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On Converse Relations – What we can Learn from Segelberg's Controversies with Russell and Moore

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1 Ivar Segelberg, Tropes, and Relations

Let me start with some general words about Ivar Segelberg's ontology. Talking in contemporary terms, he is a 'trope thinker'; his own name for tropes came in the end (his third book, 1953) to be 'quality moments'. He argued in favor of quite an original form of trope based resemblance nominalism that can be called 'moment nominalism' (Svennerlind 2008, chap. IV). Like all other forms of resemblance nominalism, his version has to face the two questions 'how to analyze what is called universals?' and 'how to analyze so-called ordinary things?'. Segelberg's answers can be stated thus:

(i) presumed monadic universals are as in all forms of resemblance nominalism similarity classes of tropes, but the constituting similarity relation has in moment nominalism a special feature: it is a *higher-order object*;

(ii) ordinary things consist of tropes bound to each other by means of a special relation, but the bounding relation of moment nominalism must not be conflated with, e.g., the functionally corresponding *compresence* relations of K. Campbell (1990) and A-S. Maurin (2002)[1]: the relation is *elementary connection*.

I will not, however, discuss these two Segelberg-specific notions of higher-order object and elementary connection, just mention them and make one brief statement about each. First, it has been claimed that Segelberg regards the similarity relation as a universal (Svennerlind 2008, 161-163), but I think he regards it as an entity that might be called a 'relational higher-order

[1] Whether or not the elementary connection relation is in intension equivalent to the *concurrence* relation of D. C. Williams (1953), I will leave as an open question. Campbell regards the compresence relation as an external and founded (C:s special term) relation, but, schematically, Maurin regards it as an external non-founded relation.

trope'; there is, though, no conclusive evidence for either interpretation.[2] Second, his elementary connection relation is not an internal relation in the usual contemporary sense of this term; instead, it has affinity to what in today's analytic metaphysics is called 'ontological dependence' (Lowe 2005).[3] In all probability, Segelberg's views on elementary connection were influenced by Edmund Husserl's view that tropes ("Momente") can be connected by 'laws of essence'.[4] The elementary connection relation is also similar to what Gustav Bergmann somewhat later labeled 'nexus' (Bergmann 2004, book one, part I); in the early sixties, by the way, Segelberg and Bergmann came to know and meet each other.

This paper is devoted to Segelberg's identity view on converse relations (to be presented in Section 2), and how it differs from some views on relations put forward by Russell and Moore. Segelberg's dispute with Moore is explicit, whereas that with Russell is only implicit. The latter dispute is with the 1903-Russell of *The Principles of Mathematics*; it is quite clear that Segelberg had read at least parts of this book (Segelberg 1999/1945, 32/23).

Being true to Segelberg's outlook on philosophy, I am not focusing on these disputes out of any pure philosophical-historical interest, but because they make four neglected problems in the philosophy of relations come to the fore. The problems are:

(a) can the set-theoretic definition of relation be substituted for the ontological notion of relation that is used by Russell, Moore, Segelberg, and several contemporary ontologists? (See Section 3, my answer: no.)

(b) can the spatiotemporal world contain instances of all the different kinds of relation (e.g., symmetric, non-symmetric, and anti-symmetric) that are usually distinguished in relation logic? (Section 4, answer: no.)

(c) can the relationship between relations and relational properties be regarded as philosophically trivial? (Section 5, answer: no.)

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[2] I rest my case essentially on two facts: (a) Segelberg has written a philosophical self-characterization (1974, in Swedish; it is in this volume for the first time in English), but here he does not mention universals at all; (b) in the most interpretatively crucial passage in his books (1999/1947, 165-167/47-49) he says: "There are no instances corresponding to objects of higher order (1999, 166)." According to Segelberg, all relations are higher-order objects, and it seems to me odd to claim that there are universals that in principle can have no instances.

[3] D. M. Armstrong writes: "A relation is internal, as I shall use the term, *when given* (my italics) certain terms with certain natures, the relation must hold between the terms. It holds 'in every possible world' that contains these terms and where these terms have these natures (1989, 43)." When two terms are elementary connected they *cannot be given*, I think, in isolation from each other. Also, Armstrong's internal relations are transitive, but Segelberg's elementary connections are not necessarily so (Segelberg 1999/1945, 54/45).

[4] I have myself tried, under the name of 'relations of existential dependence', to develop this Husserlian idea (Johansson 2004, chap. 9). This attempt of mine can also be seen as an implicit criticism of Segelberg for not having distinguished between different kinds of elementary connection, e.g., mutual and one-sided.

(d) can it make a difference to the identity view of converse relations what kinds of entities the relata are? (Section 6, answer: yes.)

2 The Identity View of Converse Relations

Converse (sometimes called 'inverse') relations are pairs of two-term relations such as warmer – colder, larger – smaller, before – after, loves – is-loved-by, parent – child, and is-part-of – has-as-part'; formally, R – Ř.[5] For all these relations the following sentences seem at first sight to be true: 'necessarily, *a* is warmer than *b* iff *b* is colder than *a*', 'necessarily, *a* is larger than *b* iff *b* is smaller than *a*', 'necessarily, *a* comes before *b* iff *b* comes after *a*', 'necessarily, *a* loves *b* iff *b* is loved by *a*', 'necessarily, *a* is parent of *b* iff *b* is child of *a*' and 'necessarily, *a* is part of *b* iff *b* has as part *a*'. In formal representation: necessarily, *a*R*b* iff *b*Ř*a*.[6] I will return to and comment on this statement in Section 6.

The statement may be given the ontological twist that *a*R*b* and *b*Ř*a* always describe or represent the same state of affairs, which, in turn, may be taken to imply that the two relation predicates R and Ř always pick out or represent the same relation. This is the view of Ivar Segelberg; I will call it 'the identity view of converse relations'. He writes:

> a relation and its converse relation are basically the same thing seen from two points of view. That *a* is larger than *b* is exactly the same thing as that *b* is smaller than *a*. The fact, which both statements signify, has the constituents *a*, *b*, and the relation of increase, and no other constituents. […][7]
>
> The difference […] is connected with the order in which we *think* of the terms of the relation." (Segelberg 1999/1947, 190/81)

It is here taken for granted that extreme nominalism (*all* property-like and structure-like features of spatiotemporal particulars come from language) is false, and that relation predicates can have not only a meaning/sense but also a referent that is distinct from the meaning/sense. Sentences such as '*a* is warmer than *b*' and '*a*R*b*' describe and represent states of affairs; whereas relation predicates such as 'warmer than' and 'R' pick out and represent objects that

[5] The symbol 'Ř' for the converse relation of R is taken from Russell (2006, 96), who says he has taken it from Ernst Schröder.

[6] This characterization implies that not all correlative pairs are converses; sister – brother, for instance, are not converses. What I will later say about it does not alter this fact about correlative pairs.

[7] I have in the quotation made a change in the translation; I have substituted 'relation of increase' for 'relation of comparison'. The Swedish word is 'stegringsrelationen', which has no connotations that there is an agent that compares the relata. On the other hand, it is not neutral with respect to direction; compare 'relation of decrease' (in Swedish: 'minskningsrelationen').

are relations. If one accepts (as I do) Frege's view that the two names in sentences such as 'the morning star = the evening star' refer to the same object, and also accepts that the identity sign can connect sentences that describe states of affairs (not only names that refer to objects, as in traditional predicate logic),[8] then Segelberg's view is (for arbitrary R, *a*, and *b*):

- R = Ř ('R' and 'Ř' refer to the same relation)
- *a*R*b* = *b*Ř*a* ('*a*R*b*' and '*b*Ř*a*' describe the same state of affairs).

Segelberg never names any forerunner of his thesis, but he is not the first philosopher to state the identity view of converse relations. Husserl puts it forward in passing 1913 in the second edition of *Logical Investigations* (Husserl 1970-I/1968, 288/48), but he seems to have forgotten it later in the book (Husserl 1970-II/1968, 457/254). Two other phenomenologists have also explicitly stated the identity view: Moritz Geiger in 1924 (reference: Ingarden 1964, 332) and Roman Ingarden in 1947 (1964, §55). There is also the once famous mathematician and philosopher of physics Hermann Weyl, who in 1927 writes:

> Two propositions such as '5 follows upon 4' and '4 precedes 5' are expressions of one and the same relation between 4 and 5. It is unwarranted to speak here of two relations inverse to each other. (Weyl 1963, 4)

It is very important to isolate the issue about converse relations from the question whether some or all relations have a directedness and/or order (in the next paragraphs, I will make a distinction between directedness and order). Much too often in discussions about converse relations, the following truth is lost sight of: *the identity view of converse relations is quite compatible with the existence of both order and directedness between relata*.[9]

The truth that *a* loves *b* = *b* is-loved-by *a*, is quite consistent with the fact that there is an intentional directedness from *a* to *b* that is the same independently of which sentence is chosen to describe the love. In the *linguistic sentence* '*a* loves *b*' there is a direction from the name '*a*' to the name '*b*', and in the sentence '*b* is-loved-by *a*' there is a direction from '*b*' to '*a*', but in the *described state of affairs* there is in both cases only one direction that is going from *a* to *b*. On the assumption that time has a direction, the same thing is true of *a* comes-before *b* = *b* comes-after *a*. In the state of affairs described, there is a temporal directedness

[8] This idea is more elaborately put forward in (Johansson 2008).

[9] In my opinion, this is true of some parts of, e.g., the papers (Fine 2000 and 2007), (MacBride 2007), (Newman 2002), and (Tegtmeier 2004). It can also be found in Russell's writings; see the next section.

from *a* to *b*, and only from *a* to *b*. Such a temporal directedness is of course also part of the converse predicate pair ‘parent – child’.

The converses warmer – colder, larger – smaller, and is-part-of – has-as-part contain no *directedness* of the kinds mentioned above, but they nonetheless contain an *order*. This order, however, exists only in relation to a third relatum (or where there are more than three relata); the order is connected with the fact that the asymmetric relations mentioned are transitive, too. For instance, necessarily, if *a* is larger than *b*, and *b* is larger than *c*, then *a* is larger than *c*, i.e., the relatum *b* lies necessarily between *a* and *c*. This very order-fact can equally well be described by means of the converse predicate ‘smaller’: necessarily, if *b* is smaller than *a*, and *c* is smaller than *b*, then *c* is smaller than *a*. In short, the existence of order relations does not falsify the identity view of converse relations; and the combination of transitivity and asymmetry, which is the essence of order, is distinct from intentional and temporal directedness.

This distinction between directedness and order does not imply that where there is directedness there is no order, or vice versa. On the assumption that time has a direction, temporal relations contain both directedness and order. According to the identity view of converse relations, the two converse relation predicates ‘comes-before’ and ‘comes-after’ pick out the same temporal relation, but this relation does nonetheless contain both directedness and order. Of course, where there is only an order, as with the pair larger – smaller, a direction can by human convention be imposed on the order.

In fact, as noted by Erwin Tegtmeier (1992, 186), the very formulation of the identity view requires that there is in the world some kind of directedness or order. It is required that the difference that is denied in the state of affairs described is instead claimed to belong to the speaker who is using the relation predicate in question. In the Segelberg quotation above, the correctness of Tegtmeier’s observation is displayed at the end (first italics added): “The difference […] is connected with the *order* in which we *think* of the terms of the relation.”

3 Ivar Segelberg vs. Bertrand Russell

About converse relations the 1903-Russell writes:

> Are *aRb* and *bŘa* really different propositions, or do they only differ linguistically? It may be held that there is only one relation *R*, and that all necessary distinctions can be obtained from that between *aRb* and *bŘa*. It may be said that, owing to the exigencies of speech and writing, we are compelled to mention either *a* or *b* first,

> and that this gives a seeming difference between "*a* is greater than *b*" and "*b* is less than *a*"; but that, in reality, these two propositions are identical. But if we take this view we shall find it hard to explain the indubitable distinction between *greater* and *less*. (Russell 2006, 228; §219)

Whose view is then the right one: Segelberg's identity view or Russell's non-identity view? Let us look at what some distinguished contemporary analytic philosophers have had to say. First a quotation from Timothy Williamson:

> Heraclitus said that the way up is the way down. Converse relations (for x to have one to y is for y to have the other to x) are traditionally seen in peculiar intimacy; thus, for instance, Geach:
>
> > a relation neither exists nor can be observed apart from its converse relation; […]
>
> This puzzling relation, I shall argue, is, simply but strictly, identity. (Williamson 1985, 249)

And then a quotation from David Armstrong:

> On this condition 'two facts will be identical when they necessarily co-exist, i.e., when it is necessary that the one exists in case the other does' (Fine, 1982, p. 58). Given this condition, one would, for instance, rule out saying that […] if *a* has R to *b* then *b* has the converse of R to *a*. […] It seems that we should accept that this [condition] is a true identity condition for states of affairs. (Armstrong 1997, 133)

That is, also Armstrong and Williamson defend the identity view of converse relations. But I can put forward an even stronger authority argument in favor of this view. Russell soon, as we now know, rejected his non-identity thesis. In a 1984 posthumously published manuscript from 1913, he strongly denounces his old position:

> The whole puzzle [about order/sense/direction] would be avoided if we could deny the result we reached at the beginning of this discussion, to the effect that "*x* is before *y*" and "*y* is after *x*" are two different symbols for the same fact. If we could say that these two symbols represent different facts, which merely imply one another, we could then say that there are two different correlated relations, *before* and *after*, each of which goes essentially *from* one term to another.[3] But tempting as such a theory is, it seems nevertheless so obvious as to be undeniable that, when we think of what actually takes place rather than of its verbal expression, we cannot find a vestige of difference between *x* preceding *y* and *y* succeeding *x*. The two are merely different names for one and the same time sequence.
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>
> 3 Arguments in favour of this view, with which I no longer agree, will be found in *Principles of Mathematics*, §219. (Russell 1984, 87)

Segelberg's and the 1913-Russell's argument might be called an argument from perception. It has the simple form: 'now, look at this instance of a relation and its converse, can you really see two relations?' It might be compared with the commonsensical remark: 'you say there are two bottles of beer in the fridge, but there is only one – go and look for yourself'. Look at these two dashes: — and –. The first dash is longer than the second, and the second is (conversely) shorter than the first, but there is only one state of affairs and one relation to be seen. Armstrong's and Williamson's arguments are more complex; Armstrong relies on a modal principle taken from Kit Fine, and Williamson argues within the philosophy of language only. He might be summarized thus: if relation predicates and their converses would not refer to the same relation then they can be shown to be indeterminate expressions, but they are not.

Earlier, I pointed out that one presupposition for the identity view of converse relations is that relation predicates and relations are not identical entities; before continuing I would like to make explicit another presupposition:

- relations must not be regarded as sets of ordered pairs.

Necessarily, the ordered pair <*a*, *b*> differs from the conversely ordered pair <*b*, *a*>, and this fact entails that any set of ordered pairs with different relata differs from the set consisting of the conversely ordered pairs. Therefore, if a relation is regarded as a set of ordered pairs, it is trivially true that when the relata are different there is a distinct converse relation, too.

Now and then one can read or hear statements such as "Since *relations are a special kind of sets* (italics added), we can consider, as applied to relations, the usual operations on sets" (Suppes 1963, 225). Often, such statements are ambiguous; they can be taken either in the innocent sense that *within set theory* relations are sets of ordered n-tuples, but also in the sense that the set-theoretic notion of relation can be substituted for all other meaningful notions of relation.[10] The fact that, trivially and necessarily, the identity view of converse relations is false for the set-theoretic notion shows that such a substitution is impossible.[11]

[10] The last view was, by the way, contested even by the 1903-Russell, He says: "There is a temptation to regard a relation as definable in extension as a class of couples. […] It seems therefore more correct to take an intensional view of relations, and to identify them rather with class-concepts than with classes (Russell 2006, 99; §98)."

[11] Compare Peter Simons: "It would be tiresome to continue citing further absurdities in philosophy resulting from the over-zealous application of set theory. […] My advice is to be of good cheer: you will manage perfectly well [without sets]. Start by a regime of replacing expressions roughly as follows: Replace 'set' by 'class', 'collection', 'plurality'; 'the set of A' by 'the A', 'all A'; […] 'set of ordered pairs' by 'relation' (Simons 2005, 150)."

There are at least three different ways in which relations have been given a non-set-theoretic and not purely conceptual ontological status:

(a) a relation is primarily a *relational universal* (which is both the 1903- and the 1913-Russell's view, and, according to Svennerlind, Segelberg's view)
(b) a relation is only a *relational trope* (which I think is Segelberg's view)
(c) a relation is a *relational ontological pseudo-entity*, an entity that is said to "have being without adding anything to being" (which is Armstrong's and Maurin's view with respect to internal relations, and Campbell's with respect to all).[12]

A reasonable identity view ought to be stated thus: when relations are universals, tropes, or ontological pseudo-entities, *there are no converse relations, only converse predicates,* but when relations are regarded as sets of ordered pairs, there are both converse relations and converse predicates. In Armstrong's words:

> But suppose that 'R' ≠ 'Ř'. Professor L. Goddard has asked the question what then is the relation? Is it R or Ř? I think that all that can be said is that to the one relation there correspond the two equally good "naming" predicates: 'R' and 'Ř'. (Armstrong 1978, 94)

The view 'there are only converse predicates' is analogous to Tractatus-Wittgenstein's view of logical constants: logical constants cannot (in contradistinctions to names and sentences) refer to or describe anything outside of the linguistic realm. The identity view of converse relations amounts to claiming that (set theory disregarded) being-a-converse cannot be a property of anything that exists outside of the linguistic realm.

4 Purely Linguistic Relation Features

Having noted that the identity view of non-set-theoretic converse relations implies that being-a-converse is with respect to some kinds of relations only a predicate, one may ask whether there also are other relation features that have only a linguistic kind of existence. And I will

[12] Even though it has no immediate bearing on this paper, I would like to add that I share Herbert Hochberg's opinion: "In rigorous ontology, nothing is free—if it is a 'pseudo-entity' then one should either not talk about it or not employ it in one's analysis (Hochberg 2004, 39)."

next show that this question should be given an affirmative answer. Both one kind of non-symmetric relations (called '*not*-symmetric relation') and anti-symmetric relations have only a linguistic existence. Or, in other words:

- the features of being not-symmetric and anti-symmetric are (set theory disregarded) features only of relation *predicates* (not of relational universals, relational tropes, or relational ontological pseudo-entities).

Let me by means of modal notions and semi-formal expressions ('if p then q' means informally 'if p is true then q is true') refresh the reader's memory about the different kinds of symmetry-properties that relations have been ascribed:

Symmetric relations: necessarily, *a*R*b* iff *b*R*a*;
necessarily, (*a* is as large as *b*) iff (*b* is as large as *a*)

Non-symmetric relations: ¬ (necessarily, *a*R*b* iff *b*R*a*):

Asymmetric relations: necessarily, if *a*R*b* then ¬ *b*R*a*;
necessarily, if (*a* is larger than *b*) then ¬ (*b* is larger than *a*)
Not-symmetric relations:[13] if *a*R*b* then ((possibly, *b*R*a*) & (possibly, ¬ *b*R*a*));
if (*a* loves *b*) then ((possibly, *b* loves *a* & possibly, *b* does not love *a*))

Anti-symmetric relations: necessarily, if (*a*R*b* & *b*R*a*) then (*a* = *b*);
necessarily, if (*a* ≤ *b*) & (*b* ≤ *a*) then (*a* = *b*)

I take it for granted that there is an instance of the symmetric relation equally-long between the dashes — and — , and that there is an instance of the asymmetric relation longer-than between the dashes — and – . Since these relation instances are really existing relations between the dashes on the paper (or computer screen), being symmetric and asymmetric, respectively,

[13] I have taken this term from (Russell 2006, 25). Remarkably, it seems as if Russell himself is later in the book conflating the distinction between non-symmetric and not-symmetric; see (Russell 2006, 96 and 218). Another way to state the definition of not-symmetric relation is: if *a*R*b* then contingently *b*R*a*. Perhaps the term 'not-symmetric' had better be exchanged for 'contingently non-symmetric' (an idea put forward by Dag Westerståhl, personal communication); asymmetric relations are necessarily non-symmetric. But I will for the moment stick to Russell.

are real properties of these relations. This fact, however, cannot be generalized to not-symmetric and anti-symmetric relations. Why? Let me first discuss not-symmetric relations.

If it is true that *a* loves *b*, then it is nonetheless possible both that *b* loves *a* and that *b* does-not-love *a*. But it is impossible that both these states of affairs obtain simultaneously. The sentence '(possibly, *b* loves *a*) & (possibly, *b* does not love *a*)' does not entail 'possibly, (*b* loves *a* & *b* does-not-love *a*)'. It is **either** the case that *b* loves *a* **or** the case that *b* does-not-love *a*. And the last statement does not, and cannot, describe a *disjunctive property* such as loves-or-does-not-love, since there are no real properties falling under the predicate form 'F or G', not to speak of 'F or ¬F', only such property predicates. This has been shown by Armstrong (1978, chap. 14).[14] He puts forward three arguments, but I will rest content with presenting two of them.

First, disjunctive properties offend against the principle that a genuine property is identical in all its instances; an instantiation of F differs from an instantiation of G, but both fall under the disjunctive predicate 'F or G'. (I do not, let me add, think that the uncertainty principle of quantum mechanics can and should be interpreted as being about ontologically disjunctive properties.)

Second, since a true statement 'F*a*' entails that '(F or G)*a*' is true, the existence of disjunctive properties would imply the absurd conclusion that, given that F is instantiated, we can have a priori knowledge of the existence of an indefinite number of disjunctive properties (Armstrong 1978, 20).

I can add that I have – outside of extreme nominalism – searched for a truly serious defense of the existence of disjunctive properties, but I have found none.

In sum: *if* there are in the world no disjunctive properties *then* there are no not-symmetric relations either, and since spatiotemporal disjunctive properties are ontologically impossible there are in the world no instances of not-symmetric relations; there are only not-symmetric relation predicates. Q.E.D.

An actual love relation between two persons, as most people know, is either mutual and in this sense symmetric (i.e., *a*R*b* & *b*R*a*, even though this symmetry requires two relation tropes), or one-sided and asymmetric (*a*R*b* & ¬ *b*R*a*). This notwithstanding, the set-theoretic "love relation" constituted by the set of ordered pairs {<Dante, Beatrice>, <Jack, Ennis>, <Juliet,

[14] He also claims that there are no negative properties; he thinks, though, that there are conjunctive properties (Armstrong 1978, chap. 15).

Romeo>} is a *not*-symmetric relation; Dante loves Beatrice, but she does not love Dante; Jack and Ennis love each other; and so do Juliet and Romeo.

A set-theoretic relation is *anti*-symmetric in a certain domain if in the domain it holds true: for all x and all y, if (xRy & yRx) then ($x = y$). In this sense the $\leq$ relation is anti-symmetric in the domain of numbers, and the set inclusion relation, $\subseteq$, is anti-symmetric in the domain of sets. But none of these relation symbols can refer to a spatiotemporal instance of a relation. Why? Because when the predicate symbols are spelled out in detail we find disjunctive properties. The symbol '$\leq$' means 'less *or* equal to', and '$\subseteq$' means 'included in *or* identical to'. Now, of course, this only proves that in these two very examples there are only anti-symmetric predicates (and corresponding set-theoretically defined relations), but no possible spatiotemporal relation instances. What then about the general truth I have stated?

The definition of anti-symmetry says: necessarily, if (aRb & bRa) then ($a = b$). This means that in case an anti-symmetric relation relates only two individual spatiotemporal relata, a and b, these relata have to be one and the same spatiotemporal particular; be it called 'a' or be it called 'b'. But this, in turn, means that all relations that can truly be ascribed to this particular have to be symmetric relations. All relations R that hold between a and itself (aRa) have to be symmetric. Therefore, there can in the spatiotemporal world be no instances of anti-symmetric relations, only anti-symmetric relation predicates. Q.E.D.

5 Ivar Segelberg vs. George Edward Moore

Whereas Segelberg does not explicitly criticize the 1903-Russell, he does explicitly take stance against Moore. He writes:

> One of the differences between "larger than" and "has as a part" would be expressed by Moore as: the converse relation of "larger than" is internal; the converse relation of "has as a part" [i.e., "is part of"] is not internal. According to our way of looking at it, this description is not very satisfactory since a relation and its converse relation are basically the same thing seen from two points of view. (1999/1947, 189-190/80-81)

From his identity view on converse relations, Segelberg derives the following principle: *if a relation between two relata is internal, then the converse has to be an internal relation, too*. And the derivation is obvious: if two converse relation predicates necessarily name one and the same relation, there is only one relation, and one single relation cannot possibly be both internal

and not internal. Nonetheless, Segelberg is in his criticism of Moore moving forward too fast. Let me explain. Here comes a central passage from Moore's paper "External and Internal Relations" (italics added), which is the paper Segelberg discusses:

> To say of a given *relational property* P that it modifies or is internal to a given term A which possesses it, is to say that from the proposition that a thing has not got P it follows that that thing is different [both qualitatively and numerically] from A. (Moore 1960, 285)

As can be seen, Moore is not talking about internal *relations*, which is what Segelberg discusses, but about internal *relational properties*. Both Moore (e.g., quotation below) and Segelberg (1999/1947, 137/7) are explicitly making the distinction between relations and relational properties, but in the context at hand none of them finds it important to bring in. Moore writes:

> And once we have defined what this sense is in which a *relational property* can be said to be internal to a term which possesses it, we can easily derive from it a corresponding sense in which the *relations*, strictly so-called, from which relational properties are derived, can be said to be internal. (Moore 1960, 282)

Moore, however, never makes the derivation mentioned. In order to make the distinction more linguistically handy, I will sometimes in what follows use the following symbolism:

- *relations*: '*a* ^{is}(larger-than)^{is} *b*', formally '*a*R*b*'; '*b* ^{is}(smaller-than)^{is} *a*', formally '*b*Ř*a*'
- *relational properties*: '*a* is (larger-than *b*)', formally '(R*b*)*a*'; '*b* is (smaller-than *a*)', formally '(Ř*a*)*b*'.

This symbolism makes one thing clear at once: since '*b*' and '*a*' refer to different entities, it is impossible for the converse *relational property* predicates '(R*b*)' and '(Ř*a*)' to pick out exactly the same relational property. Obviously, an identity view of converse *relational properties* must be false. Therefore, Segelberg is not allowed to conclude from his identity view of converse *relations* that Moore's views on internal *relational properties* must be wrong. On the other hand, Moore should have noted that his point about internal relational properties cannot without further ado be transferred to internal relations. Both of them are to blame, which

brings home my point (c) of the first section: the distinction between relations and relational properties is not philosophically trivial and unimportant.[15]

This judgment can be reinforced by noting a problem that can easily and briefly be stated in the formalism I have introduced:[16]

- is it always the case that (R*b*)*a* = *a*R*b* and (equivalently) that *a* is (R*b*) = *a* ^{is}(R)^{is} *b*?

Those who answer this question with a 'yes', thereby claiming that the sentences on both sides of the equality sign describe the same state of affairs, have an *identity view of the instantiation of relational properties and relations*. And they ought then to add: the different expressions used display only different interests of the speaker. In the sentence '*a* is (R*b*)' the focus is on *a*, but in '*a* ^{is}(R)^{is} *b*' it is either on *a* and *b* simultaneously or on R. Let this just be noted; I will not start to discuss this identity problem,[17] which is distinct from the identity problem of converse relations.

6 Converse Relations with Universals as Relata

I will now take a closer look at the converse relation pair that causes Segelberg's dispute with Moore: is-part-of – has-as-part. As an illustrative example I will use the fact that water molecules consist of one oxygen atom (and two hydrogen atoms). Moreover, I will assume that this is a defining characteristic of water molecules. On the other hand, since there are many oxygen (and hydrogen) atoms that are not parts of water molecules, it cannot be a defining characteristic of oxygen (or hydrogen) atoms that they are parts of water molecules.

Imitating Moore's way of writing (Moore 1960, 285), the water-oxygen example means: 'from the proposition that a certain thing *has not* an oxygen atom *as a part*, it follows that the thing is not a water molecule, but from the proposition that a certain thing *is not part of* a water molecule, it does not follow that the thing is not an oxygen atom'. Therefore: the relational

[15] Compare in this respect Svennerlind's criticism (2008, 107-111) of Campbell (1990) and Maurin (2002).

[16] The relevance of this issue was in the discussion after my talk in Gothenburg brought to attention by Kevin Mulligan.

[17] If I would, I should begin by taking a close look at the views on relations and relational properties that are put forward in (Armstrong 1978), (Mertz 1996), and (Mertz 2006); also, I would take a look at some contemporary papers on Aristotle's category of 'the relative', *pros ti*, e.g., (Jansen 2006).

property has-as-part-an-oxygen-atom is internal to (the identity of) a water molecule, but the relational property is-part-of-a-water-molecule is not internal to (the identity of) an oxygen atom.[18]

Before turning to Segelberg's criticism of Moore, which of course primarily should be understood from the perspective of his resemblance nominalism, I will first show what the water-oxygen example implies when placed within a realist framework. If the relata are conceived of as irreducibly substantival universals, then the complex universal *water-molecule* has to be conceived of as having as a logical part the universal *oxygen-atom*,[19] i.e., *water-molecule* has-as-(logical)part *oxygen-atom*. Nonetheless, the universal *oxygen-atom* cannot be conceived of as being a part of the universal *water-molecule*, i.e., it is NOT the case: *oxygen-atom* is-(logical)part-of *water-molecule*. Therefore, in such a realism (which I strongly endorse; Johansson 2004 and 2009) one has to accept that, as recently claimed by Barry Smith (2008, 112), there are, when the relata are universals, two distinct parthood relations: has-as-part and is-part-of.

To non-realists it may seem extremely odd, perhaps even contradictory, to make the claim: '*a* has-as-part *b*, but ¬ (*b* is-part-of *a*)'. Such a possibility, however, is part and parcel of classical realism. In both Plato and Aristotle, an instantiation *u* of a universal *U* means that in some sense *u* has *U* as a part, but that nonetheless *U* is not part of *u*; *U* cannot be confined to *u*, since it exists (or can exist) in many other instances, too. Only this being said, it may be objected that the instantiation relation is such a very special relation (connecting universals to particulars) that it should not be allowed to be regarded as being a parthood relation at all. I think this is wrong (Johansson 2009, 77), but be this as it may. The sentence '*a* has-as-part *b*, but ¬ (*b* is-part-of *a*)' can in classical realism also be used to describe states of affairs that exist wholly within the realm of universals.

Just take a look at Aristotle's old definition of the universal *man*: *man* $=_{\text{def}}$ *rational animal*. Here, *man* has-as-(logical)part both the universals *animality* and *rationality*. Of these, *rationality* is-(logical)part-of *man*, but *animality* is not. *Rationality* is specific to and confined to man, but *animality* is not. Therefore, it cannot be the case that *animality* is-(logical)part-of *man*. Similarly, since *oxygen-atom* is not specific to and confined to *water-molecule*, *oxygen-*

[18] Such a remark is not true of the relational property larger-than-*b*. If a certain size trope *a* is larger than another one *b*, then, necessarily, *b* has the converse relational property smaller-than-a. If it belongs to the identity of the size trope *a* to be larger than *b*, then it belongs to the identity of the size trope *b* to be smaller than *a*.

[19] The notion of 'logical part' is used in the sense in which, following Franz Brentano, I think one can adequately say that color is a *logical part* of red (and of all the determinate color hues); (Smith 1994, 54).

atom cannot be a logical part of *water-molecule*.[20] In classical realism (in contradistinction to Armstrong's realism), the phenomenon of being *one-in-many* does not only exist in the spatiotemporal world (as one-universal-in-many-particulars), but also in the realm of universals (as one-universal-in-many-universals).

If we follow everyday linguistic intuition and regard the relation predicates 'has-as-part' and 'is-part-of' as being converses, then the view of classical realism that there can be one distinct parthood relation corresponding to each predicate, entails that the identity view of converse relations has to be qualified. It cannot be true in general; it is not true when the converses has-as-part and is-part-of have irreducibly substantival universals as their relata. That is:

- the identity view of converse relations has not only, as earlier remarked, to be qualified with respect to how *relations* are understood (not being true in set theory), it has also to be qualified in relation to kinds of *relata* (not necessarily being true when relata are universals).

A related consequence is this. Often in philosophy in general, and always in set theory, a formula such as 'necessarily, *a*R*b* iff *b*Ř*a*' or 'for all *x* and *y*, *x*R*y* iff *y*Ř*x*' is taken as a definition of converse relations (e.g., Suppes 1963, 226). However, since in the case of the water-oxygen example these formulas are false, neither of them supplies an ontologically neutral characterization of converse relations. They fit set theory and nominalism, but not a realism that allows irreducibly substantival universals.

The formulas always hold true when the relata are conceived of only in their spatiotemporal particularity, i.e., when the relata are assumed to be tropes, collections/unities of tropes, instances of universals, individual things, or so-called bare particulars. Not only is it the case that everywhere where there is an individual water molecule, this molecule has-as-part an oxygen atom; it is also the case that everywhere where there is an individual oxygen atom that *in fact* is-part-of a water molecule, the water molecule in question has-as-part the oxygen atom. In other words: necessarily, an individual water molecule has-as-part an individual oxygen atom iff this oxygen atom is-part-of the water molecule. Or, put generally: necessarily, if (this particular) *a* has-as-part (this particular) *b* then this *b* is-part-of this *a*, and vice versa.

[20] In passing, it might be noted that what is a logical part in the universals mentioned becomes a functional part in the instances of the universals; in the water-oxygen example the logical part even becomes in the instances a spatial part.

Now back to Segelberg and Moore. With respect to the water-oxygen example, Moore claims that has-as-part is an internal relation, whereas is-part-of is not. When Segelberg rebukes Moore for not sticking to the principle 'R is internal iff Ř is internal', he is of course not trying to deny any facts about water molecules and oxygen atoms. He takes these facts into account in another way. He distinguishes between two kinds of internal relations: *unilateral* and *bilateral*. The converse parthood relations has-as-part and is-part-of are claimed to be unilaterally internal, whereas each relation in the following list of converse relations are (I take it) bilaterally internal relations: warmer – colder, larger – smaller, before – after, loves – is-loved-by, and parent – child. Segelberg's general definition looks as follows:

> That a relation *R* is *internal* means, we will say, that *at least one* of the following statements holds:
>
> 1) If *x* has the relation *R* to *y*, then every object exactly similar[21] to *x* has the relation *R* to at least one object exactly similar to *y*.
>
> 2) If *x* has the relation *R* to *y*, then every object exactly similar to *y* has the converse of *R* to at least one object exactly similar to *x*.
>
> That *R* is *unilaterally internal* means that *only one* of the statements (1) and (2) holds. If both hold about *R*, then *R* is *bilaterally internal*.
>
> (1999/1947, p. 191/82)

With respect to the sentence 'this water-molecule (*x*) has the relation has-as-part (R) to this oxygen-atom (*y*)', statement 1 in the definition is true but 2 false; with respect to 'this oxygen-atom (*x*) has the relation is-part-of (R) to this water-molecule (*y*)', statement 2 is true but 1 false. Therefore, both these relations are at least with respect to the relata in question only unilaterally internal. But more can be said.

It is true for *all* spatiotemporal particulars *x* that (1) if *x* has the relation has-as-part to *y*, then every object exactly similar to *x* has the relation has-as-part to at least one object exactly similar to *y*. It is not, however, true for all such *x* that (2) if *x* has the relation has-as-part to *y*, then every object exactly similar to *y* has the converse of *R* to at least one object exactly similar to *x* (as shown by the water-oxygen example). This means that the relation has-as-part is without qualifications unilaterally internal; and by implication that is-part-of is unilaterally internal, too.[22] If R is unilaterally internal, then so is Ř, and vice versa.

[21] In order to make it easier quickly to grasp the content of the definition, I have exchanged Segelberg's term 'congruent' for 'exactly similar'. The small difference between the terms is of no consequence for the reasoning; 'x is exactly similar to *y*' should be taken in the everyday sense of '*x* is exactly qualitatively similar to, but numerically different from, *y*'.

[22] I leave to the reader to test whether my examples of bilaterally internal relations are true such examples.

The last observation gives rise to a problem that Segelberg's otherwise very acute mind never makes explicit: can the statements below be true for the same R?

(a) $R = \check{R}$

(b) R is unilaterally internal iff $\check{R}$ is unilaterally internal

If there is an R_1 and a corresponding $\check{R}_1$ that are unilaterally internal, then for each of them (see the definition) "*only one* of the statements (1) and (2) holds". Furthermore, if (1) is true for R_1 it is false for $\check{R}_1$, and if (2) is true for $\check{R}_1$ it is false for R_1. But this means that the predicates 'R_1' and '$\check{R}_1$' cannot possibly pick out the same relation, and that the sentence '$R_1 = \check{R}_1$' is false.

On the other hand, if '$R_1 = \check{R}_1$' is true, then what is true of R_1 must also be true of $\check{R}_1$, which means that if they are internal relations they are bilaterally internal. This fact does on the surface create the following dilemma for Segelberg:

- *either* has-as-part and is-part-of are not converse relations
  or the identity view of converse relations is at least for these relations false.

In my opinion, Segelberg's way out of the dilemma is to make explicit the fact that the relation R in (a) does not have the same kind of relata as the relation R in (b). Whereas the identity view of converse relations is for Segelberg a view about relations between *tropes* (including complex unities of tropes such as individual molecules and atoms[23]), the definition of internal relation makes sense only for *relational properties of tropes*; the tropes have to be seen *in their relationship to a class* of which they are members. If *x* and *y* in the definition are not regarded as being members of exact similarity classes (or, by the way, being instances of universals), the definition of internal relations cannot be applied. Segelberg can without inconsistency say, and ought to say, the following two things:

(a*) the sentence (a) '$R = \check{R}$' is meant to be used only when the relata of R and $\check{R}$ are spatiotemporal particulars;

[23] The term 'complex unity' is in Segelberg's ontology a technical term that is intimately related to that of 'elementary connection'. Even though, or rather because, I think that the idea of complex unities is Segelberg's most important idea, I will not try a brief unpacking of it here.

(b*) the sentence (b) ‘R is unilaterally internal iff Ř is unilaterally internal’ is meant to be shorthand for this sentence: ‘when *a* and *b* are regarded as members of the exact similarity classes A and B, *a*R*b* is unilaterally internal iff *b*Ř*a* is unilaterally internal’.

The last sentence can be given a form where the relata are directly described as being relational properties. Let me as in Section 5 formalize *relational property* ascription sentences such as ‘*a* is (larger-than *b*)’ with ‘(R*b*)*a*’. The sentence ‘*a* is (member-of-class A)’ can then be formalized as ‘(∈A)*a*’, and (b*) can be rewritten:

(b*) the sentence (b) ‘R is unilaterally internal iff Ř is unilaterally internal’ is meant to be shorthand for this sentence: ‘R in ‘(∈A)*a* R (∈B)b’ is unilaterally internal iff Ř in ‘(∈B)*b* Ř (∈A)*a*’ is unilaterally internal’.

This requirement can easily be transformed to a corresponding requirement within a realist framework. All one has to do is to exchange expressions such as ‘*a* is (member-of-class A)’ and ‘(∈A)*a*’ with ‘*a* is (instance-of-universal A)’, and ‘(i-A)*a*’, respectively. We then obtain:

(b**) the sentence (b) ‘R is unilaterally internal iff Ř is unilaterally internal’ is meant to be shorthand for this sentence: ‘R in ‘(i-A)*a* R (i-B)b’ is unilaterally internal iff Ř in ‘(i-B)*b* Ř (i-A)*a*’ is unilaterally internal’.

Where resemblance nominalism has membership in exact similarity classes, realism has instantiations of universals. And this difference brings with it another difference. Universals can in the way explained have parthood relations, but there are no parthood relations (only corresponding subclass relations) between classes. Counterfactually, however, *if* classes could function as relata in parthood relations, then also resemblance nominalism would have to claim that between kind-of-substance classes there are two distinct and converse parthood relations: has-as-part and is-part-of.

What holds true of the water-molecule – oxygen-atom example is true of many entities postulated by chemistry and physics; there, often a whole is defined by means of its parts. But in biology scientists often go in the other direction and define partly a part, say an organ, by means of the encompassing whole, an organism. If there is something that makes it in principle impossible to transplant, say, human eyes to other animals, then one may regard it as part of the

definition of the human eye that it is part of the human organism. Not, however, vice versa, since there can be human organisms that have lost their eyes.

Both the two kinds of relations just mentioned are unilaterally internal relations (in realism as well as in resemblance nominalism). Their difference can be captured by saying that in the sentence 'water molecules have by definition as part an oxygen atom' there is a reference to a unilaterally internal *whole-to-part* relation, whereas in the sentence 'a human eye is by definition a part of a human organism' there is a reference to a unilaterally internal *part-to-whole* relation'. The latter kind of relation seems to appear quite frequently in functional contexts, where the very identity of a part is often given by its function in relation to a larger functional whole.

As I have made clear, Segelberg's distinction between unilaterally and bilaterally internal relations can be used within a realist framework, too. This fact makes it possible for us to move from parthood relations with universals as relata to something more general. I propose the following hypothesis:

-
- the identity view of converse relations is outside of set theory true except when (i) the relata are universals, and (ii) the relation between these relata is, when applied to instances, a unilaterally internal relation.

At the beginning of Section 2, a tentative characterization of converse relations was put forward: necessarily, *a*R*b* iff *b*Ř*a*. Now we have seen that this characterization cannot be regarded as being correct for all possible uses of converse relation predicates. It always holds true when *a* and *b* refer to spatiotemporal particulars, but not always when they refer to universals. The fact of the matter seems (outside of set theory) to be this: where the sentence 'necessarily, *a*R*b* iff *b*Ř*a*' is true, there are no converse relations, only converse relation predicates; and where there are real converse relations, the sentence is not true.

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