view** (TEMPs) in an order defined by their frame-defining temporal parameter
- The content of the TEvPOV represents the view of time from an **evolving frame**.
- NB: it is not just the externally observable events of your life, but the perspectives themselves that we represent.

how to build a system whose representational states have this structure

- start with a system that is receiving perceptual input from the environment,
- add a temporal dimension to its representational states,
- allow memory to work recursively on those states, first storing them as snapshots of passing experiences and then organizing them into an explicit autobiographical history.
- Take a **temporal cross section** of the resulting stream and you have the contents of the **TEMP**.
- Take **the whole stream** of representations and you have **TEVPoV**.

Adding Decision

- A cognitive system with the capacity for decision-governed behavior is not just a passive consumer of information, but a *producer*.
- Decisions, judgments, choices have the status of **mental performatives**.
- The effects of decision, conditioned on the contents of memory, **propagate into the future**
- Beliefs about the past, by contrast, are FAPP indifferent to choice (conditionalizing past events on present choices, given the body of information contained in memory will not (FAPP) alter their probability).

The flow of information

- There is a directed flow of information in through perceptual channels where it is combined with memory and used to fuel a decision procedure whose output one gets information about in the next cycle of perception. Our sense of where the connections lie in nature and the direction in which they run is a product of this flow.
- Start with a field of events that are the field over which belief is defined
- **Actual history** is given by a fixed truth valuation over this field.
- **Belief** (credence/opinion) is represented by an evolving probability distribution over the field.
- The *flow of information* refers to **the way that the probability distribution evolves in response to input from perception and decision**

Letting the cycle run

- This generates structure at the phenomenological level in two ways.
 - The brain gloms onto regularities and patterns that appear over time, and stabilizes distinctions that depend on those patterns.
 - Representations of past experiences accumulate in memory, reflective processes take those representations as *objects* and a much more interesting hierarchy of beliefs begins to emerge.
- The accumulation of memories involves **explicit representations of how history as a whole appeared to us from differing perspectives over the course of our lives**

Notable features

- The *content* of any perceptual state spans a finite interval of time
- There is an almost profligate **reification of structure** along the temporal dimension of your world-line
- There is a **direction** to the internal flow of information over the field of belief

The Heraclitian properties of temporal experience

- **Flow:** the fact that the content of experience at any instant spans a finite interval means that the world as perceived at any moment *as* moving, changing, constantly in flux.
- **Passage:** The fact that the TEvPoV is evolving, means that your perspective on time is changing over the course of your history in a way that is readily represented in your autobiographical history
- **Openness:** You cannot stabilize your beliefs about the future until you've stabilized your choices. And you cannot stabilize your choices until you've made them. This means that you cannot view the future as already in place, there to be discovered before the choice is made.

The content of temporal experience and the absolute structure of time

- In **temporal experience**, events are ordered (and reordered over time) by their practical and epistemic relations to the viewer at different points in her life.
- Viewed **sub specie aeternitatus**, the events of history ordered only by their intrinsic relations to one another.
- Passage, flow, and **openness** emerge as **artifacts of changes in perspective** relative to the fixed background of absolute time.

From Heraclitian time to Parmenidean time and back

- We can **transform between these two perspectives** in the way we can transform between a **frame-dependent** and **frame-independent** representation of space.
- The generator of the TEVPoV is more complex, e.g.,
 - it is an iterated procedure, rather than a static mapping, and
 - Iterating the procedure allows structure to build up around *changes* in perspective in a manner that generates a complex hierarchy inside the frame
- But it plays the same formal role

Competing visions or two sides of the same coin?

- **George Ellis:** the history of Being is “ongoing irreversible development of time itself.”
- **John Norton:** “The passage of time is a real, objective fact that obtains in the world independently of us. ... it has all the marks of an objective process whose existence is independent of the existence of we humans.”

Passage is an illusion

- **Thomas Gold:** "We ought to eliminate this flow idea from the real picture, but before we can eliminate it we ought to understand how it arises. We should understand that there can be a self-consistent set of rules that would give a beast this kind of phony picture of time."

No real conflict

- Physics moves towards an increasingly Absolute conception of reality.
- It is a product of the logic of that progression that **a lot of the structure that has the most immediate epistemic and practical import for us ends up being perspectival.**
- “Perspectival” means **implicitly relational**, not unreal.



Closing the circle

- There are two “dimensions” in the logic of the relationship between the manifest and scientific image.
- **The vertical dimension:** transforming a fine-grained macroscopic model into a coarse-grained image
- **The horizontal dimension:** transforming a vision of the world into a view through the eyes of the participant in history
- Adding the vertical dimension allows us to bring experience and ontology back together as part of a single unified vision.

The relevance to physics

- **The negative way:** there is a lot of distracting noise about the relationship between Heraclitian and Parmenidean time; getting clear on the status of the heraclitian appearances can at least soften the impact of the noise.
- **The constructive way:** physics is moving into uncharted territory, and again time has been a central focus. Worries about the appearance (or disappearance) of time in quantum gravity are raising new issues and we are seeing here ways of recovering temporal experience that might be helpful in that capacity (e.g., a thorough relativization a la Rovelli, with time emerging as a relation between two kinds of physical system, one of which functions effectively as a clock for the other.)
- **More generally,** reexamination of the relationship between the fundamental ontology and our experience is being forced by new issues in foundations