

Master's in Philosophical Knowledge:  
Foundations, Methods, Applications

Bergamo  
Pavia

## 4. Empiricism

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Philosophy

# lecture aims

- What is empiricism?
- History of empiricism, empiricism v. rationalism
- the Duhem–Quine thesis and Quine’s confirmational holism
- Criticism of empiricism. Can there be empirical knowledge without empiricism?

# foundationalism

self-justifying beliefs

beliefs whose existence entails that they are true:  
'I exist', 'I think', 'I have at least one belief'

*a priori* beliefs: mathematical, logical truths;  
conceptual truths, etc.

beliefs about one's own internal (mental states)?  
e.g. beliefs about appearances

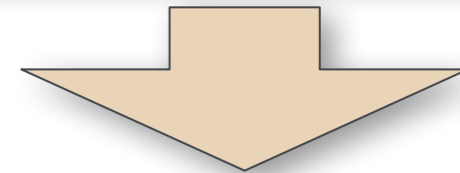
beliefs whose existence entails that they are  
justified (?) perceptual beliefs etc.

# foundationalism

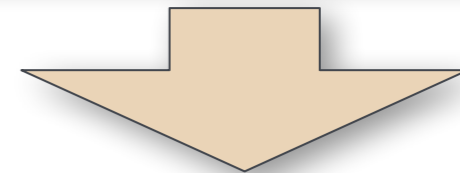
justification,  
knowledge  
are a priori

rationalism

but can all scientific  
knowledge be a  
priori?



need for a  
connection to the  
world



central role for  
sense-experience

empiricism

# empiricism

empiricism is any philosophy that gives a central role to sense-experience/perception

metaphysics

philosophy of language

epistemology

e.g. no entities  
beyond what  
can be  
perceived

e.g. meanings of basic  
terms defined in  
terms of perceptible  
qualities/entities

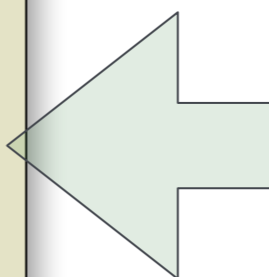
e.g. knowledge/  
justification  
founded on  
perception

# empiricism

empiricism is any philosophy that gives a central role to sense-experience/perception

epistemology

evidence is  
observational  
and to observe is  
to perceive



e.g. knowledge/  
justification  
founded on  
perception

# empiricism

empiricism is any philosophy that gives a central role to sense-experience/perception

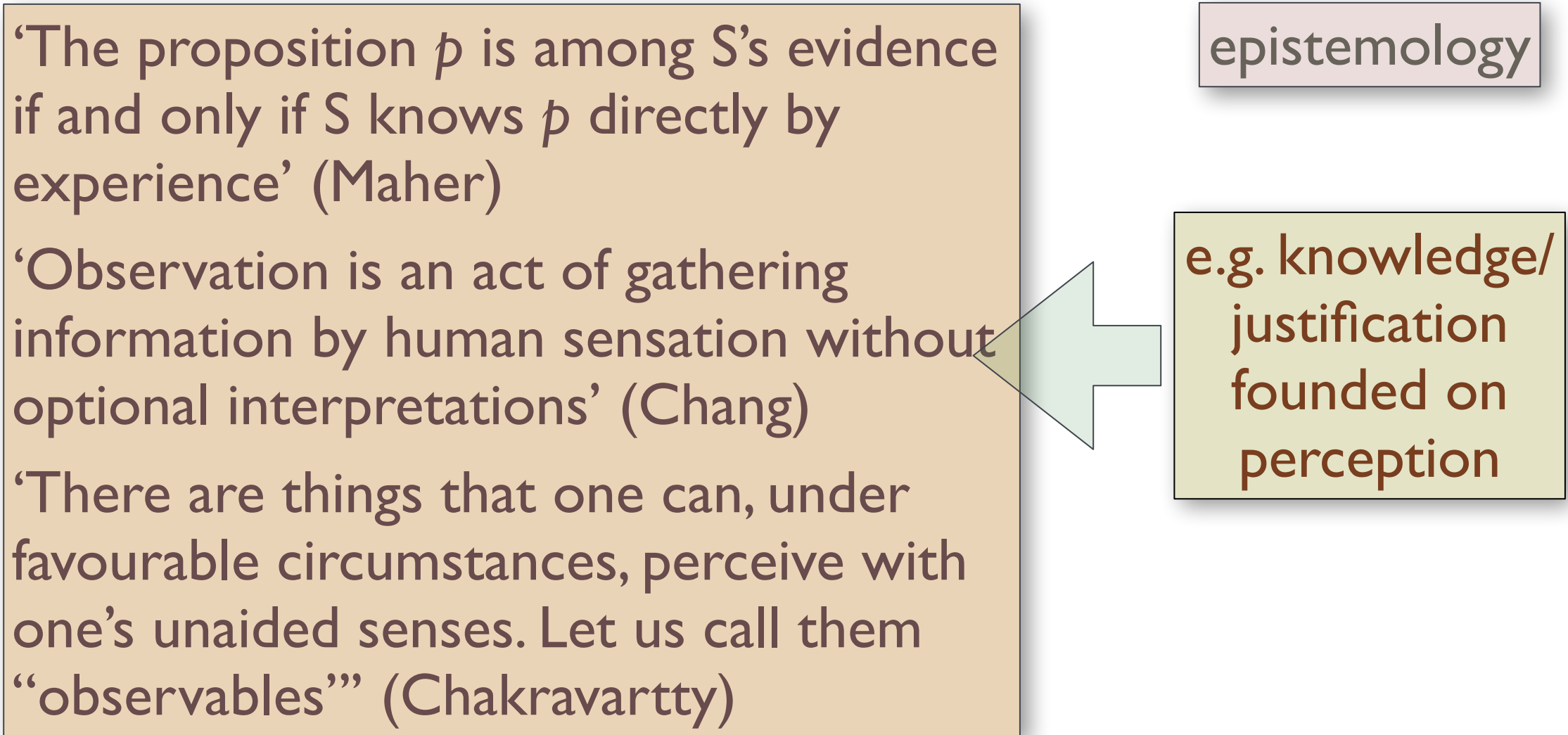
‘The proposition  $p$  is among  $S$ ’s evidence if and only if  $S$  knows  $p$  directly by experience’ (Maher)

‘Observation is an act of gathering information by human sensation without optional interpretations’ (Chang)

‘There are things that one can, under favourable circumstances, perceive with one’s unaided senses. Let us call them “observables”’ (Chakravartty)

epistemology

e.g. knowledge/  
justification  
founded on  
perception



# history of empiricism

origins

renaissance questioning of ancient authorities

Aristotle's physics: Bombelli, Galileo  
Galen's medicine: Vesalius, Fabricius, Harvey  
Ptolemy's astronomy: Copernicus, Kepler

*emphasis on observing for one's self; note that  
the point of this is to avoid errors of testimony*

Francis Bacon *Novum Organum* (1620)

# history of empiricism

John Locke

no innate ideas,  
mind a tabula rasa  
all simple ideas come  
from experience  
we learn by the  
association of ideas  
perception is a matter  
of having ideas that  
are caused by the  
objects they represent

George Berkeley

if Locke were right, we  
would have to be  
sceptics about the  
external world  
so it cannot be that  
there are two things:  
ideas and material  
objects; what we *think*  
are objects are in fact  
combinations of ideas

David Hume

all ideas come from  
antecedent  
impressions (sense  
experiences); we  
should be sceptical,  
but we are incapable  
of sustained  
scepticism, the mind is  
governed by the  
association of ideas

# history of empiricism

John Stuart Mill

observation is strictly of our own, inner experiences, but we make an inference (unconsciously) to an external object

Moritz Schlick

‘protocol sentences’ — the basic evidence propositions of science — record reports of inner experiences

Otto Neurath

‘protocol sentences’ record intersubjective reports of external perceptible states of affairs

# history of empiricism

Moritz Schlick

‘protocol sentences’  
— the basic evidence  
propositions of  
science — record  
reports of inner  
experiences

Otto Neurath

‘protocol sentences’  
record intersubjective  
reports of external  
perceptible states of  
affairs

protocol sentence debate

# history of empiricism

the protocol sentence debate

Moritz Schlick

‘protocol sentences’  
record reports of inner experiences

**foundationalist**

protocol sentences provide  
certainty in foundational  
propositions

but have difficulty in bridging gap to  
the external world

Otto Neurath

‘protocol sentences’ record  
reports of external states of affairs

**coherentist**

protocol sentences are statements  
about the perceptible features of  
the external world

but are not certain and are  
revisable — Neurath’s boat

# history of empiricism

coherentist empiricism

Otto Neurath

science (knowledge in general) is like a boat on the sea—we can replace the planks individually but not all at once

W. v. O. Quine

our body of belief faces the tribunal of experience as a whole, not as individual beliefs

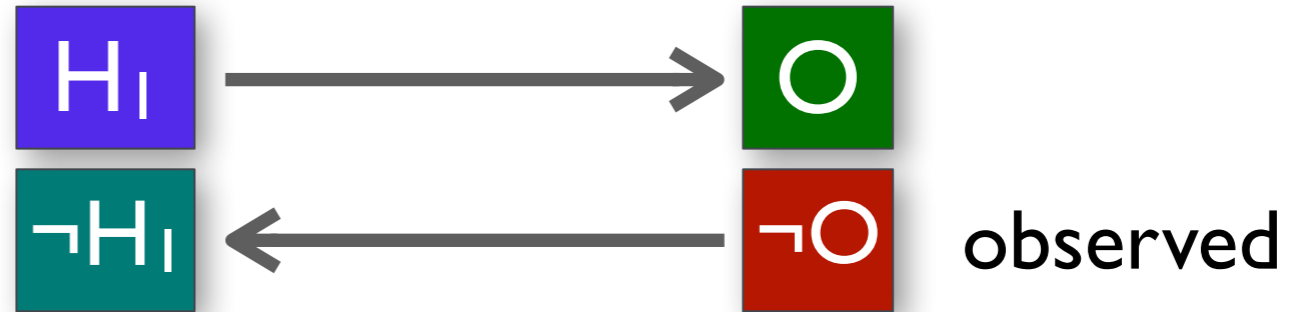
# the Duhem–Quine thesis

## **The Duhem Thesis**

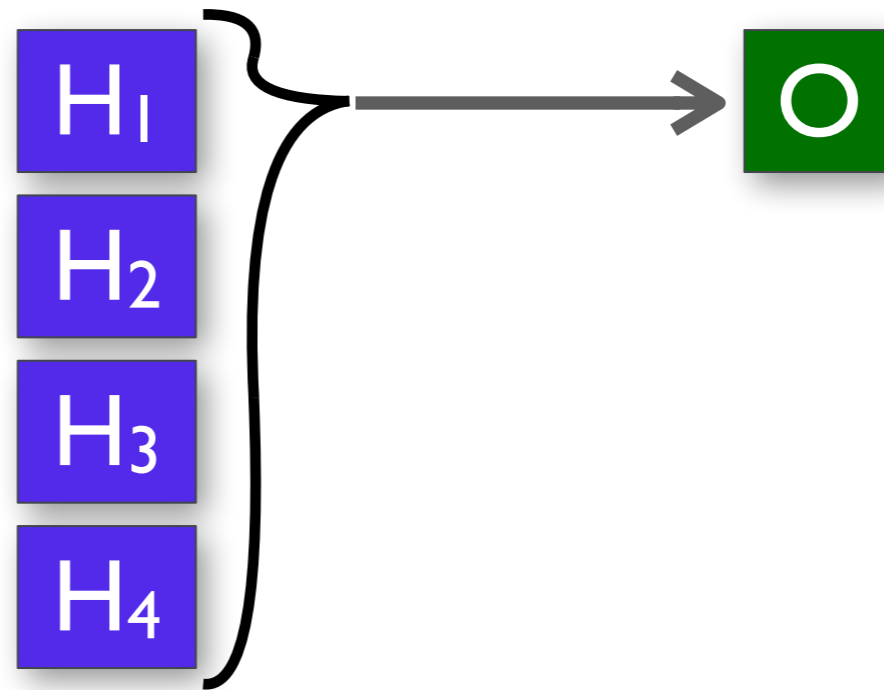
Scientific theories are not refuted singly but only in sets of multiple hypotheses

# the Duhem-Quine thesis

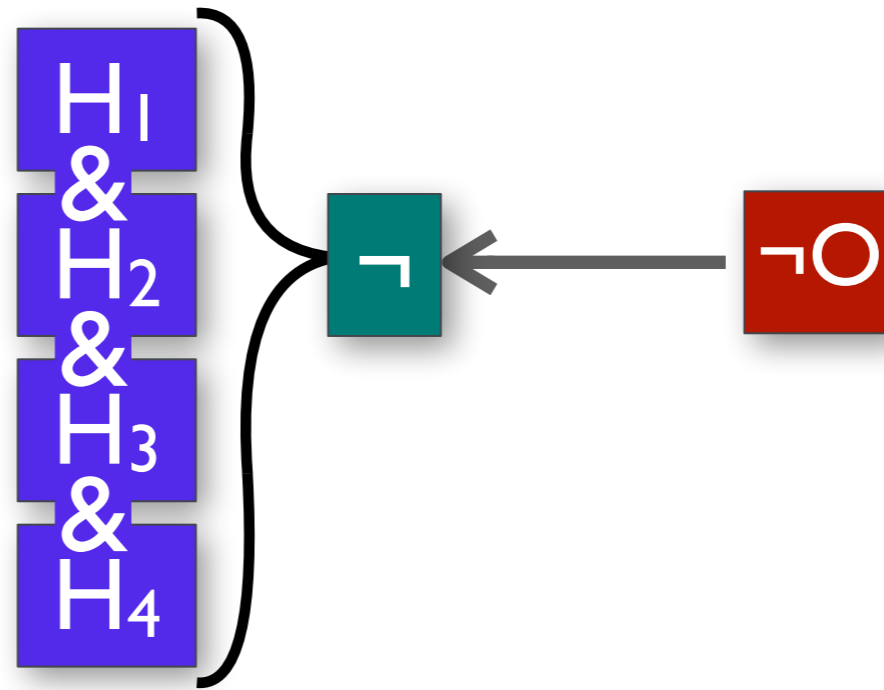
*hypothetico  
deductivism*



# the Duhem-Quine thesis



# the Duhem-Quine thesis



# the Duhem-Quine thesis

Newtonian celestial mechanics



orbit  $O_1$  of Uranus

$O_1$  not observed

# the Duhem-Quine thesis

Newtonian celestial mechanics

the planets are Mercury, Venus, Earth,  
Mars, Jupiter, Saturn, and Uranus

orbit  $O_1$  of Uranus

```
graph LR; A[Newtonian celestial mechanics] --- B[the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, and Uranus]; A & B --> C[orbit O1 of Uranus];
```

# the Duhem-Quine thesis

Newtonian celestial mechanics

the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, and Uranus

¬

$O_1$  not observed

# the Duhem-Quine thesis

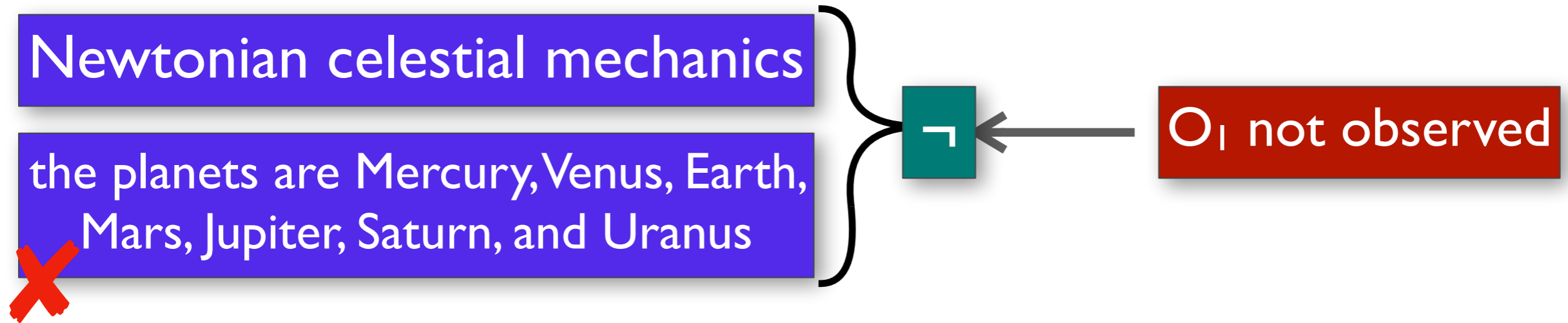
Newtonian celestial mechanics

the planets are Mercury, Venus, Earth,  
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$O_1$  not observed



# the Duhem-Quine thesis

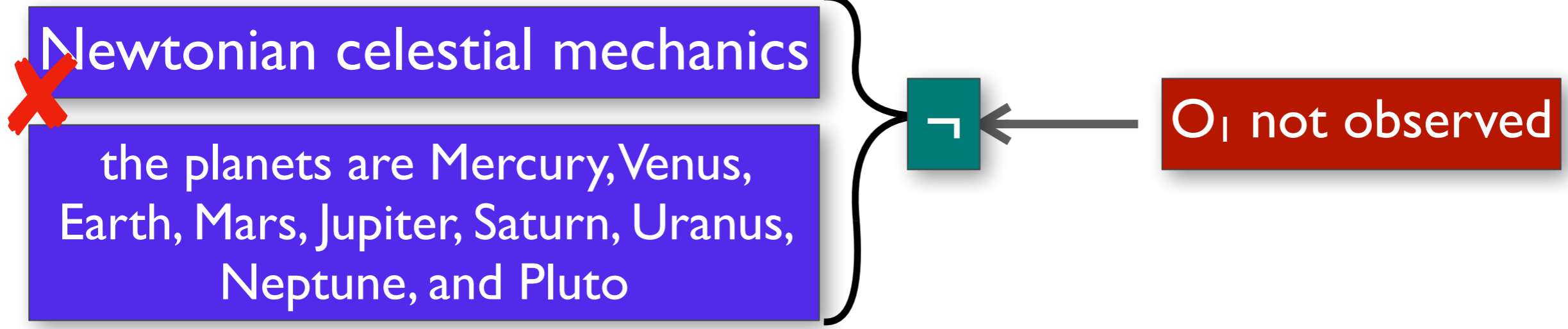
Newtonian celestial mechanics

the planets are Mercury, Venus,  
Earth, Mars, Jupiter, Saturn, Uranus,  
Neptune, and Pluto

orbit  $O_2$  of Mercury

```
graph LR; A[Newtonian celestial mechanics] --- B[the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto]; A --- C[orbit O2 of Mercury]; B --- C;
```

# the Duhem-Quine thesis



# the Duhem–Quine thesis

## **The Duhem Thesis**

Scientific theories are not tested (and so refuted) singly but only in sets of multiple hypotheses

## **The Quine Thesis**

It is the entire web of belief that is tested

# the Duhem-Quine thesis

Newtonian celestial mechanics

the planets are Mercury, Venus, Earth,  
Mars, Jupiter, Saturn, and Uranus

orbit  $O_1$  of Uranus



# the Duhem-Quine thesis

Newtonian celestial mechanics

the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, and Uranus

mathematical assumptions

orbit  $O_1$  of Uranus



# the Duhem-Quine thesis

Newtonian celestial mechanics

the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, and Uranus

mathematical assumptions

perceptual  
experience of  
the observer

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Newtonian celestial mechanics

the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, and Uranus

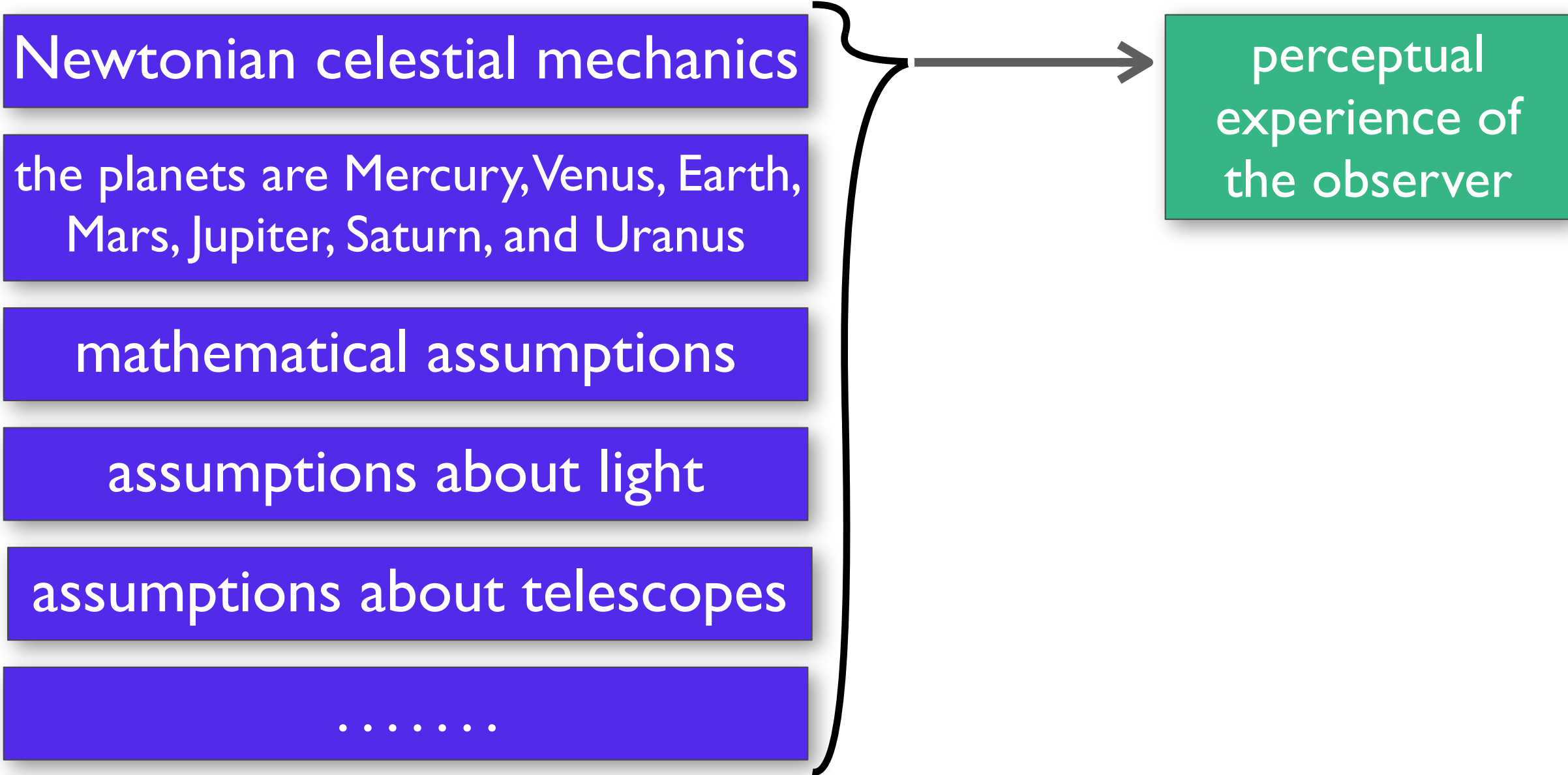
mathematical assumptions

assumptions about light

assumptions about telescopes

.....

perceptual  
experience of  
the observer



# the Duhem-Quine thesis

Newtonian celestial mechanics

the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, and Uranus

mathematical assumptions

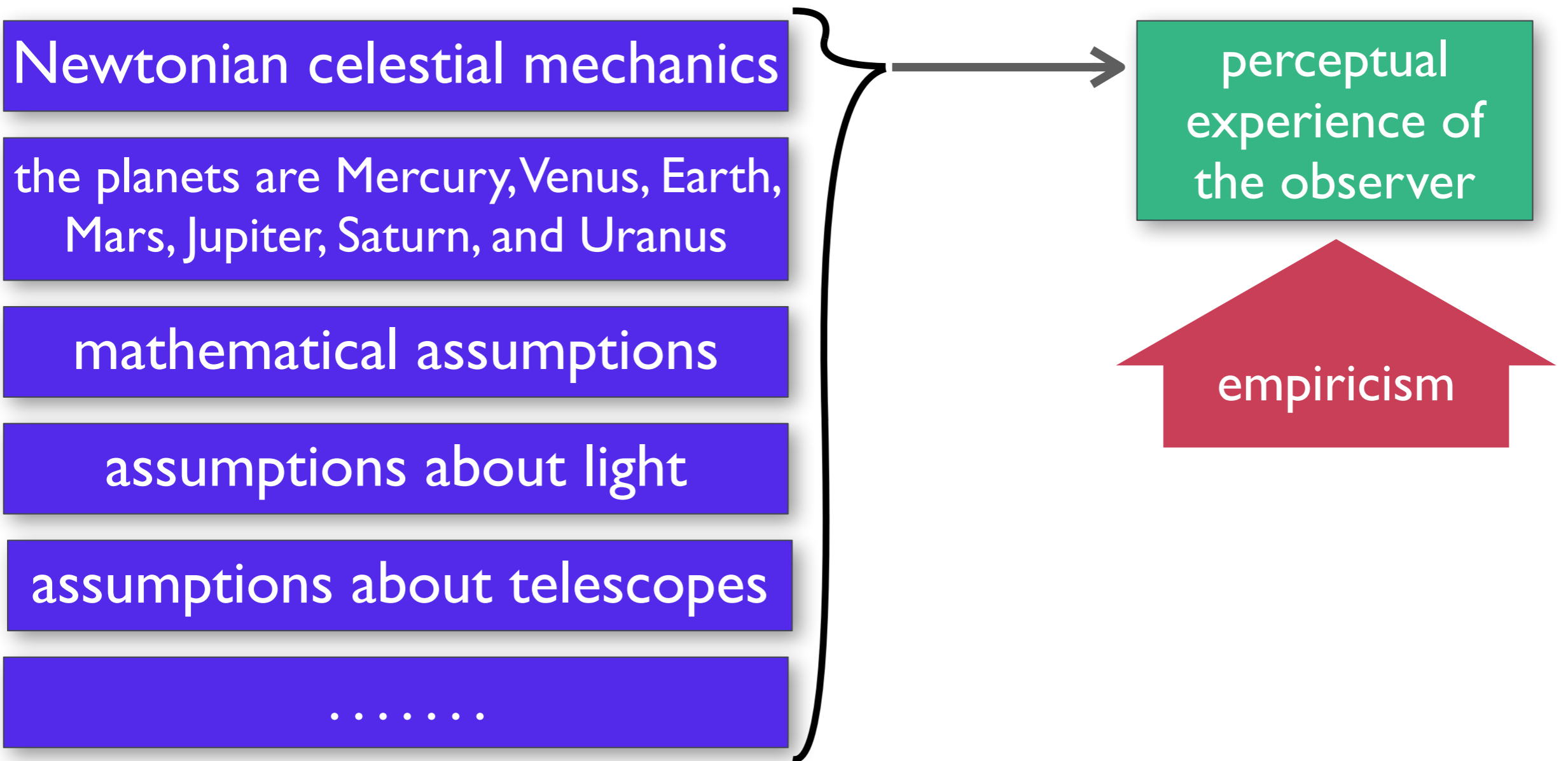
assumptions about light

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perceptual  
experience of  
the observer

empiricism



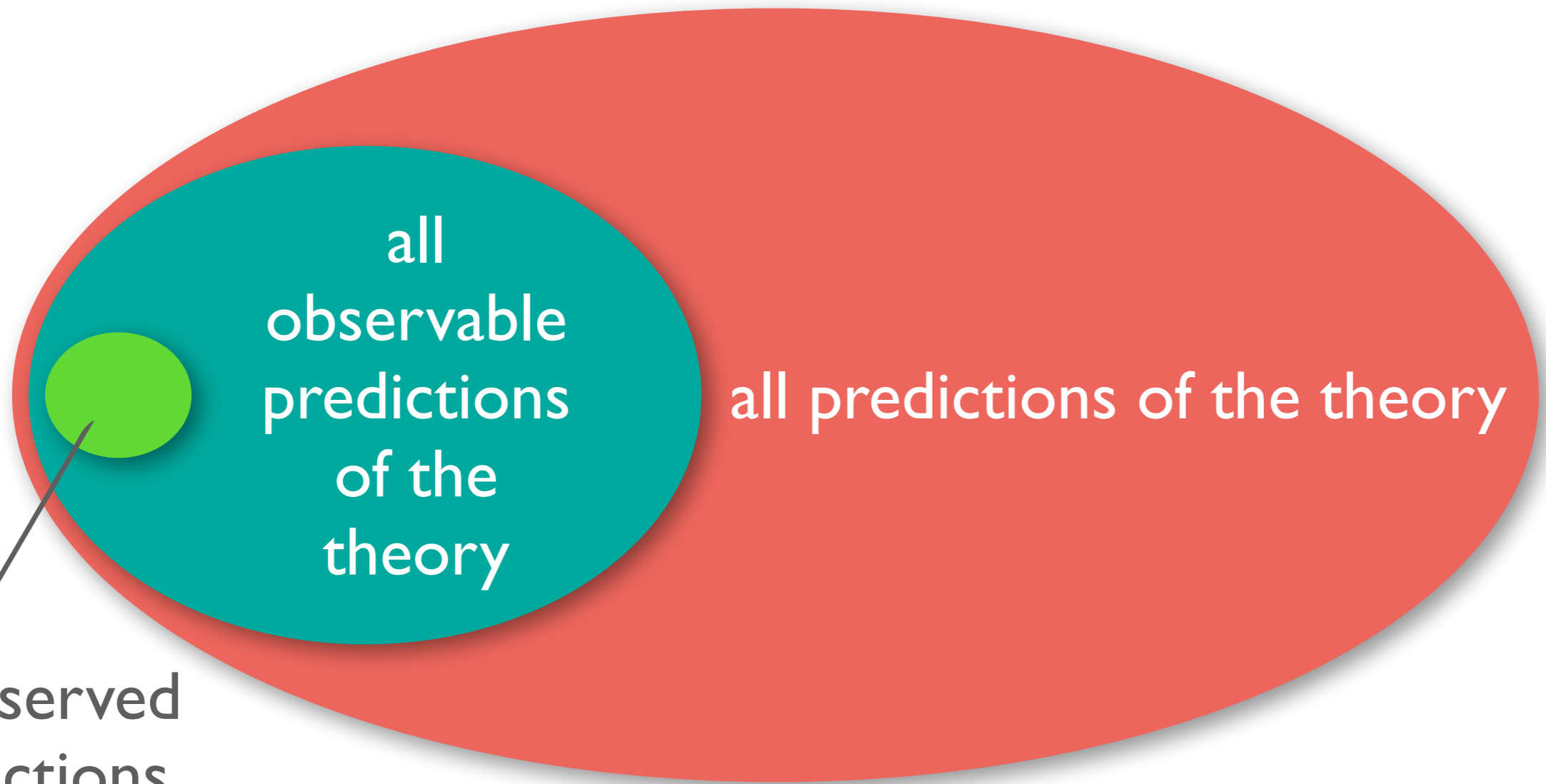
# constructive empiricism

Bas van Fraassen

*observable* = can be perceived by the unaided human senses

a theory is *empirically adequate* iff its observable consequences are true

# constructive empiricism



all observed  
predictions  
of the  
theory

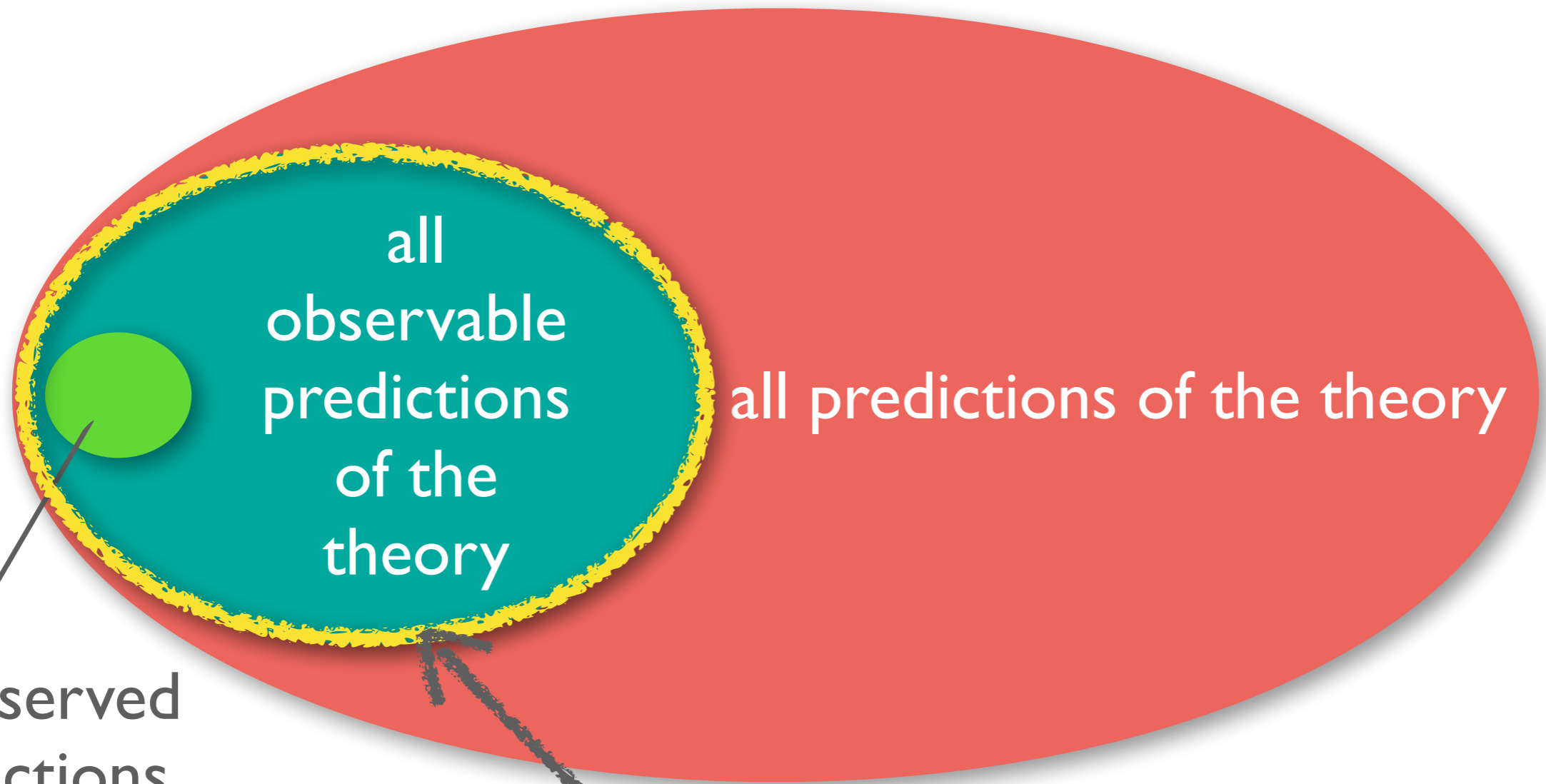
# constructive empiricism

scientific theories aim at empirical adequacy, not at truth

“Science aims to give us theories which are empirically adequate; and acceptance of a theory involves as belief only that it is empirically adequate.” (van Fraassen 1980, 12)

science aims to ‘save the phenomena’

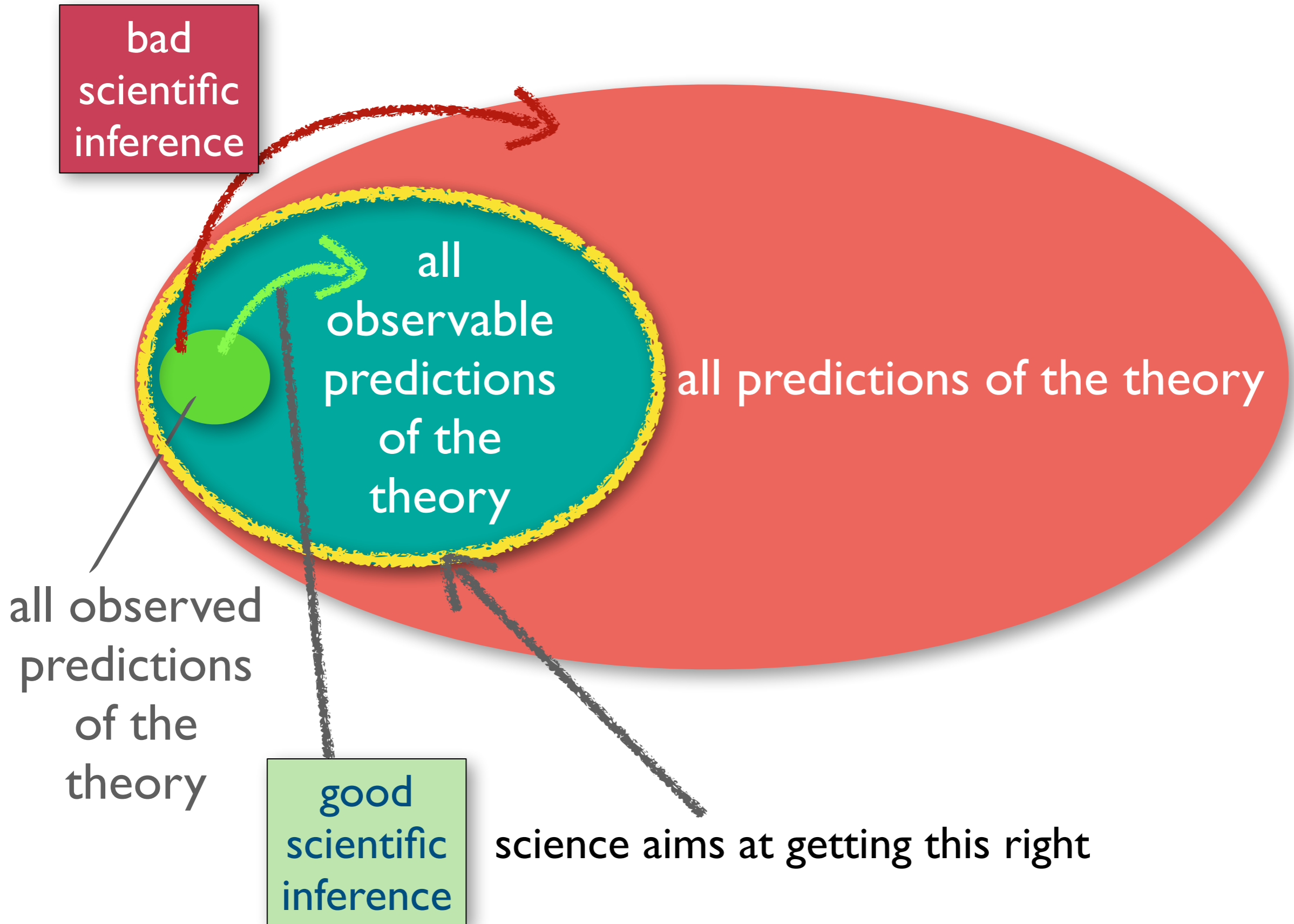
# constructive empiricism



all observed  
predictions  
of the  
theory

science aims at getting this right

# constructive empiricism



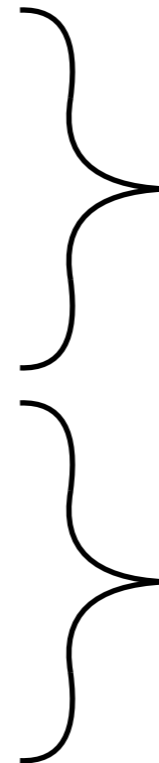
# forms of scientific inference

laws of motion

statistical generalisations

atoms

the cause of dinosaur extinction



enumerative induction

inference to the best explanation

*discovered by*

# realism — inference to the best explanation

mass extinctions —  
75% of species extinct,  
including all non-avian  
dinosaurs  
global — across all  
continents


potential explanations

- evolution
- volcanic eruption
- meteor impact

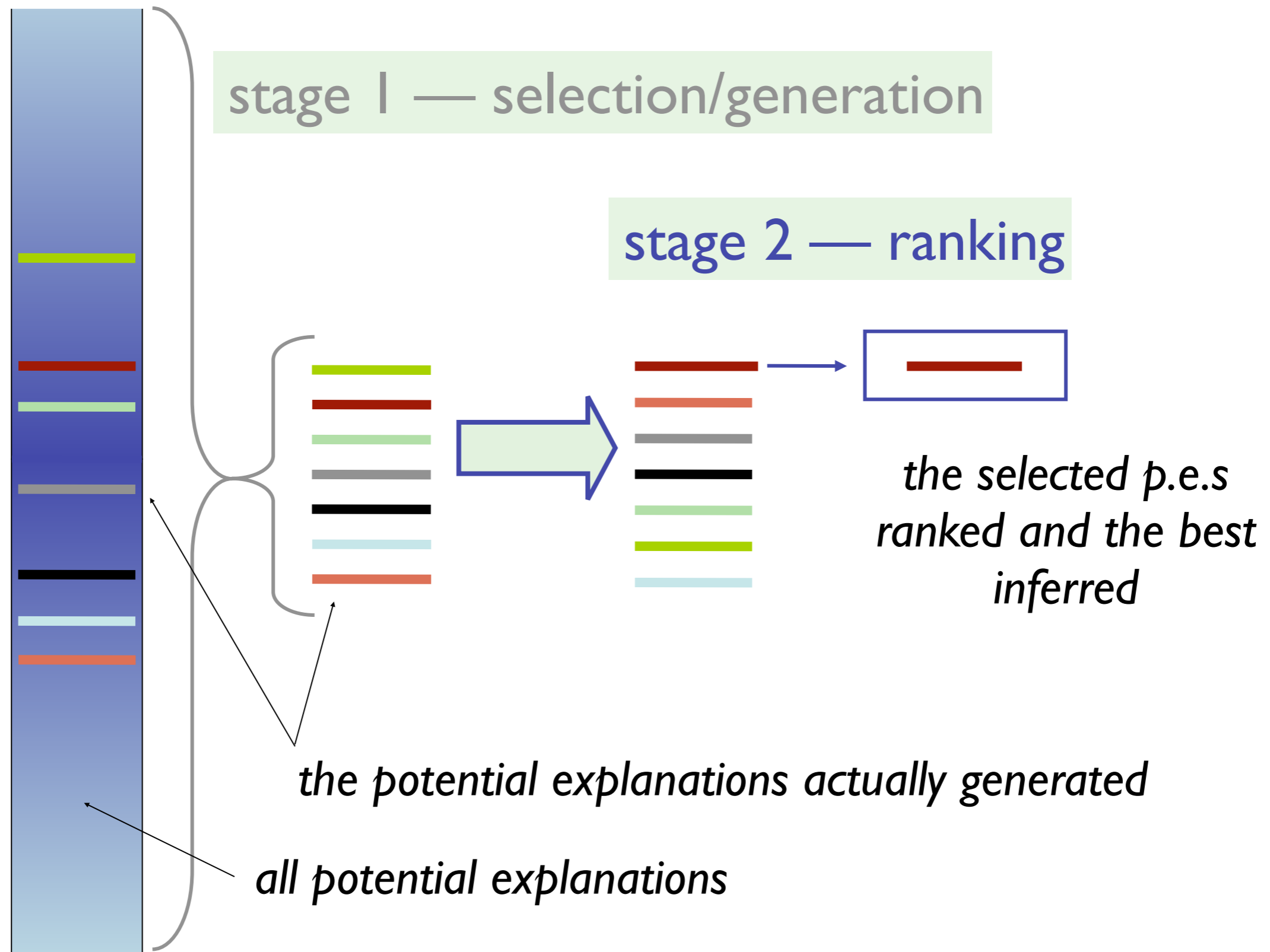
evidence

rapid extinction  
simultaneous globally  
iridium anomaly

which best explains  
the evidence?



# realism — inference to the best explanation



# realism — inference to the best explanation

'unobservable'

atoms

the cause of dinosaur extinction

'observable'



inference to the best explanation

*discovered by*

# realism — inference to the best explanation

problems

Stage 1: Underconsideration

Stage 2: Hungerford's objection

Stage 2: Voltaire's objection

Is IBE consistent with Bayesianism?

# realism — inference to the best explanation

problems

Stage I: Underconsideration

at Stage I (thinking up the potential explanations)  
should we be confident that one of these is the true  
hypothesis?

# realism — inference to the best explanation

problems

Stage 2: Hungerford's objection

'beauty is in the eye of the beholder'  
'la bellezza è negli occhi di chi guarda'

# realism — inference to the best explanation

problems

Stage 2: Voltaire's objection

Dr Pangloss (i.e. Leibniz): all is for the best, in the best of all possible worlds

Objection: why think that this is the best possible world explanatorily?

# realism — inference to the best explanation

problems

Is IBE consistent with Bayesianism?

# constructive empiricism again

scientific theories aim at empirical adequacy, not at truth

“Science aims to give us theories which are empirically adequate; and acceptance of a theory involves as belief only that it is empirically adequate.” (van Fraassen 1980, 12)

science aims to ‘save the phenomena’

# constructive empiricism again

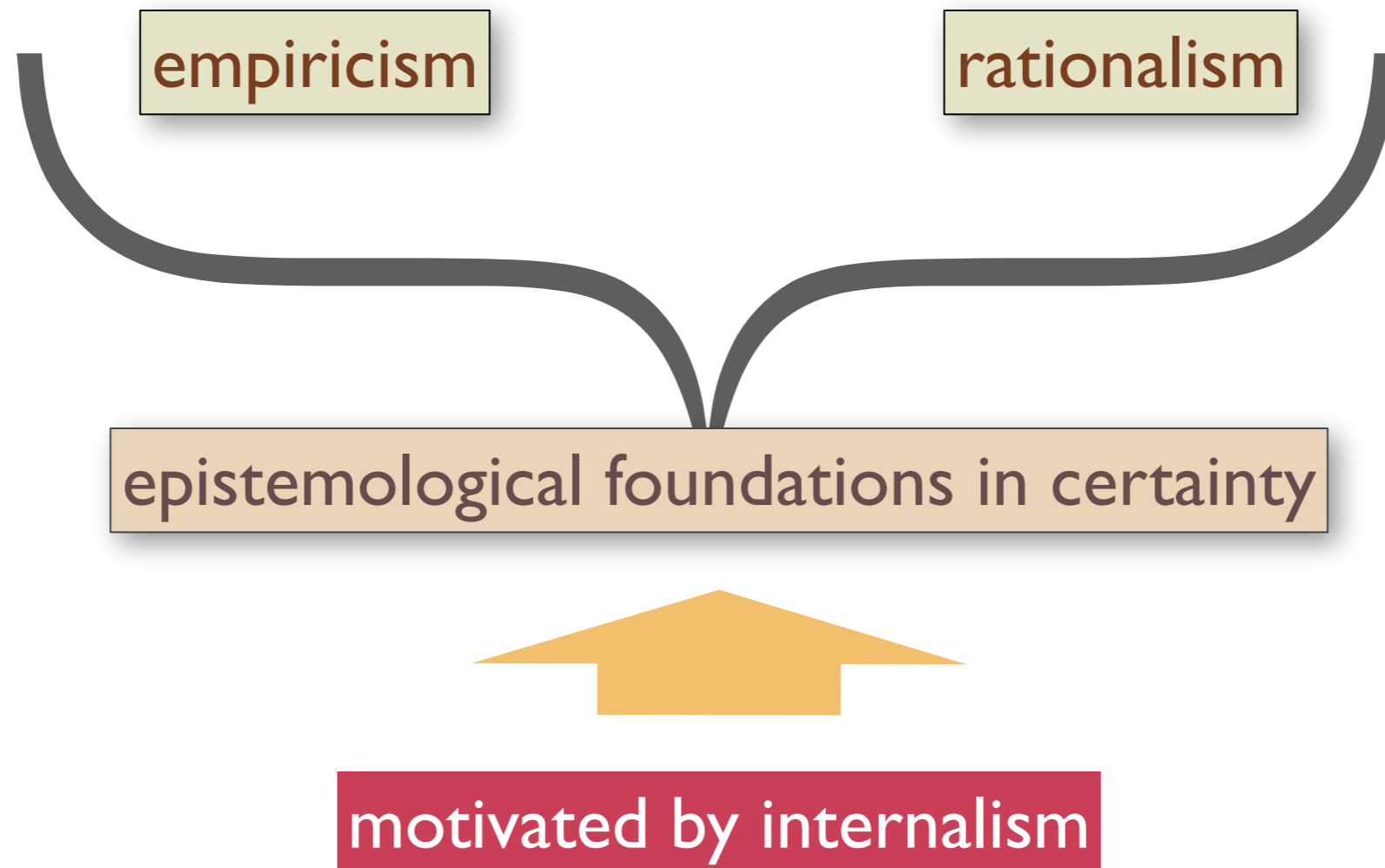
what does the empirical adequacy of the Higgs hypothesis amount to?

(CE) if a particle accelerator is constructed to specifications  $X$ , operated according to instructions  $Y$ , and software  $S$  is run on the collected data, commands  $C$  are issued by the scientist, then she will have experiences  $E$  when she looks at her computer screen.



empirical adequacy as the aim of science is absurd

# empiricism versus rationalism and internalism versus externalism



# empiricism versus rationalism and internalism versus externalism

*internalism*

S is justified in believing  $p$  iff S can become aware by reflection of all the facts relevant to S's justification for  $p$

*simple reliabilism*

S is justified in believing  $p$  iff S's belief in  $p$  is the result of a reliable process of belief formation.

# the pessimistic deduction

(P1) The evidence of science concerns only what is observable<sub>P</sub>

(P2) The conclusions of science concern what is unobservable<sub>P</sub>

(P3) No conclusion concerning what is unobservable<sub>P</sub> can reasonably be drawn from evidence solely concerning the observable<sub>P</sub>

---

(C) We cannot have a reasonable belief in the conclusions of science

# the pessimistic deduction

(P1) The evidence of science concerns only what is observable<sub>P</sub>

(P2) The **optimistic empiricists versus pessimistic empiricists**

(P3) No conclusion concerning what is unobservable<sub>P</sub> can reasonably be drawn from evidence solely concerning the observable<sub>P</sub>

---

(C) We can **scientific realists (optimistic empiricists) reject (P3) by appealing to Inference to the Best Explanation** science

# the pessimistic deduction

(P1) The evidence of science concerns only what is observable<sub>P</sub>

(P2) The conclusions of science concern what is unobservable<sub>P</sub>

(P3) No conclusion concerning what is unobservable<sub>P</sub> can reasonably be drawn from evidence solely concerning the observable<sub>P</sub>

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(C) We cannot have a reasonable belief in the conclusions of science

# the pessimistic deduction

(P1) The evidence of science concerns only what is observable<sub>P</sub>

(P2) The conclusions of science concern what is unobservable<sub>P</sub>

(P3) No conclusion concerning what is unobservable<sub>P</sub> can reasonably be drawn from evidence solely concerning the observable<sub>P</sub>

---

(C) We cannot have a reasonable belief in the conclusions of science

(C') We cannot have knowledge of the truth of theories concerning the unobservable<sub>P</sub>

note that in the light of  $E=K$  these amount to the same thing

# reading

see reading list at: [http://www.alexanderbird.org/Teaching/Reading\\_lists.pdf](http://www.alexanderbird.org/Teaching/Reading_lists.pdf)