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EMPIRICAL EQUIVALENCE AND UNDERDETERMINATION*

LARRY LAUDAN AND JARRETT LEPLIN

thinking about
empirical equivalents
to our best
scientific theories



actually creating
empirical equivalents
to our best
scientific theories



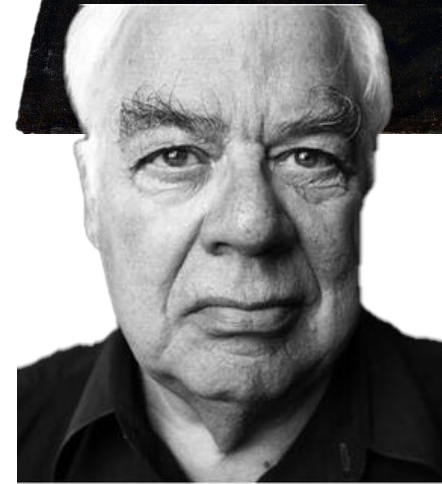
Outline

1. empirical equivalence
2. underdetermination
3. formal constraints on epistemology

Two Theses

1. there are always *empirically equivalent* rivals to any successful scientific theory
2. scientific theory choice is radically *underdetermined* by any conceivable evidence

Problem Children



Empirical Equivalence

- traditional view: theories are empirically equivalent just in case they have the same class of empirical consequences
- determining empirical equivalence among theories therefore requires identifying their respective empirical consequence classes
- **central ideas:**
 - the *observational properties* of a theory
 - the *empirical consequences* of a theory
 - the *logical consequences* of a theory

Three Familiar Theses

1. **VRO**: the variability of the range of the observable
2. **NAP**: the need for auxiliaries in prediction
3. **IAA**: the instability of auxiliary assumptions

Argument Against Empirical Equivalence

- VRO → what is a logical consequence of a theory may become an empirical consequence → findings of empirical equivalence are not reliably projectable
- NAP → what is considered an empirical consequence of a theory must allow for consequences which are derivable with the help of auxiliaries
- IAA → a theory's empirical consequence class may increase to the theory's total consequence class through the augmentation of auxiliaries
- **conclusion:** any finding of empirical equivalence is both *contextual* and *defeasible*

Potential Objections

- three possible ways of establishing empirical equivalence without needing to establish empirical content
 1. Lowenheim-Skolem
 2. instrumentalist algorithms
 3. potential examples
 - $(TN + R)$ vs. $(TN + V)$

Underdetermination

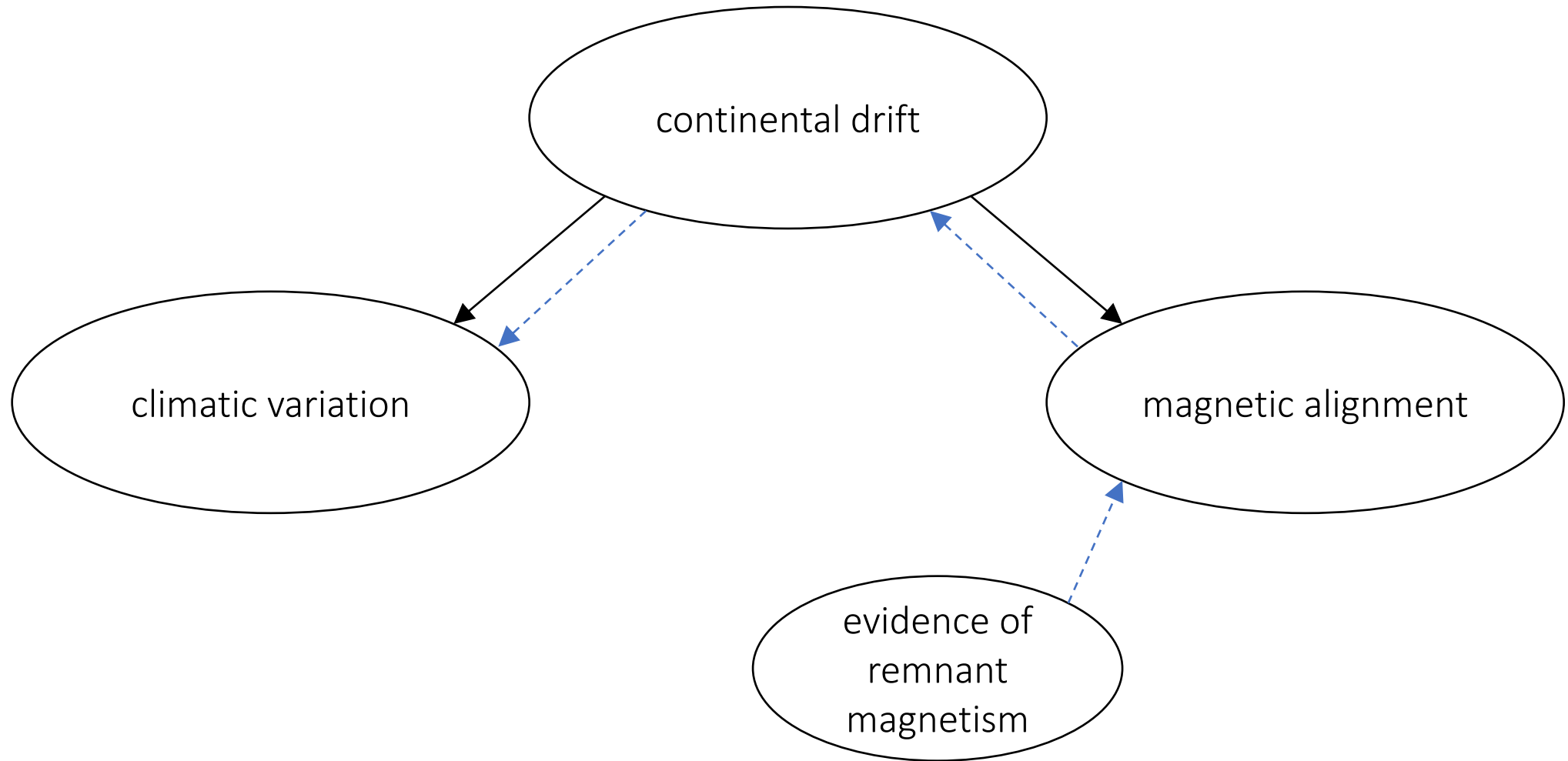
- claim: scientific theory choice is radically underdetermined by any conceivable evidence
 - L&L: “we shall argue that underdetermination does not in general obtain, not even under conditions of empirical equivalence”
- **claim:** if scientific theories possess the same empirical consequences, then they will be *equally well (or ill) supported* by those instances
 - L&L: “we shall contest this supposition and, with it, *the reduction of evidential relations to semantic relations*, on which it rests”

Underdetermination

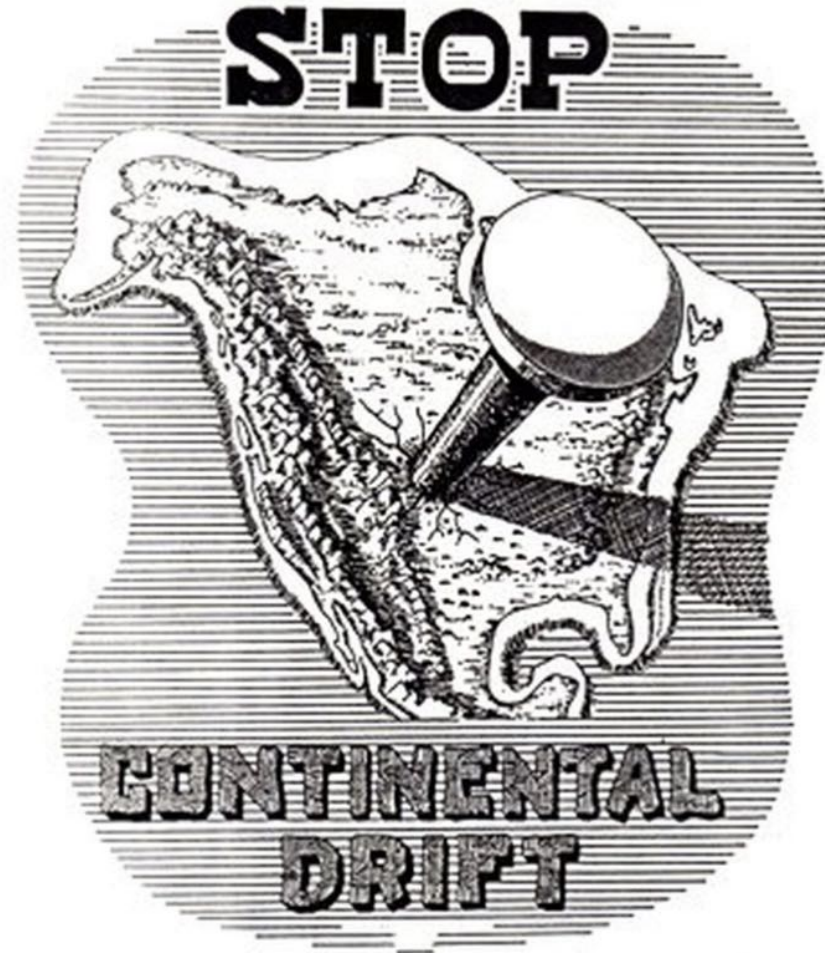
- to be shown:

1. results that are not empirical consequences of a theory may nevertheless still provide significant evidential support for the theory
2. even true empirical consequences of a theory need not provide evidential support for the theory

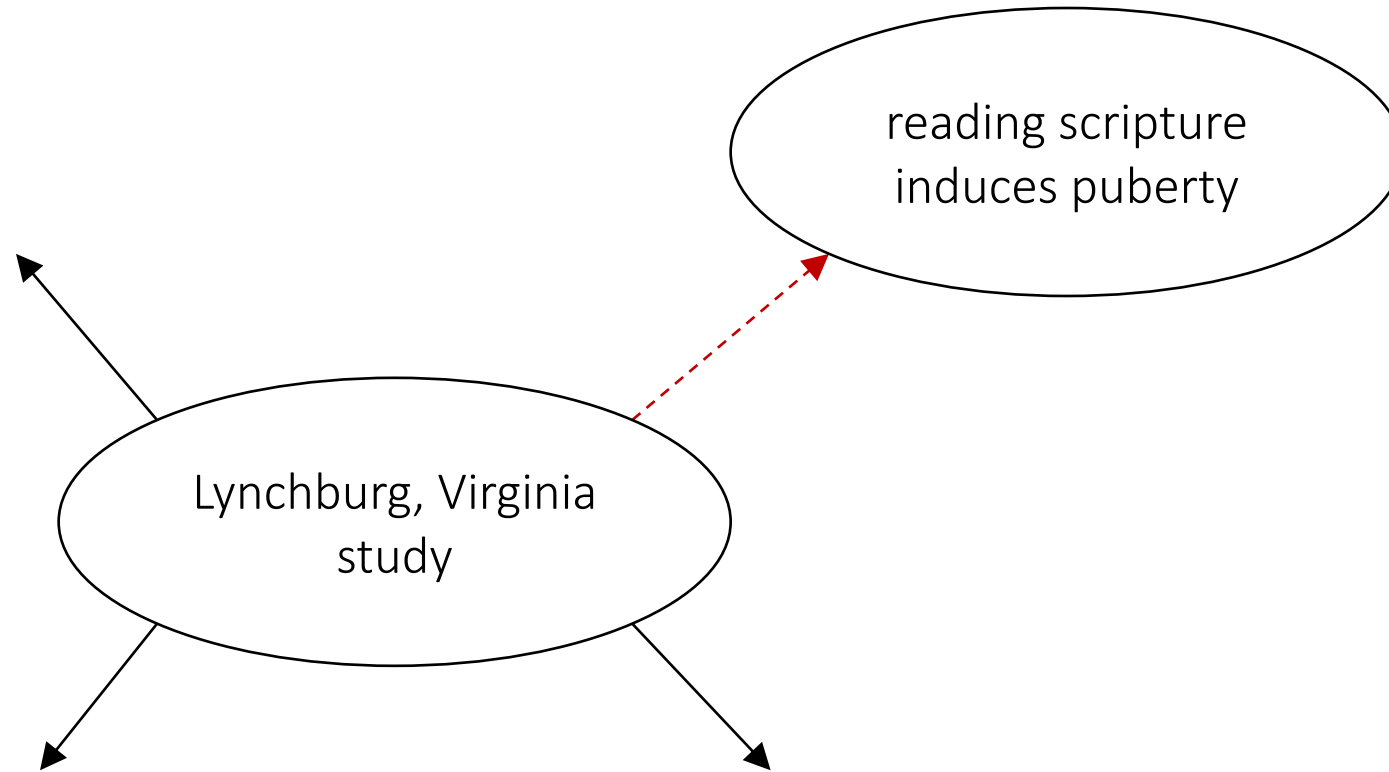
Evidential Relations that are Not Consequences



Evidential Relations that are Not Consequences



Empirical Consequences that are Not Evidential



Formal Constraints on Epistemology

- **confusion:** misunderstanding the relationship between semantics and epistemology
 - improperly applying the technical and formal machinery of semantics to epistemic issues

Gems



sentence structure



assuming empirical equivalence is OK (which it isn't), what follows?



diagnosing the issue



weird, and therefore memorable, example