



OXFORD JOURNALS
OXFORD UNIVERSITY PRESS

ANALYSIS

An Alleged Analogy between Numbers and Propositions

Author(s): Tim Crane

Source: *Analysis*, Vol. 50, No. 4 (Oct., 1990), pp. 224-230

Published by: Oxford University Press on behalf of The Analysis Committee

Stable URL: <http://www.jstor.org/stable/3328258>

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dary auxiliaries. And this brings us to a really fundamental objection. Ternary theories confine themselves to only a narrow subclass of conditionals, rarely descending below even the top row of the table of secondary auxiliaries. Resisting the urge to generalize, they confront examples like (A), (B) and (R), rather than (C), (D) and (E). This is bad science: unignorable family resemblances connect 'will' with 'can', 'must' and the rest. And in the present case the narrow approach disguises a serious problem. Once it is seen that 'will' (say) is in paradigmatic relation with other secondary auxiliaries, it becomes hard to miss the need for a separate factor *v* to trigger the choice of row. And where might a ternary theory accommodate this *v*?⁵

*Macquarie University,
Sydney, N.S.W., Australia 2109*

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⁵I am indebted to the Editor for many improvements.

AN ALLEGED ANALOGY BETWEEN NUMBERS AND PROPOSITIONS

By TIM CRANE

A COMMONPLACE of recent philosophy of mind is that intentional states are relations between thinkers and propositions (see [4] p. 78; [5] p. 178; [6]; [3] pp. 7-9; [14] pp. 7-8; [13] p. 7). This thesis—call it the 'Relational Thesis'—does not depend on any specific theory of propositions. One can hold it whether one believes that propositions are Fregean Thoughts (see [7]), ordered *n*-tuples of objects and properties ('Russellian Propositions'; see [12]) or sets of possible worlds (see [9] and [14]). An assumption that all these theories of propositions share is that propositions are abstract objects, without location in space or time. So which-

ever theory of propositions is correct, the Relational Thesis says that intentional states are relations to certain abstract objects.

This thesis gives rise to one aspect of the problem of intentionality: how can intentional states, thus conceived, have any causal powers? Our commonsense theory of intentional states says that intentional states have effects that are appropriate to their propositional contents. But abstract objects have no causal powers. So how can the effects of intentional states depend on the abstract propositions they incorporate? Indeed, how can intentional states have any effects at all? This causal problem is one of the most intractable problems of intentionality (for discussion, see [4] p. 79; [5] pp. 201–23; [10] p. 60).

There are a number of options for a solution to this problem — for instance, one may deny the Relational Thesis, deny that intentional states are causes, or (the least promising) deny that relations to abstract objects cannot be causes. Or one may try and reconcile these three theses in some way — the approach I favour. But if one takes this approach, then one is obliged to show how a relation to a proposition can be causally efficacious. Or, less cryptically: one has to give an account of the causally efficacious properties whose instantiations make it the case that a thinker is related to a proposition.

Paul Churchland ([1] p. 105), Hartry Field ([4] pp. 113–4) and Robert Stalnaker ([14] p. 8) have argued that this apparent difficulty with the Relational Thesis may be disarmed by comparing ascriptions of intentional states to ascriptions of physical magnitudes like weights or temperatures. Just as ‘X believes that p ’ may be thought of as expressing a relation — belief — between X and the proposition p , so ‘X has a temperature of 100 degrees centigrade’ may be thought of as expressing a relation — temperature in centigrade — between X and the number 100. According to this analogy, propositions are ways of ‘indexing’ beliefs and other intentional states, just as numbers are ways of indexing temperatures and other physical magnitudes (see [10] pp. 62–5 and [11] pp. 106–7 for this idea of indexing).

If this analogy is accepted, one could respond to it in one of two ways, the second more plausible than the first. One could say that there is nothing peculiar about invoking such real relations to abstract objects in intentional psychology, since they are invoked all the time in physics. Just as having a temperature is a real relation to a number, so having a belief is a real relation to a proposition. What makes it the case that an object has a temperature of 100 degrees is not just something about that object, but about its relation to the number 100. It is in virtue of standing in this relation that it has the temperature it does. And likewise with belief.

This cannot be right, because if it were, then the same problem would arise with temperatures (and weights etc.) that arises with intentional states. How could the state of something’s having a cer-

tain temperature have effects, if it is really a relation to an abstract object? The causal problem of intentionality would seem to apply not only to intentional states, but to physical magnitudes as well! But of course, if any properties at all are causally efficacious, then temperatures, weights and the like are. So this way of interpreting the analogy is hopeless; it creates more problems than it solves. (See [8] pp. 17–18 and 253–5 for further arguments against regarding measurements of physical quantities as involving real relations to numbers.)

None of the above philosophers accepts this interpretation of the analogy. Stalnaker ([14] pp. 8–14) appears to do so, but in fact he is concerned with the relational structure of intentional and physical magnitude *predicates*; he reserves judgement on the 'ontological thesis about what kinds of properties are expressed by certain semantically complex expressions' (p. 10). Since this first interpretation of the analogy is incredible and has no serious defenders, I shall discuss it no further.

The more credible interpretation of the analogy, due to Churchland ([1] p. 105), attempts to undermine the Relational Thesis by pointing to the implausibility of the idea that having (e.g.) a temperature is being related to a number. So, the interpretation goes, there is no more reason to treat belief (etc.) as genuinely relational than there is to treat temperature (etc.) as genuinely relational.

This interpretation may be motivated by nominalism – the view that there are no abstract entities (see [4] appendix; [11] p. 141). The idea may be that the reason physical magnitudes are not relations to numbers is that there are no such numbers; similarly, the reason intentional states are not relations to propositions is that there are no such propositions. However, the interpretation does not entail nominalism, for one could believe in both abstract numbers and abstract propositions and still hold that the analogy shows that just as physical magnitudes are not really *relations* to these numbers, so intentional states are not really *relations* to these propositions. The issue is not about the existence of abstract objects, but about apparent *relations* between them and concrete objects. Nominalism, therefore, is irrelevant.

By suggesting that intentional states are not really relations at all, this second interpretation threatens to make short work of the causal problem of intentionality. It says that just as an object's temperature can be represented as its relation to a number, although it is patently not a relation, so a thinker's intentional state can be represented as a relation to a proposition, although it likewise is not a relation (see [10] p. 142). But the causal problem of intentionality was a consequence of the Relational Thesis; so if the analogy undermines this Thesis, then there may be less of a problem of intentionality than we initially thought. The apparently relational character of intentional states may perhaps

be a fiction generated by a feature of the 'surface grammar' of their ascriptions – the fact that 'believes' and the other intentional verbs are 2-place predicates.

Now while I have no desire to make the problem of intentionality more difficult than it already is, I think that its causal aspect cannot be dissolved so easily. I do not deny here that a solution to the problem of intentionality may end up by dispensing – in some way – with relations to propositions. What I deny is that this can be done as simply as the analogists claim.

We should all agree that having (e.g.) a temperature is not a real relation to a number: it is a non-relational or intrinsic property. The reason we can represent it as a relation is that all temperatures belong to a family of intrinsic properties (see [14] p. 9). The members of this family – like that of other magnitudes such as *weight*, *mass*, or *velocity* – can be classified numerically, and to a certain extent their behaviour is mirrored by certain mathematical operations. (Why this is so is a hard question that I can ignore here.) Once we have decided on a unit of measurement, say centigrade, we may pick out each property in the family of temperatures with a two-place predicate 'x has a temperature in centigrade of n' true of pairs of objects and numbers. But these are just ways we have of picking out the non-relational properties in the family – the fact that we can do this does not, on its own, show that there is a real relation of *temperature-in-centigrade* that an object has to a number. If the analogy with intentional states is to work, then *belief* (for example) must pick out a family of non-relational properties, just as *temperature* picks out a family of non-relational properties. As Stalnaker says,

The analogy suggests that to define a relation between a person and a proposition is to define a class of properties with a structure that makes it possible to pick one of the properties out of the class by specifying a proposition. ([14], p. 11).

But does the analogy work?

In the case of physical magnitudes like temperature, which number indexes an object's temperature depends on the choice of a unit. But there are other actual systems of measurement of temperature, under which the object's temperature is indexed by different numbers. Which numbers are the right ones? All of them? Or is there some privileged number?

It is implausible to say that any one number is privileged. Take weight: a standard bag of sugar weighs 2.2 pounds or 1 kilo. Nationalistic prejudices aside, statements of weight in imperial and metric units are both equally statements of *weight* – and both equally true, when they are true. So the bag may be described as being related to 2.2 by the relation 'weight-in-pounds'; and to 1 by the relation 'weight-in-kilos'. Which number the bag is 'related to' depends on which unit of measurement is in question.

What is the analogue of this in the case of intentional states? It is true that which proposition I am related to depends on which *attitude* is in question — belief or desire or whatever. For instance, I may be related to the proposition *There is no beer* by the relation *belief*, and to *I have some beer* by the relation *desire*. But of course, this belief and this desire are different states, whereas there is an obvious sense in which ‘2.2 lbs’ and ‘1 kilo’ are different ways of picking out the *same* state of the bag of sugar — its weight.

The analogue of a unit of measurement in the case of intentional states is rather this. Anglophone Alf’s belief that snow is white may be described as a relation between Alf and an abstract object, the English sentence-type ‘Snow is white’, tokens of which Alf is disposed to utter from time to time. But a French speaker can classify his belief by relating it to a different abstract object, the French sentence-type ‘La neige est blanche’. These are two ways of indexing Alf’s one belief, and (like fahrenheit and centigrade, or pounds and kilos) there can be translations between these different indexings. So like weights, intentional states can be classified by being related to abstract sentences. And like the numbers that measure weights, no one sentence is privileged (nationalistic prejudices aside) and the same intentional state can be indexed by any number of different sentences, depending on the choice of a language (the ‘unit of measurement’).

Those who are sceptical of propositions may use this analogy between sentences and numbers to illustrate how intentional states can *only* be indexed by sentences, not propositions, and thus only relative to a public language. (Compare Davidson’s use of the analogy: [2] pp. 224–5.) But this claim does not, of course, follow from the mere analogy alone, and arguments against the existence of propositions that may support it are largely irrelevant to the problem of this paper. After all, the problem is how a relation to an abstract object can be a cause; and this problem arises, on the face of it, with sentence-types as with propositions alike. The issue, as I said above, is about the causal efficacy of relations to abstract objects, not about the existence of those objects.

So just as numbers can index temperatures relative to a unit of measurement, so sentences can index intentional states relative to a language. But propositions are not sentences. They are supposed to be what sentences with the same meanings express; and they are supposed to be the contents of intentional states of all thinkers, whether or not they speak a public language. So propositions should not be thought of as indexing intentional states relative to a language.

This fact reveals exactly where the analogy between numbers and propositions breaks down: with propositions themselves, unlike the sentences that express them, there is no analogue of the unit of measurement. It makes no sense to say that a given belief, say, can be related to many different abstract propositions, as it

can be related to different abstract sentences, since if a belief were related to a different proposition, it would be a different belief. *Pace* Davison, the natural language sentences that index beliefs are no more essential to those beliefs than the particular numbers that index token weights and temperatures are essential to them. But the propositions that index beliefs are thus essential. The proposition to which a given belief is related is part of what individuates it, part of what makes it the belief it is. This is because the proposition gives the conditions under which the belief is true, and beliefs are standardly individuated by their truth conditions. Desires, likewise, are individuated by propositions that give their satisfaction conditions. (Some may deny these truisms, but they will need more than the analogy to prove the point.)

The disanalogy, then, is this. All that is essential to the 'relationality' of temperature is that each token temperature is *indexable* by some number or other. Which number this is is relative to the unit of measurement in question. But token intentional states are not merely indexable by some proposition or other: each token is essentially *indexed*, without relativisation, to a *particular* proposition.

But why does this disanalogy matter? Because it reveals what does seem to be the genuinely relational character of intentional states, as opposed to the pseudo-relational character of physical magnitudes. A thing's temperature may be indexed by some number or other, which number depending on the choice of a unit: it is *only* the arbitrary choice of a unit that enables temperatures to be indexed by numbers at all. But real relations do not have this 'unit-relativity'. Take *being a son*: each son is related to one particular father. But it makes no sense to say that token sons are 'indexed' by some father or other, which one depending on (some analogue of) the choice of a unit. Of course not: there is no analogue of a unit here. It is because being a son is a genuine relational property, while having a temperature isn't, that unit-relativity is essential to the pseudo-relationality of temperature, and inapplicable to the real relationality of being a son.

(Do not be misled by the fact that spatial relations can be measured — i.e. that some real relations as well as non-relational properties can be indexed by numbers. The two-place real spatial relation that holds between New York and London is not unit-relative; the three-place pseudo relation between New York, London and a number is. In any case, the relevant analogy is between the abstract numbers that index *non-relational* properties and the abstract propositions that index intentional states. After all, it would not help the solution of the causal problem of intentionality to be shown that intentional states were like *spatial* relations!)

What we have discovered is that what applies to sons here applies to beliefs. It makes no sense to say that token beliefs are

just indexed by some proposition or other, which one depending on (some analogue of) the choice of a unit. For there is no analogue of a unit here either. Like sons, beliefs and desires do not have unit-relativity. And this structural similarity between beliefs and other relations strongly suggests that the relationality of beliefs is more than superficial.

So if the propositions that index token intentional states are essential to them in a way that the numbers that index token weights and temperatures are not, then the relationality of intentional states cannot be dismantled along the same lines as the apparent relationality of physical magnitudes. This is the crucial disanalogy between intentional states and physical magnitudes, and it frustrates the attempted dissolution of the causal problem of intentionality. So the analogy between numbers and propositions does not undermine the Relational Thesis; the causal problem of intentionality remains, unfortunately, as it was.¹

*University College London,
Gower Street, London WC1E 6BT*

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¹I am grateful to Joseph Melia, Hugh Mellor, Peter Smith and Jamie Whyte for very helpful discussion.