

Pragmatic Structural Realism and the Newman Objection

Workshop: "Structural Realism, Structuralism and Theory Change"

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Aim of the talk

- (1) To discuss the Newman Objection and some of the responses it generated.
- (2) To develop a pragmatic, Carnapian response.
- (3) To highlight some implications of the Carnapian proposal.

Outline of the talk

- 1 Structural realism and the Newman objection
- 2 Some responses to Newman
- 3 A pragmatic way out of the Newman objection
- 4 Founded relations
- 5 Structuralism
- 6 Realism
- 7 Conclusion

1. Structural realism and the Newman objection I

Quick reminders:

Epistemic structural realism (ESR): All we can know is structure (Poincaré, Russell, Cassirer, Worrall, and others).

Ontic structural realism (OSR): All there is *is* structure, and there are no individual objects at the ontologically fundamental level (Steven French, James Ladyman, and others).

We will focus on ESR, which does not aim to eliminate objects altogether, and we will make, at a crucial juncture, a Carnapian move.

1. Structural realism and the Newman objection II

Structure is not sufficient to uniquely pick out relations in the world.

- Suppose that the world consists of a set of objects, and its structure is W . W includes a family of relations R , but nothing else is known about it.

Given any collection of objects, only the formal structure of these relations can be established—provided that there are enough objects to begin with.

Given only the formal structure, it is not possible to identify a unique referent for this class of relations. We could stipulate that we are talking about the intended class of relations. But, as will become clear below, this move goes beyond a purely structural description.

1. Structural realism and the Newman objection III

- **Newman himself expressed this very clearly:**

“Any collection of things can be organized so as to have the structure M , provided there are the right number of them. Hence the doctrine that only structure is known involves the doctrine that nothing can be known that is not logically deducible from the mere fact of existence, except ('theoretically') the number of constituting objects" (Newman 1928: 144).

2. Some responses to Newman I

- **Two attempts to answer Newman's objection:**

From the semantic conception: "the Newman problem is obviated if one does not think of structures and relations in first-order extensional terms" (French and Ladyman 2003a: 33).

From an ESR-perspective: "First of all, it should be made clear that if all the structural realist is arguing for is the claim that there exist relations with particular structures, then this is obviously trivial for the reasons Newman mentions. But no structural realist makes such a claim!" (Votsis 2004: 122).

2. Some responses to Newman II

- It is an open question whether versions of SR within the semantic conception of theories don't get affected by the Newman objection. After all, Newman's formal result holds regardless of the mathematical framework that is in use.
- Ontic structural realism is unaffected by Newman's objection, since it is not an epistemological position, but rather a view about what there is. **An obvious problem: In order to claim what there is, don't we need to *know* what there is first?** A proper interaction between one's ontology and epistemology is in order here.
- In agreement with Votsis: One should say more than just that there exist relations within particular structures. This leads to a pragmatic version of SR.

3. A pragmatic way out of the Newman objection I

- We accept, of course, the formal result of Newman's Objection, but we wonder about its philosophical impact.
 1. In debates on structural realism (mostly on ESR), we search for cases of structural continuity between apparently radically different theories.
 2. Given these cases, one can employ a variety of different formal tools to reconstruct them—Ramsey-sentence views (not recommended!), semantic approaches (partial structures, structuralist meta-theory, and so on).

3. A pragmatic way out of the Newman objection II

3. When we write down the structure of an empirical theory in a specific formal framework, Newman's problem doesn't emerge. After all, we need to state explicitly what the domain of the theory consists of (particles, genes, markets, etc.), and it's no longer a trivial matter whether structures of the appropriate kind can be constructed.

- But doesn't this leave structuralism behind? No! It is a pragmatic move, which allows one to incorporate the content of Newman's result, while questioning its philosophical import.
- However, if one stays at a very abstract level (disregarding the content of the theories in question), Newman's objection arises.

3. A pragmatic way out of the Newman objection III

Semantic approaches in the philosophy of science typically make use of set-theoretic predicates, relying on Suppes' (1957) original proposal. We can characterize a set-theoretic predicate P as a predicate that specifies:

- the type of a structure $\langle D_1, \dots, D_k, R_1, \dots, R_n \rangle$, where k is the number of base sets, and n the number of relations;
- the typification of the relations R_1, \dots, R_n ;
- the axioms that the relations R_1, \dots, R_n need to satisfy.

As a result, the structure $\langle D_1, \dots, D_k, R_1, \dots, R_n \rangle$ will eventually satisfy the set-theoretic predicate P .

This tool allows one to represent the structure of scientific theories (e.g. within ESR).

3. A pragmatic way out of the Newman objection IV

An example: A potential model of *Classical Collision Mechanics*:

$M_p(\text{CCM}) = \langle P, T, \mathbb{R}, v, m \rangle$ (see Balzer *et al.* 1987):

- 1 P is a finite, non-empty set;
- 2 T contains exactly two elements;
- 3 $v : P \times T \rightarrow \mathbb{R}^3$;
- 4 $m : P \rightarrow \mathbb{R}^+$.

P is a set of discrete bodies that can be called 'particles', T is a set of two instants, one time instant before the collision, and the other time instant after the collision. v is the velocity function, assigning to each particle p and point of time its velocity as an element of \mathbb{R}^3 . Velocity is a time-dependent vectorial function whose range are triples of real numbers. It assigns a three-component vector (one component for each direction in space) to each particle at each time. m is the mass function, assigning to each particle its mass.

3. A pragmatic way out of the Newman objection V

- Why is the information provided by a theory representation using a set-theoretic predicate trivial, as Newman would have claimed?
- The information is not trivial, since we say explicitly what the elements of our basic domain are—in this case, particles.
- To provide a structuralist representation of an empirical theory, with a set-theoretic predicate, is no trivial task: a structure of the relevant kind (about the objects in question) may not be available.
- Our proposal is that, if the SR wants to be safe from a trivialization charge, a pragmatic stance is needed. The pragmatic move consists in specifying explicitly the empirical system that is being represented, and to determine concretely the domain of objects and their relations.
- This is required to make sense of any structural formulation of a scientific theory; otherwise, the theory becomes just a piece of mathematics.
- This move bears relations to van Fraassen's (1997) response to Putnam's model-theoretic argument, but as will become clear below, it's also importantly different from it.

3. A pragmatic way out of the Newman objection VI

- In purely formal terms, Newman's objection presents a challenge to those who make the abstract claim that "all our knowledge is structural", since a pragmatic component is required.
- In fact, the proper understanding of the relevant theories requires attention to their pragmatic counterpart. Thus, attention to particular case studies is central (as is usually the case with the semantic view, such as the partial structures approach, or the structuralist meta-theory).
- By specifying explicitly what our set-theoretic predicates represent in each case, the information about the structure of our theories is not trivial.

4. Founded relations

- A Carnapian proposal:

In §154 of the *Aufbau*, Carnap (1928) introduces *founded relations*:

"we want to call relations that correspond to an experienceable, 'natural' relation, whose corresponding parts do have something experienceable in common, 'founded relations'".

→ The relations specified by set-theoretic predicates are experienceable and "natural" in Carnap's sense.

4. Founded relations

- Following Carnap, founded relations are *erlebbar*, which means that they are experienceable. Given this feature of founded relations, it is possible to specify only those structures that are relevant for the description of our empirical knowledge, namely, those corresponding to experienceable relations.
- Thus, we begin by picking out *real*, existing, physical relations.
- We then provide a description of such real relations in terms of set-theoretic predicates, and we select those set-theoretic relations that stand for the appropriate experienceable relations.

4. Founded relations

- This Carnapian proposal provides an answer to the Newman objection, for it restricts the possible structures only to *experienceable* relations.
- These are any relations that one *can* experience. Some are experienced directly (directly observable relations); others are experienced indirectly (via instrumental access). But in none of these cases are we concerned with *any abstract* structure.
- As soon as one tries to talk about structure in a more general and abstract way, the Newman objection may rise again.

5. Structuralism

Have we given up on pure structuralism by moving to experienceable relations?

- It depends on what the requirements are on structuralism. If pragmatic considerations are not considered part of the structuralist framework, then structuralism is left behind. Otherwise, it isn't.
- But note that without such pragmatic component, pure structuralism makes very little sense, since one cannot specify what the structures that are introduced in one's theories are *about*. The intelligibility of structuralism ultimately demands this pragmatic feature.

6. Realism

Have we given up on realism by moving to experienceable relations?

- We have emphasized the empiricist requirement on experienceable relations, but we have understood such relations broadly (some are directly experienceable, others are indirectly so). Three interpretations:
- (a) *Constructive empiricist reading*: The experienceable relations (those to which one should assign an epistemic role) are restricted only to directly observable relations.
- (b) *Broadly empiricist reading*: The experienceable relations include directly observable relations and indirectly observable relations—as long as one knows that the relevant instruments satisfy epistemic conditions akin to observation (Bueno 2011).
- (c) *Realist reading*: The experienceable relations include directly observable relations and indirectly detectable relations (that is, one can detect them with instruments that need not be akin to observations).

6. Realism

Thus, depending on how one interprets the experienceable relations, realist and anti-realist views can be accommodated within the framework we propose.

7. Conclusion

- Newman's objection holds if we make just abstract structural claims. But understood in this way, the objection has no connection to SR in the philosophy of science, where concrete cases of actual theories are at issue.
- By invoking a set-theoretic predicate formulation of the structure of a physical theory, we need to state explicitly the domain of objects the theory is about. By doing so, one is forced to leave behind the territory of abstract knowledge claims.
- We then emphasize the crucial role of experienceable relations, and provide a broad framework in which these relations can be multiply interpreted. This leads to different philosophical views (from constructive empiricism through a broad form of empiricism to realism).
- In this way, we can acknowledge Newman's place, and claim that Newman is of course right, although the philosophical impact of his result is, in the end, limited.

Thank you!

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