Understanding Russell's Response to Newman

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Synopsis

The revival of Newman's (1928) objection to Russell's Causal Theory of Perception by Demopoulous & Friedman (1985) has led to the widespread opinion that Russell's view was an early form of Epistemic Structural Realism, against which Newman had provided a devastating objection. Russell's letter to Newman soon after is taken to represent his complete capitulation, where, in a "classic Homer Simpson 'Doh!' moment" (French, 2014, 73), he realizes that his structuralist account of theoretical knowledge has been "demolished" (Linsky, 2013). But if this was really Russell's understanding then how are we to explain the "nonchalant response to a devastating criticism" that follows (Linsky, 2013)? Why, then, did Russell never discuss Newman's objection in print, while essentially restating the same theory in later work (Demopoulos & Friedman, 1985)?

To remove this appearance of intellectual dishonesty on Russell's part, I argue that Newman only pointed out an ambiguity in the formulation of Russell's theory of perception in *Analysis of Matter*, which was easily remedied. Russell's letter merely thanks Newman for pointing out this ambiguity, which was due to his incautious statements to the effect that "*nothing* is know about the physical world except its structure" (Russell, 1968, 259), while accepting Newman's suggested reformulation of his view. This reformulation,

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however, departs from what Russell wrote in *Analysis of Matter*. Nonetheless, I find there a plausible formulation of Russell's view that also avoids Newman's objection.

The failure of recent scholarship to discern this possibility is due to the conflation of Russell's actual views with Grover Maxwell's later Epistemic Structural Realism which, although inspired by Russell, is not Russell's view. This has led recent commentators to suppose that Russell was committed to the thesis that only *abstract* structure can be directly known (Votsis, 2003, 2005). However, Russell had never maintained that we cannot be directly acquainted with relations—as he later wrote, this view he had "repeatedly repudiated with all possible emphasis" (Russell, 1944, 693)—and *Analysis of Matter* contains a list of 'perceptual relations' that can be perceived, e.g., temporal precedence, spatial relations, resemblance, simultaneity (Russell, [1927] 1954, 278).[1]

With this in mind, we see that Russell's causal theory of perception involves acquaintance with a concrete structure, and his formal explication of similarity of structure should be read as an equivalence relation that holds between two concrete structures, relative to a perceptual relation (given in intension). Rather than asserting the mere existence of an abstract structure, a condition that Newman showed to be trivially satisfied when a set of the same cardinality exists, Russell really meant to assert the existence of an external relation with the same logical properties as the perceived relation and a set of events ordered by that external relation in the same way (represented by, e.g., a partially ordered set). Russell's theory, then, asserts that there exists a concrete structure with a relation (given in intension) defined on it such that (i) the relation has the same logical properties as the perceived relation and (ii) the set is structured by that relation in the same way, i.e., the two concrete structures instantiate the same abstract structure relative to their respective logically equivalent relations. This claim suffices to avoid Newman's triviality objection, but doesn't go so far as Newman's suggestion that the theory be revised so that *the same* relation is said to hold in each case.

This interpretation respects Russell's Doctrine of External Relations (which counts ag-

[1]The exception that proves the rule: although Demopoulos (2003, 2011) appreciates this aspect of Russell's position, by formulating the problem in Maxwell's terms he fails to see its significance for understanding Russell's response to Newman.

ainst taking relations in extension) and also receives support from his discussion of structural similarity in his *Introduction to Mathematical Philosophy* ([1919] 1993). It is relevant to the recent literature on Newman's objection since, although it has often been suggested that taking relations in intension would suffice to avoid Newman's problem (by, e.g., Hochberg, 1994), there is no precise formulation of a structural realism that does so. There is also relevance for the continuing debate among structural realists concerning the relative merits of Ontic and Epistemic Structural Realisms. Perhaps surprisingly, my account of Russell's relational realism more closely resembles contemporary Ontic Structural Realisms, although Russell avoids objections concerning the incoherence of positing relations without relata. Russell's attempted reconstruction of space-time in relational terms also bears a close resemblance to the space-time structuralism considered by Wüthrich (2012). This resemblance is not accidental: Russell's *Analysis of Matter* contains an important—and, in some ways, more sophisticated—antecedent of this structuralist understanding of space-time.

1 Introduction

Russell's Causal Theory of Perception is laid out in Chapter 20 of *Analysis of Matter* (AMa) ([1927] 1954) and can be summarized as follows. In the event ontology of AMa, a perceiving subject is to be identified with a family of inter-related events forming a biography, i.e., the history of a mind. Some of these events are percepts, which are richly structured due to the causal relationships they bear to external stimuli, e.g., tables. We are not directly acquainted with the groups of events from which Russell would construct external objects like tables, but we are acquainted with the relations that order our percepts and so structure our experience. The structure that these percepts bear in virtue of being ordered by these relations is mirrored in the structure of the external events that caused them, in the sense that the external events are structured in a logically equivalent manner.

The problem with this last claim, applied to some definite set of percepts, is that it is ambiguous between:

S1 If a set of percepts P instantiates a structure S then the set of external events E instantiates an isomorphic structure S' (i.e., they are structures with the same relation-number).

S2 If a set of percepts P is ordered by a perceived relation R then the set of external events E is ordered in the same way by a relation R' having the same logical properties as R.

This ambiguity is the focus of Newman's (1928) paper, who supports the first reading by quoting an incautious remark of Russell's that "wherever we infer from perceptions it is only structure that we can validly infer; and structure is what can be expressed by mathematical logic" (254). But, as Newman points out, the first conditional (S1) is trivially satisfied when E and P have the same cardinality. This cannot suffice to explicate the required notion of shared structure that would support meaningful inferences about the complex causes of percepts. However, Newman acknowledges that something like S2 is non-trivial:

> A point to be emphasised is that it is meaningless to speak of the structure of a mere collection of things, not provided with a set of relations—e.g., of a set

> of dots not connected by any lines. Further, no important information about the aggregate A, except its cardinal number, is contained in the statement that *there exists* a system of relations, with A as field, whose structure is an assigned one. For given any aggregate A, a system of relations between its members can be found having any assigned structure compatible with the cardinal number of A. Thus the only important statements about structure are those concerned with the structure set up in A by a given, definite, relation. (Newman, 1928, 140)

The distinction that Newman draws our attention to here has to do with the differing standards of similarity of structure for two sets with a relation defined on them and, e.g., two sets partially ordered by a binary relation (i.e., two posets), a distinction that also applies to S1 and S2. In the first case, isomorphism suffices; in the case of two posets, however, we require an order homomorphism, i.e., an order-preserving bijection. However, rather than consider S2, Newman apparently presents a third, logically stronger, alternative:

S3 If a set of percepts *P* is ordered by a perceived relation *R* then the set of external events *E* is ordered in the same way by the same relation *R*.

This is evidently stronger than S2, which could be satisfied by two empirically distinct relations (given in intension).

2 Russell's Response

It seems clear that Russell could be interpreted as holding either S1 or S2 in AMa, but not S3. So when Russell writes to Newman that "I had not really intended to say what in fact I did say, that *nothing* is known about the physical world except its structure" (Russell, 1968, 259) he could be interpreted as merely saying that he regretted making statements that could be taken to assert S1 rather than S2. However, Russell follows this sentence with remarks that could be taken to endorse S3, choosing co-punctuality—a relation central to his attempted construction of space-time in AMa—as an example:

> I had always assumed spacio-temporal continuity with the world of percepts, that is to say, I had assumed that there might be co-punctuality between percepts and non-percepts, and even that one could pass by a finite number of steps from one event to another compresent with it, from one end of the universe to the other. And co-punctuality I regarded as a relation which might exist among percepts and is itself perceptible. (Russell, 1968, 260)

In fact, this idea is also Newman's, and he regards it is a plausible interpretation of AMa that Russell had intended to propose that such a relation is directly perceived (Newman, 1928, 148).

But what exactly does Russell commit himself to in AMa? Instead of a precise statement of the relation of 'similarity' for systems of relations (i.e. concrete structures—as the current literature on Newman's objection would lead one to expect) what we find is an account of similar *relations*:

> Take, e.g.: "*Before* is a transitive relation." This is not a statement which pure logic can enunciate, because *before* is an empirical relation. But "*R* is a transitive relation, where *R* is a variable, can be enunciated by pure logic. . . . It will be seen that transitiveness, e.g., is a logical property of a relation; so is asymmetry or symmetry . . . We can now state the proposition on account of which structure is important:
> *When two relations have the same structure (or relation-number), all their logical properties are identical*. (Russell, [1927] 1954, 251)

Call this RC, for Russell's Criterion. This is intended as a criterion of equivalence for *relations*, understood in intension. This criterion, applied to percepts, is what Votsis (2005) calls the:

> Mirroring Relations Principle (MR). Relations between percepts mirror (i.e., have the same logico-mathematical properties as) relations between their non-perceptual causes. (Votsis, 2005, 1362)

Votsis regards this principle as underwriting Russell's assumption of structural similarity, In Russell's presentation, however, this principle *follows* from the assumption that complex effects share structure with their complex causes; it does not imply it.[2]

Given Russell's frequent assertions to the effect that relations such as 'before' can be perceived, it seems that Votsis errs in saying that "Russell claims that we can at most know the second-order structure of physical relations but not the relations themselves for we have no epistemic access to them" (Votsis, 2003, 882). In fact, later in AMa, Russell gives further examples of the sort of relations between percepts that can be perceived.[3]

> I shall call a relation "perceived" or "perceptual" if the fact that this relation holds between certain terms can be discovered by mere analysis of percepts. Thus before-and-after is a perceptual relation, when it occurs between terms both of which belong to the specious present. Spatial relations within the visual field are perceptual; so are those between simultaneous tactile sensations in different parts of the body. . . . There are perceived relations between a percept and a recollection, which leads us to refer the latter to the past. There are perceived relations of comparison [e.g., resemblance] . . . There is also, I should say, a perceived relation of simultaneity. I do not suggest the above list is complete, but it indicates the kinds of cases in which relations can be perceived. (Russell, [1927] 1954, 278)

So Russell regards simultaneity as a perceptual relation in AMa. But, in the event ontology interpretation of relativity theory that he presents, the relation of local simultaneity—the only objective simultaneity relation that relativistic physics supports—is nothing but co-punctuality, i.e., overlap of events. So Russell was already committed to the idea that co-punctuality was a perceptible relation (at least, when it holds between percepts). To claim that these relations must be *qualitatively* identical in order to escape Newman's ob-

[2]See the introduction to this chapter, where Russell writes that he is taking for granted "the assumption of a certain similarity of structure between cause and effect where both are complex" (Russell, [1927] 1954, 249).

[3]Assertions like this, made throughout Russell's career, explain Russell's apparent astonishment in replying to Max Black in 1944 that "Mr. Black must suppose me to hold that we cannot be acquainted with relations—a view which I have repeatedly repudiated with all possible emphasis" (Russell, 1944, 693).

jection, as does Demopoulos (2003, 414), surely misses the point: what quality could a *non-experienced* relation possess that would be relevant to science? And what could prevent relations among percepts from satisfying the definitions of relations that physics takes to apply to *all* events, without exception?

That is, when we give a theoretical description of a relation, e.g., 'temporal precedence,' we can only give its logical properties. (At least, so claims Russell in AMa.) This provides, therefore, a definite description satisfied by an entire equivalence class of physical relations (equivalent under RC). Now suppose that we are able to perceive a relation that behaves just like temporal precedence, having the same logical properties on the class of events of which we are directly aware (i.e. percepts). In that case, we are justified in claiming that the relation we perceive satisfies the theoretical definition, and thus lies in the same equivalence class as the posited theoretical relation 'temporal precedence.'

However, referring to a physical relation *by description* can only pick out an entire equivalence class of logically equivalent physical relations that are apt to play that theoretical role. Since the perceptual relation lies within that equivalence class it is, for all intents and purposes, *the same relation* as the theoretical relation. In this respect, the theoretical description behaves as if it picked out a universal that is instantiated as a perceptual relation. Nonetheless, the perceptual relation is not *identical with* the theoretical relation, it merely satisfies the corresponding description. In this sense, Russell's response to Newman is consistent with him having maintained S2 rather than S3. And S2 is sufficient to avoid Newman's objection, as I now explain.

3 Understanding this Response

The key point is that Russell's claim of direct acquaintance with perceptual relations allows us to suppose that we have empirical access to concrete structures and the relations that structure them (rather than abstract structures) and this allows us to pick out an equivalence class of structurally similar concrete structures—i.e., sets structured by a specified relation—in a non-trivial way. The sense in which S2 is stronger than S1, then, is that S1 only asserts the existence of a set E on which a relation structurally similar to R can be defined, whereas S2 asserts that there exists a another relation R' logically equivalent to R (in the sense of RC) which structures some set E in the same way as R structures P. Key to this solution is the idea that R and R' can be given independently of their extensions: in particular, R is known by direct acquaintance and both R and R' are known to satisfy a theoretical definition. In that case, S2 asserts that R' is a physical relation in the same equivalence class as R and that E is a set structured by R' in the same way that R structures P. Here's a more precise expression of RC that captures this idea.

Definition 1. *Let A and B be two n-term relations and let $\langle R_A, S\rangle$, $\langle R_B, S'\rangle$ be two concrete structures, where $R_A \subseteq S^n$ and $R_B \subseteq S'^n$ contain the n-tuples related by A and B, respectively. That is:*

$$A(x_1, x_2, \ldots, x_n) \Leftrightarrow (x_1, x_2, \ldots, x_n) \in R_A;\ B(x'_1, x'_2, \ldots, x'_n) \Leftrightarrow (x'_1, x'_2, \ldots, x'_n) \in R_B.$$

Then $\langle R_A, S\rangle$ and $\langle R_B, S'\rangle$ are structurally similar with respect to A and B if and only if *there exists a bijection $f : S \to S'$ such that*

$$A(x_1, x_2, \ldots, x_n) \Leftrightarrow B(f(x_1), f(x_2), \ldots, f(x_n)) \text{ for all } x \in S.$$

If there exists an injection $f : S \to S'$ such that

$$A(x_1, x_2, \ldots, x_n) \Rightarrow B(f(x_1), f(x_2), \ldots, f(x_n)) \text{ for all } x \in S,$$

then $\langle R_A, S\rangle$ and $\langle R_B, S'\rangle$ are semi-similar with respect to A and B.

Recall that Newman's problem arose for S1 because merely claiming the existence of a system of relations R' given in extension is a trivial matter: all it requires is the existence of the set $R' \subseteq \mathcal{P}(E)$ whose inverse image is $R \subseteq \mathcal{P}(P)$, and this is guaranteed to exist by the usual axioms of set theory if E and P have the same cardinality. However, so long as A and B, relations on E and P respectively, are taken in intension then R_B denotes *some definite subset* of $\mathcal{P}(E)$, and the existence of a map $f : P \to E$ such that every ordered n-tuple of elements related by A in the domain is mapped to an ordered n-tuple of elements related by B in the codomain is a non-trivial affair.

Thus defining S2 as follows suffices to avoid Newman's problem:

S2′ If P is a set of percepts structured by a perceptual relation A then there exists a physical relation B and a set E such that $\langle R_A, P\rangle$ and $\langle R_B, E\rangle$ are structurally (semi-)similar with respect to A and B.

The supposed unavailability of this option is due to the conflation of Russell's position with a Ramsey-sentence form of structural realism, with its attendant distinction between observational and theoretical vocabulary. Requiring of Russell that he respects this distinction distorts his view: for Russell, the key distinction is between experienced (i.e., perceptual) and non-experienced *relations*, interpreted realistically. (Russell assumed objects to be of a single type: events.)

To see how this allows for a non-trivial claim of structural similarity, consider the example of Russell ([1919] 1993), which he illustrates by the diagram in Figure 1. This represents

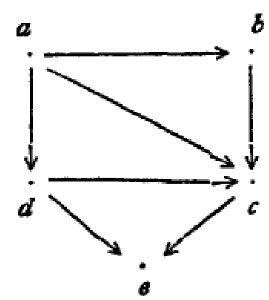

Figure 1: Russell's example from Intro. to Math. Phil.

a system of relations R_A which we will write in extension as follows:

$$R_A = \{\langle a,b\rangle, \langle a,c\rangle, \langle a,d\rangle, \langle b,c\rangle, \langle c,e\rangle, \langle d,c\rangle, \langle d,e\rangle\}.$$

So we have here a concrete structure, $\langle R_A, P\rangle$, where $P = \{a,b,c,d,e\}$. The conflation of A, a binary relation, with its extension R_A, a subset of $P \times P$, will lead to Newman's problem when combined with Russell's criterion of equivalence for relations (RC).

Russell's definition requires that there exists a one–one map between P and some other set Q (i.e., a bijection). This is a necessary condition for a relation on Q to have the same structure as a relation on P. Newman's problem relies on the fact that this is also a *sufficient* condition for there to exist a relation on Q having the same structure as any given relation on P.

Now suppose that there exists another set $Q = \{h, k, l, m, n\}$. Since P and Q have the same cardinality, there exists a one–one map between P and Q (or, rather, many such maps), $f : P \to Q$, say $f(a) = h$, $f(b) = k$, etc. For any given map there also exists a set $R'_A \subset Q \times Q$ such that

$$R'_A = \{\langle f(a), f(b)\rangle, \langle f(a), f(c)\rangle, \langle f(a), f(d)\rangle, \langle f(b), f(c)\rangle, \langle f(c), f(e)\rangle, \langle f(d), f(c)\rangle, \langle f(d), f(e)\rangle\}.$$

In either case, R'_A is a relation having the same structure as R_A, i.e., forming a concrete structure $\langle R'_A, Q\rangle$ such that $\langle x, y\rangle \in R_A \Leftrightarrow \langle f(x), f(y)\rangle \in R'_A$. In defining this relation, it sufficed to posit the existence of a set with the same cardinality as P; nothing else was required.

However, we can use the idea of S2′ to describe the structure of Russell's simple example in a way that doesn't succumb to Newman's problem. The diagram that Russell draws is a directed acyclic graph. Every such graph uniquely determines a partially ordered set (or poset) where the partial order is given by the relation of 'reachability'.[4] That is, $x \leq y$ *if and only if* there exists a directed path from x to y. So we can describe Russell's example as a poset $\langle P, \leq\rangle$, where we have $a \leq b$, $a \leq c$, $a \leq d$, $a \leq e$, $b \leq c$, $b \leq e$, $c \leq e$, $d \leq e$. The extension of $\leq$ on P is given by a set $R_{\leq} \subset P \times P$.

The relevant notion of 'same structure' for posets is given by a monotone map, i.e., an order-preserving bijection. That is, two posets $\langle S, \leq\rangle$ and $\langle S', \leq'\rangle$ have the same structure

[4]A poset is a set S on which a partial order $\leq$ is defined, i.e., a pair $\langle S, \leq\rangle$, where a partial order is a binary relation that is transitive, asymmetric and reflexive.

if and only if there exists a function $f : S \to S'$ such that (i) f is a bijection, and (ii) $a \leq b \Leftrightarrow f(a) \leq f(b)$, for all $a, b \in S$. This is just to say that $\langle R_{\leq}, S\rangle$ and $\langle R_{\leq'}, S'\rangle$ are structurally similar with respect to $\leq$ and $\leq'$. It is easily seen that this is a non-trivial claim. Consider the example above, where P and Q are sets with cardinality $|P| = |Q| = 5$, and define the extension of $\leq'$ on Q as follows:

$$R_{\leq'} := \{\langle h, l\rangle, \langle k, m\rangle\}.$$

Since there are fewer pairs related by $\leq'$ than are related by $\leq$, there is evidently no injection $f : P \to Q$ such that $x \leq y \Rightarrow f(x) \leq f(y)$ for all $x, y \in P$.

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