

# ***Iterative Interpretation***

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Try-out talk at:  
*Realism for Realistic People: A Copenhagen-Cambridge  
Symposium on Hasok Chang's philosophy of science*

Copenhagen, June 29, 2022



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# Interpretation is not just difficult

## Problems of interpretation are non-linear, ill-structured problems

**Situation:** We might not all be realist,

but we all interpret... Yet how do we decide on ontological commitment?

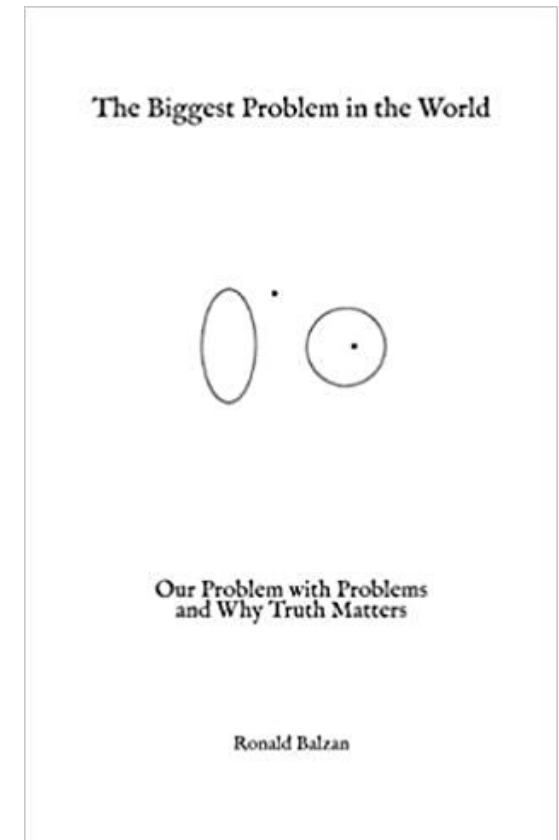
Some systematic elements: empirical adequacy, explanatory power, predictive success...

The story- structure of problems: a beginning (initial problem), middle (solution), and end (goal).

A 'well-structured problem' yields a right answer through the application of an appropriate algorithm.

**Complication:** interpretative problems escape immediate representation. Problems often reformulated during the process of solving it: ill-structured problems in a non-linear process.  
How to deal with this?

**Claim:** *if* we want to systemise the ill-structured problems of interpretation, *then* we need an **iterative** and philosophically **pluralistic** component in our systematization.



**Complication:** Interpretation is an ill-structured, non-linear process.

**Claim:** a philosophical pluralism with a systematic iterative component is insightful and desirable.

**Why again?**

Pluralistic iteration  
helps to formulate

**What is that exactly?**

A scaffolding for a  
systemisation

**Historical  
example:**

Spacetime structure

**Contemporary example:**

Geometricists &  
Dynamicists

Comparison with some  
**Changian** themes

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# Characteristics of ill-structured problems

## Multiple solutions and no good way to order them

A 'well-structured' problem:

- Solving for X in an algebraic equation.
- Calculating the thermodynamic efficiency of a nuclear power plant.

An 'ill-structured' problem: no straightforward path towards a solution.

- Deciding on how to dispose of nuclear waste safely.

Characteristics:

- No unique certain answer --- prone to disagreement!
- Data can be conflicting or inconclusive.
- Different proposed solutions, each with particular strengths and weaknesses.
- Disagreement about appropriate assumptions.
- Conflicting values.

**Fun fact:** IQ (measure for cognitive intelligence) plays little-to-no role in solving ill-structured problems<sup>1</sup>

Generally: approaching ill-structured problem involves attending to alternative points of view: *pluralism*.



# Bohmians and Everettians

## Philosophical monism as an unnecessary seduction

Two popular, and conflicting, ways to solve the quantum measurement problem.

Opposition between the 'Oxford school' of Everettians and 'New York school' of Bohmians.<sup>2,3</sup>

I believe it to be unconstructive: talking past each other.

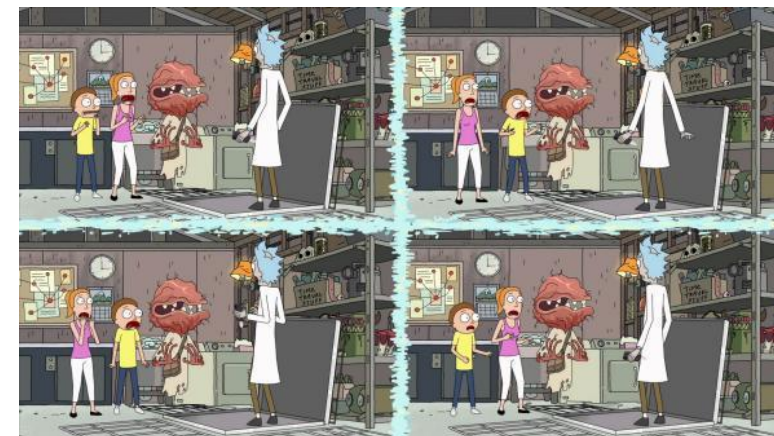
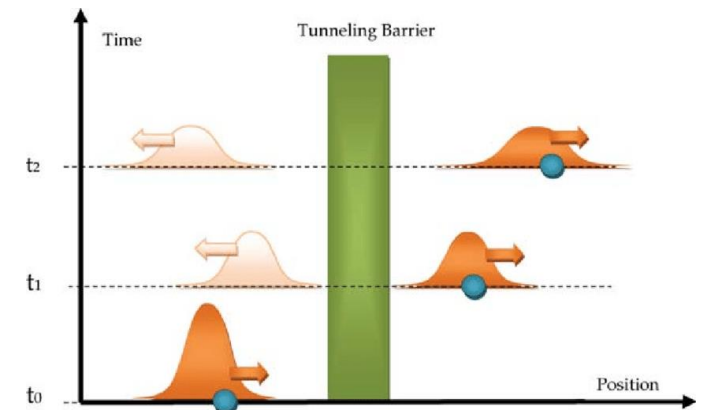
Why? One reason is that – I think – Everettians are almost exclusively **structural realists**, while the Bohmians are usually **primitive ontologists**.

Everettians: only the wavefunction, then robust (due to decoherence) patterns or **structures in the wavefunction** are (functionally) identified (quasi-)classical worlds.

→ Done at a coarse-grained level, while not explicit (even dismissive) on lower-level ontology.

Bohmians: classical particles + guided by the wavefunction (which are only contextually approachable by experiment).

→ Makes for clearly defined and **explicitly demarcated local ontology** (local beables).



2. Tim Maudlin (2019). *Philosophy of Physics: Quantum Theory*.

3. David Wallace (2012). *The Emergent Multiverse*.

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# Pluralism and iteration

## Using all available interpretative tools for problem-solving

One responds to an ill-structured problem with a claim and a justifying argument.<sup>4</sup>

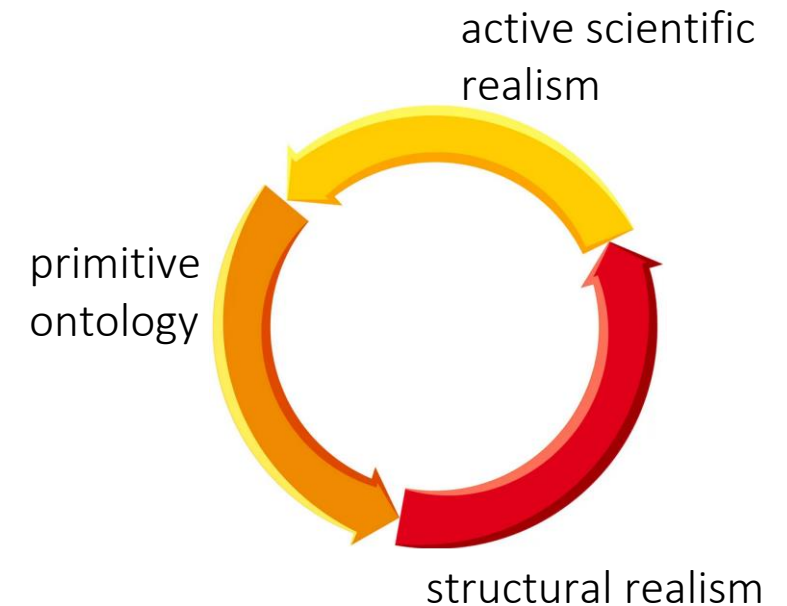
Justifying arguments derive from philosophical criteria, or meta-theories, such as

- structural realism,
- primitive ontology,
- indispensability arguments,
- arguments for explanatory power,
- entity realism,
- active scientific realism,
- ...

I propose:

- Use multiple meta-theories to evaluate a given formalism.
- Formulate arguments within the context of that formalism.
- Then do it again, taking with you what you have learned: **iteration!**

*Ill-structured problems are not well formulated, but iteration helps to gather justifying arguments.*



4. Patricia King & Karen Kitchener's (1994). *Developing Reflective Judgment*. (Influenced heavily by Dewey, as well as Piaget).



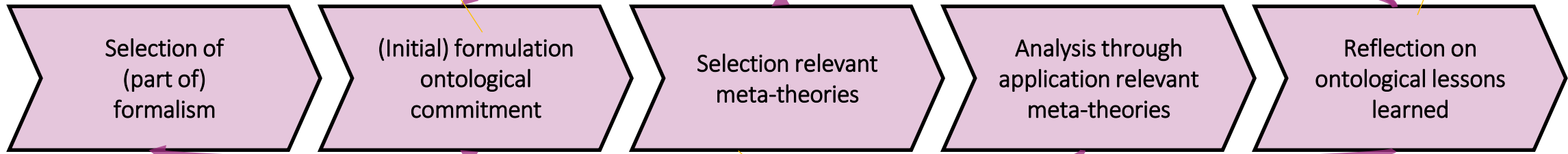
# Scaffolding for systematic iterative Interpretation

## Five phases to reach reflective interpretative equilibrium

Initial interpretation can be very rough. One may consider naive realism, or even one's personal hunch about what is ontologically salient.

Reflection most likely hinges not on the correct analysis of phase 4, but on how the phase-1-formulation of ontological commitment can be improved, whether other meta-theories can be helpful, or whether other parts of formalism are relevant to the problem.

Goal:  
informed and well-argued formulation of ontological commitment of this formalism



Selection of relevant philosophical frameworks will – to some degree – be arbitrary, and highly context-dependent. One may only be able to make a well-reasoned choice after the initial round

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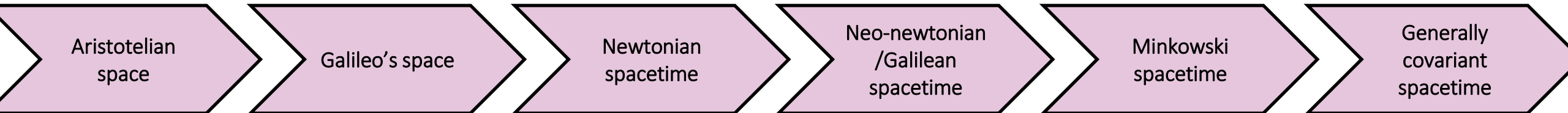
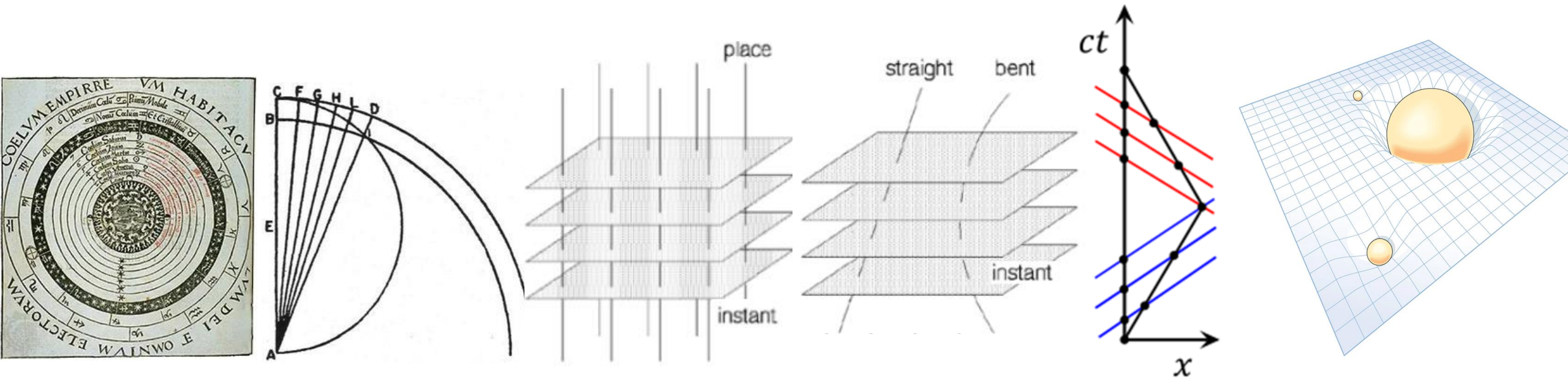
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# The structure of space

The detective story for eliminating unobservable spatiotemporal structure (Whiggishly)



# The structure of space

## Iteration between traditional realism and structural realism

At least from Newtonian space(time) onward: this historical process can be (whiggishly) reconstrued as an iteration between several theories of ontological commitment:

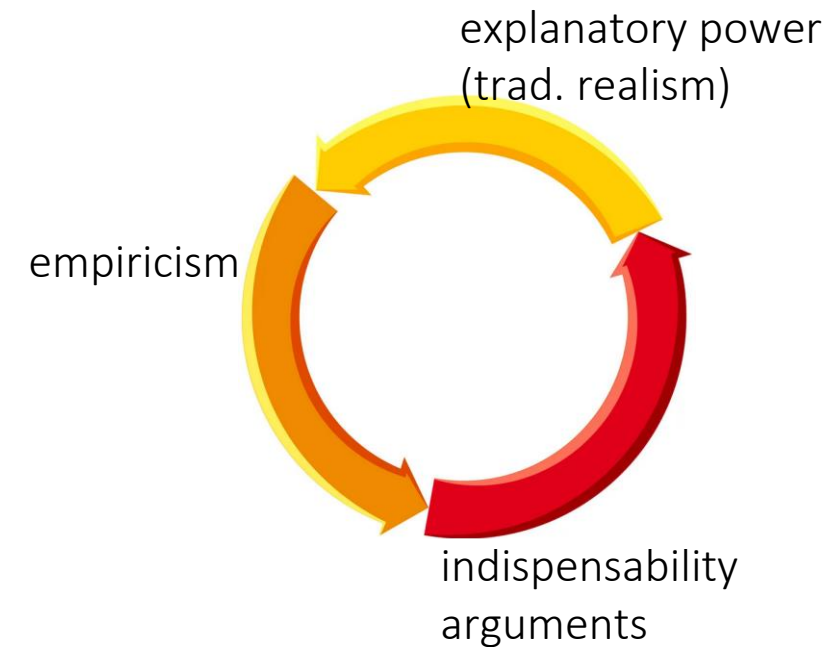
- Arguments for the **explanatory role** of space(time):  
think Newton's bucket and the explanation of inertial effects)
- The elimination of **unobservable structure** (empiricism / structural realism):  
epistemic modesty, e.g. the principle of parsimony.
- Emphasis on the **indispensability** argument:  
all our theories quantify over spacetime points .

If we consider this to be a converging iteration, then the lesson-to-be-learned is captured by **Earman's symmetry principles** for any theory of motion<sup>5</sup>:

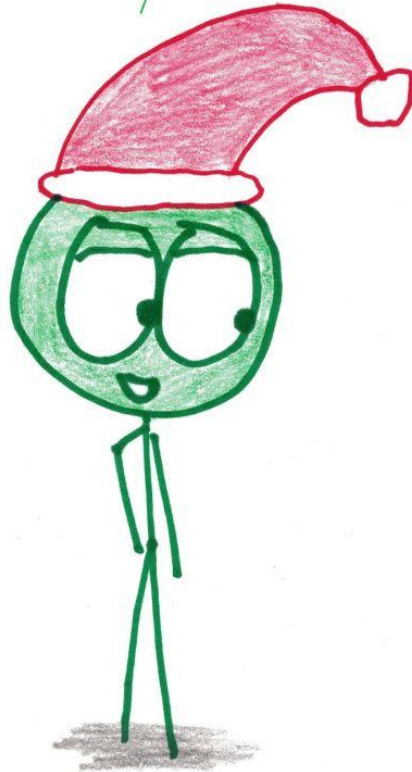
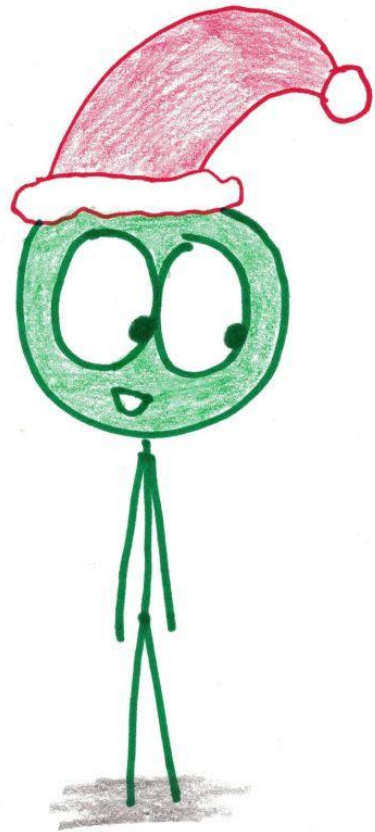
SP1: Any dynamical symmetry of the theory is a spacetime symmetry of the theory.

SP2: Any spacetime symmetry of the theory is a dynamical symmetry of the theory.

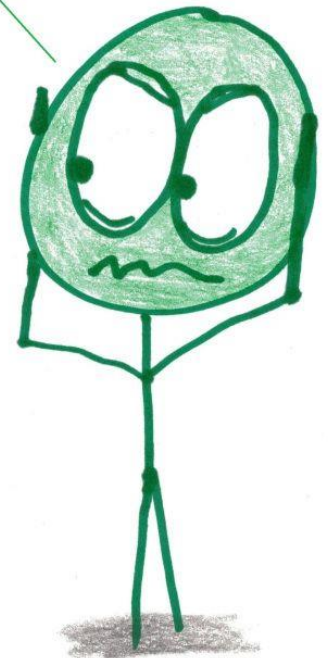
It is not necessary to stop the iteration here. Earman's SP's are not set in stone, but one has to stop at some point.



On the twelfth iteration,  
my for loop gave to me...



stop... no more...



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# The Twin Effect

## and a debate in the foundations of special relativity

The twin effect is an empirically-verified fact:

Proper times measured along two paths with at least two (not all) events in common, diverge.

What explains this fact?

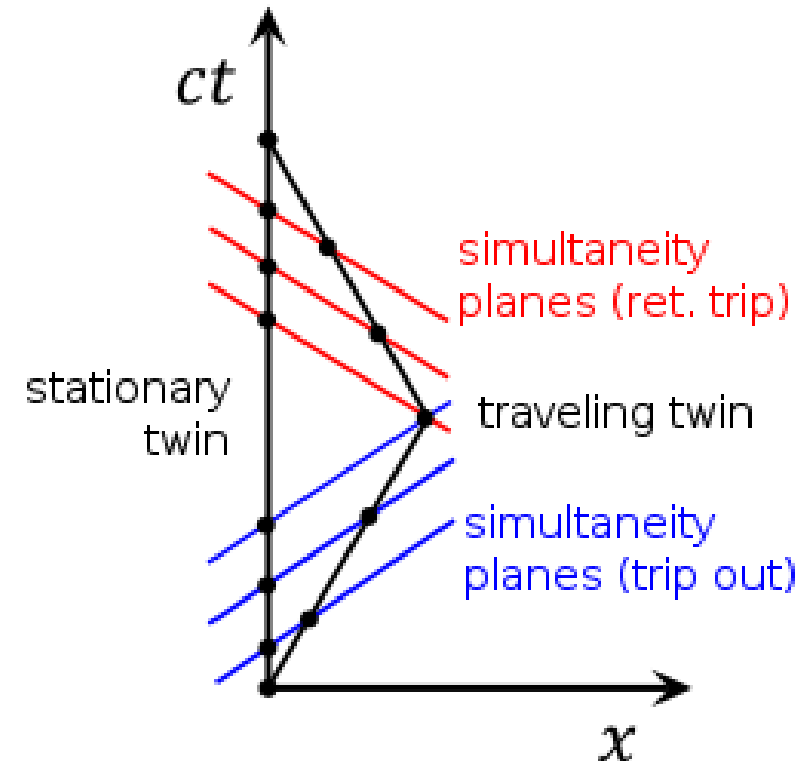
The geometry of Minkowski spacetime; or the Lorentz invariance of the dynamics?

### Geometricists:

- Spacetime structure explains observable physical effects.
- Frame-dependent notions are suspect, not explanatory.
- 'the stationary twin is on a straight trajectory, while the traveling twin is on a bent trajectory.'

### Dynamicists<sup>6</sup>:

- Spacetime is merely a codification of dynamical symmetries of matter.
- Frame-dependent explanations are valid, even though they look differently in different frames.
- 'there is a double effect of time dilation with respect to the stationary twin's rest frame: outbound trip and return trip.'





# The Twin Effect

## Can the dynamicist and the geometricist can learn from each other?

The dynamicist and the geometricist can learn from each other

Namely: non-inertial motion can be fleshed out in two ways:

- Lorentz invariance
- Minkowski trajectories

Lesson learned: Lorentz invariance and Minkowski spacetime are seemingly on a par.

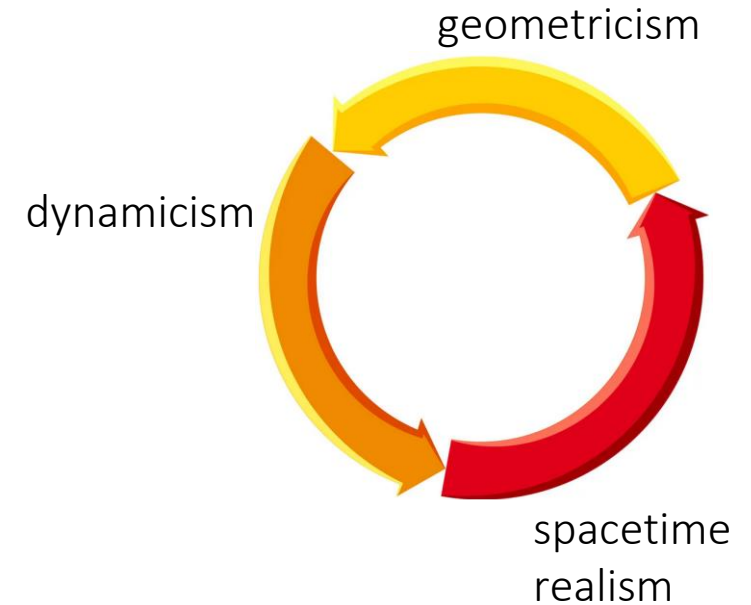
Perhaps one can be explanatorily reduced to the other.<sup>6</sup> Perhaps Minkowski spacetime and Lorentz invariance do *not* have explanatory power on their own, only together.<sup>7</sup>

Convergence of iteration is *not* guaranteed:

Possibly these are simply two valid ways of speaking, neither of which can claim explanatory priority.<sup>8</sup>

Nevertheless, the tie may be broken: the process may start to converge if other interpretations are taken onboard into the iterative process:

Include traditional realism about spacetime?



6. Harvey Brown (2005). *Physical Relativity*.

7. Pablo Acuña (2016), "Minkowski spacetime and Lorentz invariance."

8. Wayne Myrvold (2019), "How could relativity be any other than physical?"



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# Changian themes

## Pluralism, iteration, and epistemic activity

**Iteration:** I think my proposal is in line with *the spirit* of epistemic iteration:

"[...] a process by which scientific knowledge claims are progressively altered and refined via self-correction or enrichment [...]" [InvTemp, p.228]),

but not as detailed (such as finding the boiling point) and *not quantitative*.

**Pluralism:** not so much a *scientific* pluralism, but a *philosophical* pluralism. But compatible! Whether scientifically pluralistic or not depends on how iterative process pans out.

**Epistemic action:** I really don't have an 'active' component in the form of *practical application*: primarily concerned with *belief*. But it does aim to

"learn as much as possible about reality, actively and systematically" (H2O, p.222, my emphasis),

but by other means than practical activity, namely continued engagement with the subject matter from all possible *philosophical* angles, as well as the endorsement that

"science should do everything it can in order to gain more and better knowledge, as opposed to the position of a spectator who observes with satisfaction that science seems very good at finding knowledge" (R4R, p.12)

Also, at the very least: including active scientific realism as one of the meta-theories in scope will certainly teach us many things to take with us in the next iteration.

Inspired by Hasok, John Dewey, Patricia King.

9. **Hasok Chang** (2004).

*Inventing temperature*.

10. **Hasok Chang** (2012).

*Is water H<sub>2</sub>O? Evidence, pluralism and realism*.

11. **Hasok Chang** (Draft of 4 October 2021).

*Realism for Realistic People*.

12. **Patricia King & Karen Kitchener** (1994).

*Developing Reflective Judgment*.

13. **John Dewey** (1938).

"The Pattern of Inquiry."

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<b>Why again?</b> Pluralistic iteration helps to formulate	<b>What is that exactly?</b> A scaffolding for a systemisation	<b>Historical example:</b> Spacetime structure	<b>Contemporary example:</b> Geometricists & Dynamicists	Comparison with some <b>Changian</b> themes
<ul style="list-style-type: none"><li>• Philosophical monism is closed-minded.</li><li>• Iteration helps to formulate the non-linear character of ill-structured problems.</li><li>• Iteration of philosophical meta-theories (such as structural realism, active scientific realism, etc.).</li></ul>	<ul style="list-style-type: none"><li>• The goal is the informed and well-argued formulation of ontological commitment of a particular (part of) formalism.</li><li>• The means is the selection and iterative application of multiple relevant meta-theories. Hence philosophically pluralistic.</li></ul>	<ul style="list-style-type: none"><li>• The historical quest for the true structure of spacetime can be cashed out as an iterative process of the elimination of unobservable structure under the constraints of explanatory power and indispensability.</li><li>• Can be seen as converging towards Earman's symmetry principles.</li></ul>	<ul style="list-style-type: none"><li>• Contemporary debate whether dynamics or spacetime is explanatorily salient.</li><li>• Lorentz invariance and Minkowski spacetime seemingly are on a par.</li><li>• Iterative process may not converge given the current scope: spacetime realism perhaps needed.</li></ul>	<ul style="list-style-type: none"><li>• Iterative interpretation is compatible with active scientific realism</li><li>• Philosophical rather than scientific pluralism – though compatible</li><li>• Concerned primarily with belief, rather than ability.</li><li>• Including active scientific realism into the iteration is recommended</li></ul>

Pablo Acuña (2016). "Minkowski spacetime and Lorentz invariance: cart and the horse or two sides of a single coin?" *Studies History and Philosophy of Modern Physics* **55**, pp. 1–12.

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