Natural Necessity and Structural Realism (Ontic and Methodological)

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Epistemic and Ontic Structural Realism

“[V]an Fraassen…comes very close to our view. The only difference between us is that we understand the relations in question to be nomological or more broadly modal, whereas he understands them to be extensional occurrent regularities. …[S]ome scientific realists of a Humean inclination…argue that van Fraassen is right about this latter point. We…argue that the marriage of scientific realism and Humeanism about modality is an unhappy one.” -Ladyman and Ross, 2007, 79, italics added.

- Informally, **structure** can be understood as the **abstract form of a system**. In other words, think of a **structure** as a property (universal) which abstracts away any features of the system’s objects that don’t bear on their interrelations and intrarelations.²

- **ESR**: (Weak) Individuals’ intrinsic properties are unknowable. (Strong) What is knowable consists only in the second-order relational structure of otherwise unknowable individuals and their properties.³ “[S]cience only tells us about purely logical features of the world …[since] we know only the (second-order) isomorphism class of the structure of the world and not the (first order) structure itself.” (Ladyman, 2009, 7)

- **OSR**: Regarding Demopoulos & Friedman’s (1985) criticism of ESR In accords with the semantic view, “the Ramsey sentence of a theory and the theory itself are importantly different.” (Ladyman, 2009, 10) At best Ramsey sentences pick out entities in such a manner that the referents of theoretical terms become functions of the place such terms hold in the theory’s logical structure, “so simply adopting Ramsification may actually make the problem of ontological discontinuity even more acute… structural realism should be thought of as metaphorically, rather than merely epistemically revisionary.” (ibid., emphases added).

- “I put aside e-OSR and focus on r-OSR and od-OSR only…I believe that the only way to make sense of e-OSR is to reduce it to some version of r-OSR or od-OSR…As for c-OSR [i.e. OSR-7] I really don’t know how to translate the term ‘being a construct’ unless talking about reduction again.” (Nounou, 2012, n. 10, 125)

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² Johannes Korbmacher (2015) formally characterizes these “two ways of talking about structure” in terms of a property qua system (interrelation) versus a property qua object within a structured system (intrarelations). For example, a group G and its subgroups can be specified in the former sense as a “node” within its lattice structure L(G) as well as in the latter sense as a structured entity in its own right (i.e. 〈G, ·〉 characterized by its “pattern of relations on relations” via the axioms of identity, inverse, associativity via its binary operation · : G × G → G.

³ Carnap (1929) and Russell (1929) articulated positions of strong ESR
• Object ontologies and the boundaries of OSR (Chakravartty, 2012, Fig. 10.1, 191)

![Diagram](image)

- **Limit:** Substance realism
- **Object-oriented ontologies (Brading & Skiles, 2012)**
- **Object realism**
- **Dispositional essentialism (Chakravartty, 2007)**
- **od-OSR (Nounou)**
- **r-OSR (Nounou)**
- **The ontological slippery-slope (Chakravartty, 2012)**

**Limit:** eliminativism (e.g. e-OSR)

- The ontological slippery-slope: There’s an unbridgeable lacuna between dispositional essentialism and od-OSR, as in the case of the former identity is determined by the potential for relations (e.g. causal). “The potential for relations is encapsulated in the concept of a disposition…applies to intrinsic properties of objects…it is simply not the case that the identities of objects depend on the relational structures of which they are a part.” (196)

- “The very attribution of an extrinsic property assumes that one has a prior grasp, ontologically speaking, of what it is that stands in the relevant relation…[T]here is no parallel difficulty in the context of intrinsic features.” (201)

- As a direct response to Chakravartty (2012) Dean Rickles argues: “In a background independent gauge theory like general relativity…the physical observables just are relational quantities. That is all there is!...[T]he notion of a non-relational quantity, defined at a point of spacetime, is physically incoherent...In other words, there’s nothing ‘underneath’ the relational properties...we have here an empirical argument for ontic structural realism that evades the ‘no relations without relata’ objection. The relations are the correlations here...and the relata would be the non-gauge invariant, partial observables...We cannot decompose the correlations in an ontological sense, though we clearly can in an epistemic or formal sense.” (2012, 143)

- Antigone Nounou: “[I]f the characteristic properties turn out to be structural...then showing that the [three] relational properties are also structural and that objects or kinds thereof can be deflated metaphysically should be straightforward.” (2012, 131)

- Katherine Brading & Alexander Skiles: “[T]he shift from eliminating objects to ‘reconceptualizing’ them...reveals how OSR is a victim of its own argument...trading in object-oriented realism for OSR, we have traded one pair of metaphysically underdetermined interpretations for another.” (2012, 112)

*Metaphysics Naturalized (Ladyman & Ross, 2007)*

- “What OSR denies is that real patterns resolve ‘at bottom’ into self-subsistent individuals...we must put the ‘at bottom’ inside scare-quotes, because we find the levels metaphor misleading. *The single most important idea we are promoting in this book is that to take the conventional philosophical model of an individual as being equivalent to the model of an existent mistakes practical convenience for metaphysical generalization.*” (Ladyman and Ross, 2007, 228-9, italics added)
• The above, arguably, is an instance of a metaphysics of physics based non-fundamental ontology (Kerry McKenzie, 2015)

• Naturalistic metaphysics, then, utilizing the PNC and PPC underwrites OSR as a species of information-theoretic (not ‘infostuff’) fundamentalism:

• “[A] practicing physicist entertains the idea of modal structure ungrounded in substances and natures of fundamental entities is...PNC-compatible evidence that OSR should be taken seriously despite its incompatibility with the intuitions fostered in philosophers by the combination of parochial demands placed on our cognition...and an education in the classical texts of metaphysical tradition.” (Ladyman & Ross, 2007188)

Information and Modality

• Pace Chakravartty’s accusation of PPC’s “question-begging”: “[T]here are some real patterns about which measurements taken anywhere in spacetime at any scale of measurement carry information (in the logical, not thermodynamic, sense). Fundamental physics is that part of institutional science responsible for trying to discover maximally redundant real patterns.” (Ladyman & Ross, 2007, 251)

Nomic Preservation (Marc Lange)

Subnomic facts: propositions without embedded “it is a law that...” operators. I.e., ‘energy is conserved’ is a subnomic fact, whereas ‘It is a law that energy is conserved’ is not.

Lange’s shorthand for counterfactual conditionals:

\[ p \Box \rightarrow m \] should be read as: “Had \( p \) been the case, then \( m \) would have been the case.” Elsewhere, Lange connects such counterfactual conditionals with subjunctive ‘might have’ statements: \( p \Diamond \rightarrow q \) is shorthand for “Had \( p \) been the case, then \( m \) might have been the case.” In particular, ( n. 24, 195-195): The following entailment is demonstrated \(~(p \Diamond \rightarrow \neg q) \Rightarrow p \Box \rightarrow q\). However, Lange argues against the converse entailment, and thus denies an equivalence between ‘not-might-not have’ with ‘would have’ (as opposed to the ordinary, i.e. non-counterfactual, case in modal logic, i.e. \(~\Diamond \equiv \Box\)).

The principal reason why Lange denies the converse entailment has to do with the Modality Principle (MP) discussed in 63-71.

“Sub-nomic stability does not start by giving special privileges to laws. It is very egalitarian; it does not grant the laws the right to dictate to every set the range of counterfactual suppositions under which that set’s invariance is to be tested. Stability thus has the potential to be a genuinely special feature of the laws.” (30, italics added).

“My purpose in offering this argument [for NP] is...to explain why it is not unprincipled to acknowledge context’s tremendous influence on what is preserved under a given counterfactual supposition, and yet to insist that in any context, the laws are preserved under any sub-nomic supposition logically consistent with them.” (n. 34, 206)

Subjunctive Facts as Lawmakers: Insofar as facts of course correspond to an abstract, propositional structure, “the universe’s state at a given moment cannot be purged of irreducibly subjunctive facts,” (2009, xiv)
For example, instantaneous rates of change lend themselves to a naturally subjunctive interpretation: “[A] quantity’s instantaneous rate of change at time $t$ traditionally plays various causal and explanatory roles...[and] [t]he best way to account for the causal and explanatory roles...is to interpret the rate in terms of some irreducibly subjunctive fact.” (ibid) To take the homely example of velocity, for instance, according to Lange naturally connotes that the case “were the body (existing at $t$) to remain in existence after $t$, the body’s trajectory would have a time-derivative at $t$ equal to $v$” (ibid.)

Lange argues that subjunctive facts are what underwrite natural necessity—i.e. the distinctive kinds of nomological modality providing the structure of sets of laws (135-189). “If such [subjunctive] facts must be countenanced as anyway, parsimony urges us to put them to work as lawmakers.” (xiv)

**Methodological Structural Realism**

Recalling Ladyman & Ross’s (2007) PNC: Naturalism imply for Landry that claims of existence are made by scientists, not philosophers, “and that the methods that give rise to such claims are scientific, not philosophical...philosophers [on the other hand] have the task of the analysis of the content and structure of what scientific theories express.” (Landry, 2012, n. 2, 29)

**Law Constitutive Ontology**

For something to be a physical object it is both necessary and a sufficient condition that it satisfies the laws in a physical theory. (Brading & Skiles, 2012, 104)

Compare this with Elaine Landry’s argument for the sufficiency of objects’ presentation by the particular structures most suitable in a given physical theory.

“By appealing to the law-constitutive account of physical objects, we can pull apart objecthood and individuality in a very natural way...In itself, the law-constitutive approach to physical objects is neutral with respect to structuralism: adopting the approach is consistent with, but does not entail, a structuralist reading of the objects that are the subject-matter of those laws.” (105)