Lange's Counterfactualism

Reference

Lange, Marc (2009). *Laws and Lawmakers: science, metaphysics and the laws of nature*. Oxford: Oxford University Press.

Rodrigo Cid
Universidade Federal do Rio de Janeiro

Counterfactuals

$p \Box\!\!\rightarrow q$ (p would q)

Had p been the case, q *would* have been the case.

$p \Diamond\!\!\rightarrow q$ (p might q)

Had p been the case, q *might* have been the case.

Had I put salt into water, it would have dissolved.

Mysterious truthmaker

Counterfactualism

- The laws are set apart from the accidents by their necessity, and such necessity is constitued of some maximal invariance under counterfactual (subjunctive) suppositions. This invariance is expressed through some subjunctive facts, which are primitively true and, thus, are the lawmakers of laws.
- Not Lewis / Not Ellis / Intermediate role as contingent necessities / Between accidents and broad logical truths.

Laws x Accidents

- All couples in this building have 2 children.
- All copper is electrically conductive.

- Had a couple in this building had just 1 child, copper would still be electrically conductive.

Nomic Preservation (NP) (p. 13)

- m is a law iff m would still have held under any subjunctive supposition p that is logically consistent with all the laws taken together, i.e., $p \mathbin{\Box\!\!\rightarrow} m$.

NP: Refinements

- Introducing context sensivity (p. 15)

  Taking context into account

- Only sub-nomic truths for p (p. 20)

  Avoiding counterlegals at the basis

- Excluding m and ~m at the same time (p. 21)

  $$\sim(p \Diamond\!\!\rightarrow \sim m) \rightarrow (p \Box\!\!\rightarrow m) \;\&\; \sim(p \Box\!\!\rightarrow \sim m)$$

- Allowing for nested counterfactuals (p. 23)

  $$\sim(r \Diamond\!\!\rightarrow (q \Diamond\!\!\rightarrow (p \Diamond\!\!\rightarrow \sim m)))$$

NP: Final Concept

m is a law iff in any context,

- $\sim(p \Diamond\!\!\rightarrow \sim m)$,
- $\sim(q \Diamond\!\!\rightarrow (p \Diamond\!\!\rightarrow \sim m))$,
- $\sim(r \Diamond\!\!\rightarrow (q \Diamond\!\!\rightarrow (p \Diamond\!\!\rightarrow \sim m)))$, …
- all hold, as long as p is logically consistent with all the n's (taken together) where it is a law that n, q is likewise, r is likewise, and so forth (p. 24).

Accidents also can be resilient, but they do not have nomic preservation. / NP does not differentiate laws from broad logical truths.

NP: Triviality, Circularity & Arbitrariness

- NP: m is a law iff in any context, p□→m holds for any p that is logically consistent with all the n's (taken together) where it is a law that n.

- Trivial: It is obvious that no accident have NP, because if m is an accident, the range of p accepts ~m, but if m is a law, it does not. / NP only shows that a p that fails to be preserved is not a law, because p is logically consistent with the laws. (or with the logical truths → not a logical truth)

NP: Triviality, Circularity & Arbitrariness

- Circular: The range of counterfactual suppositions for p is determined by the consistency with the laws, and it is used to determine which facts are laws.

- Arbitrary: It is arbitrary to priviledge the consistency with the laws. Why is consistency with laws special? Why not consistency with the fact that I am wearing a grey sweater?

Solution: Sub-nomic Stability

Consistency with the laws → Consistency with the set

- Consider a nonempty set Γ (gama) of sub-nomic truths containing every sub-nomic logical consequence of its members. Γ possesses sub-nomic stability if and only if for each member m of Γ (and in every conversational context), $\sim(p \Diamond\!\!\rightarrow \sim m)$, $\sim(q \Diamond\!\!\rightarrow \sim(p \Diamond\!\!\rightarrow \sim m))$, $\sim(r \Diamond\!\!\rightarrow (q \Diamond\!\!\rightarrow \sim(p \Diamond\!\!\rightarrow \sim m))$, ... for any sub-nomic claims p, q, r, ... where Γ U {p} is logically consistent, Γ U {q} is logically consistent, Γ U {r} is logically consistent, ...

Accidents and Sub-Nomic Stability

- The set of all sub-nomic truths trivially possesses sub-nomic stability.
- Λ (lambda, the set of all laws) is the largest nonmaximal set that is sub-nomically stable.
- **No nonmaximal set containing accidents is sub-nomically stable**. Ex.: All gold cubes are smaller than 1 cubic mile (g). / Had there existed a gold cube larger than 1 cubic mile, g would not hold; but it's inconsistent with the set. / Bill Gates wants that cube to be buildt (h). / To add ~h to the set makes h to be inconsistent with it. The idea is that this process goes on until we add all sub-nomic truths.

Proof: Arbitrary Accidents

- Disjunctive suppositions allow us to generalize: “had a gold cube exceeded 1 cubic mile or *had I had grey hair*” (k) is consistent with the set, and “all gold cubes are smaller than 1 cubic mile” would not held under the disjunction.
- To be inconsistent, we need to add the arbitrary accident “I do not have grey hair” (~k) to the set.
- So, if a set possesses an accident, it can only be sub-nomically stable, if contains every other accident. So, no nonmamximal sub-nomically stable set contains an accident.

One sub-nomic stable set and its proper sub-sets

For any two sub-nomically stable sets, one must be proper sub-set of the other (p. 37-38).

Assume that Γ (gama) and Σ (sigma) are two different sub-nomically stable sets and that one is not a proper sub-set of the other. Suppose t ϵ Γ, but not to Σ, and suppose s ϵ Σ, but not to Γ. All members of Γ must hold under "~s or ~t", given that it is consistent with the set. So t must hold and thus (~s or ~t)□→~s. In respect to Σ, the same reasoning leads us to ~((~s or ~t)□→~s). **Reductio achieved**. Ergo, there are no two sub-nomically stable sets that one is not a proper sub-set of the other.

Lawhood & Sub-nomic stability

- Every sub-nomically stable set contains the set of all sub-nomic logical truths, and no nonmaximal superset of Λ (lambda) is sub-nomically stable.
- In terms of sub-nomic facts: All sub-nomic truths > Λ (all laws and logical consequences) > Dynamical Laws + Conservations + Symmetries (excluding Force Laws) > Broad Logical Truths
- m is a law iff m belongs to the largest nonmaximal sub-nomically stable set, i.e., Λ. / Laws form nonmaximal sub-nomically stable sets.

The (Modal) Eutyphro Question

Are laws neccessary in virtue of being laws, or are they laws in virtue of being necessary?

- Armstrong: **Necessity in virtue of Lawhood**
- P is naturally necessary = P follows from the laws

Why is “follow from the laws” important? He cannot say “because it is naturally necessary”.

- Lange: **Lawhood in virtue of Necessity**
- Necessity consists of membership to a nonmaximal sub-nomically stable set / Members are invariant under the counterfactual suppositions that are consistent with the set.

Necessity is Stability

- Principle 1: for all p, q: $(\Diamond p \,\&\, (p \Box\!\!\rightarrow q)) \rightarrow \Diamond q$ (1)
- Principle 2: for all q: $\Diamond q \rightarrow$ for some p: $(\Diamond p \,\&\, (p \Diamond\!\!\rightarrow q))$ (2)
- From (1): for all p, q: $(\Diamond p \,\&\, {\sim}\Diamond q) \rightarrow {\sim}(p \Diamond\!\!\rightarrow q)$ (3)
- From (3): for all p, q: $(\Diamond p \,\&\, \Box{\sim}q) \rightarrow {\sim}(p \Diamond\!\!\rightarrow q)$ (4)
- From (4): for all p, q: $(\Diamond p \,\&\, \Box q) \rightarrow {\sim}(p \Diamond\!\!\rightarrow {\sim}q)$ (5)
- From (5): for all q: $\Box q \rightarrow$ (for all p: $(\Diamond p \rightarrow {\sim}(p \Diamond\!\!\rightarrow {\sim}q))$) (M)
- From (2): for all q: (for all p: $(\Diamond p \rightarrow {\sim}(p \Diamond\!\!\rightarrow q))$) $\rightarrow {\sim}\Diamond q$ (6)
- From (6): for all q: (for all p: $(\Diamond p \rightarrow {\sim}(p \Diamond\!\!\rightarrow {\sim}q))$) $\rightarrow \Box q$ (7)
- From (M) and (7): for all q: $\Box q \leftrightarrow$ (for all p: $(\Diamond p \rightarrow {\sim}(p \Diamond\!\!\rightarrow {\sim}q))$)
- Necessity is Stability: $\Box q \leftrightarrow (p \Box\!\!\rightarrow q)$, for all p that is consistent with all the necessities taken together.

Unified Necessity

- To be naturally necessary is to be member of the largest nonmaximal sub-nomically stable set.
- To have **stronger necessity**: To be a member of a nonmaximal sub-nomically stable set (proper sub-set of Λ) that survives under **more spheres of counterlegals**.
- Less to more necessary: Λ (including Forces) > Λ^* (excluding Forces) > Λ+ (only Meta-laws) > Broad Logical Truths > Narrow Logical Truths

Symmetries as Meta-Laws

Laws governing laws governing sub-nomic facts.

Symmetry Principles (Symmetries)

- Ex.: Laws are Lorentz Symmetrical (Coulomb's Law in rest / inertial movement)
- Symmetries are regularities of laws that hold as a matter of natural law; they are *requirements* over laws inasmuch laws are requirements over sub-nomic facts, and not their contingent *byproduct*.
- Requirement ~ Heuristic roles (structure of laws + to find new laws + to deal with counterlegals)

Meta-Laws and Nomic Stability

- To capture meta-laws, we have to broaden the concept of lawhood in terms of membership to a set with *nomic stability instead of mere sub-nomic stability*. (Symmetries have Nomic Stability, given they are nomic facts.)
- **Nomic Stability** (p. 114): Consider a nonempty set Γ (gama) of truths that are nomic or sub-nomic containing every nomic or sub-nomic consequence of its members. Γ possesses *nomic stability* if and only if for each member *m* of Γ (and in every conversational context), ~(p◊→~m), ~(q◊→(p◊→~m)), ~(r◊→(q◊→(p◊→~m))), ..., for any nomic or sub-nomic claims p, q, r, ..., where Γ U{p} is logically consistent, Γ U{q} is logically consistent, Γ U{r} is logically consistent, and so forth.

Noether's 1st Theorem: Symmetries and Conservations

1st Theorem: For a vast class of Lagrangian systems, some symmetries are logically equivalent to some conservation laws.

- Symmetries are more fundamental than conservation laws (and other first order laws), because symmetries have a stronger necessity, and only something with a **higher degree** of necessity **can ground** something with a **lower degree** of necessity.
- Symmetries have a stronger necessity, because, for example, had the dynamical laws been different, the symmetries would held, but not the conservations.

The Lawmakers Regress

- “The lawmakers (whatever they are) must be responsible for the laws' necessity. (…) But if the lawmakers themselves lack the relevant species of necessity, then it is difficult to see how they can supply the laws with their necessity” (p. 142-143). If they have it, we must ask ourselves from where did this necessity come?

- Subjunctive facts of the form $p \Box\!\!\rightarrow m$, $q \Box\!\!\rightarrow (p \Box\!\!\rightarrow m)$ etc., are invariant enough to ground laws. / No outside facts to ground necessity – self-contained.

Why Primitive Subjunctive Facts?

We cannot eliminate subjunctive facts

- They are not reducible to categorical facts: the nomic part is always additional (eg.: laws)./ **Less mysterious** than laws.
- Facts about **instantaneous rates of change** (instantaneous velocity – the heart of mechanicism/categoricalism) cannot have explanatory and causal roles (explain trajectory), if they are not thought as subjunctive facts (p. 164-ss).
- “That the match is actually dry is not directly responsible for making it true that the match would light, were it struck. That work is done by the fact that the match ***would be*** **dry,** ***were*** **it struck**”.
- If p and q are sub-nomic, $p \Box\!\!\rightarrow q$ is also sub-nomic. $\Box p$ is not sub-nomic, and it is a strengthening of p; and $p \Box\!\!\rightarrow q$ is not a strengthening of p neither q.

Work for Primitive Subjunctive Facts

- Sub-nomic + Subjunctive Facts at the bottom of the world.
- Some subjunctive facts are the **lawmakers** of the facts that are laws, and they are true primitively. (Accidents x Laws)
- Explain why lawhood is important: Lawhood is in virtue of Necessity, Necessity consists of Stability, i.e., **maximal counterfactual invariance** (important), what needs primitive subjunctive facts to not be circular. Lawhood and Necessity are explained. / No answer for the primitivist.
- Relation between laws and **counterfactuals for free**, thus keeping the heuristic roles of laws.
- Account for **nontrivial counterlegals** (≠ from categoricalism).

Stability (with Capitals)

- If we accept subjunctive facts at the bottom together with sub-nomic truths (using lower-case Greek letters), we can simplify the concept of nomic or sub-nomic stability to the concept of **Stability** (p. 153):

Γ (gama) is Stable exactly when there are some φ where $\Gamma \cup \{\varphi\}$ is logically consistent and for any such φ and any member ω of Γ, $\sim(\varphi \Diamond\!\!\rightarrow \sim\omega)$ holds (in any conversational context).

- **m is a law** iff m belongs to a nonmaximal Stable set.
- The **Stable set Λ'** includes Λ and the lawmakers. (Problem: lawmakers are not exactly laws / Answer: they are necessary enough to be considered laws)

And now?

- Counterfactualism internally consistent?
- Is Counterfactualism better than the alternatives?
- Could we metaphysically understand what are primitive subjunctive facts?

- Even if Counterfactualism is wrong, (i) the (modal) Eutyphro question, (ii) the lawmakers regress and (iii) the question about the reason of the Stability of laws, all of them must be adressed by all theories of laws.

Acknowledgements to

Alexandre Guay & Peter Verdee, by all the profitable discussions about Lange's theory