

Poincaré's Radical Ontology

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I present an exegesis of Henri Poincaré's metaphysical position in three key essays within his book, *The Value of Science*. In doing so, I argue for three theses: First, that Poincaré's metaphysical position in these sources is incompatible with his metaphysical position in his earlier book, *Science and Hypothesis*. Second, that the phenomenological relationism defended by Poincaré in these sources is not a form of structural realism but a structuralist form of empiricism, and (by design) has no greater metaphysical commitments than constructive empiricism. Third, that Poincaré holds in these sources that the existence of the external world is merely a convention. These theses serve to correct misconceptions about the consistency of Poincaré's philosophical corpus, about his position(s) on the realism/anti-realism landscape, and about the scope of his conventionalism.

Keywords: Henri Poincaré; conventionalism; structural realism; anti-realism; history of philosophy of science

1. Introduction

Henri Poincaré's philosophy presents a special exegetical challenge. It was published across several essays which subsequently formed collections that were published in book form; he

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did not write a systematic treatise, so there is significant work involved in determining the extent to which his work is unified. However, I think the challenge is well worth the effort. Poincaré's philosophical thought was original and insightful, and it is persistently relevant to issues in the philosophy of science.

This paper focuses on Poincaré's metaphysics, with special attention to ontology. Existing literature on Poincaré has not fully appreciated how radical some of Poincaré's ideas about what exists are. His conventionalism has been extensively explored as an interpretation of principles in geometry and mechanics, but Poincaré, in certain key sources, extends his conventionalism to external objects in some striking ways. He distances himself from the opinion that absolutely everything is conventional by committing to two things: the existence of objective phenomenological relations, and a notion of objective convenience. This results in a metaphysics which refuses to commit to the ultimate reality of the external world but upholds a commitment to the facticity of empirical human knowledge.

I must clarify the sense in which I am using some key terms in order to prevent some potential misunderstandings. When I refer to "Poincaré's metaphysics", I do not mean some description he has provided of the ultimate nature of reality: he very consciously refuses to provide any such thing. What I mean by "Poincaré's metaphysics" is the collection of his philosophical opinions about reality which are not strictly epistemological. For example, his important claim (explored in section 4) that "the ether is no less real than any external body" (1905/2001, 349) is not a description of reality, nor can it be reduced to a claim about the limits of human knowledge; there, as we will see, Poincaré is explaining what he thinks constitutes the meaningful designation of an external object. That is metaphysics.

Next to be clarified is the term "conventional" and what its application to the external world implies. For Poincaré, a convention is something expressed in the form of a proposition

which is accepted or rejected by free choice. Though the senses or reason might inform what conventions we adopt, they can never ultimately compel us to accept one; the element of free choice in adopting conventions is ineliminable by definition. We adopt conventions for the sake of the *convenience* they provide: they make it easier for us to think or speak about something productively. When Poincaré claims that “the external world exists” is a convention, he is saying that we choose to accept it rather than its negation because accepting its negation would make it extremely inconvenient (though not impossible) to make systematic sense of our collective experiences.

Let us further develop the notion of a ‘convention’ as it is used in Poincaré’s work. There are two critical questions which I will use to frame this effort. Firstly, do we have absolutely free choice in what conventions we can legitimately accept or is our choice constrained? Secondly, does judging a metaphysical statement to be a convention have only epistemic consequences, or does such a claim have ontological weight?

For the first question, consider this well-known quote of Poincaré’s:

The geometrical axioms are therefore neither synthetic à priori intuitions nor experimental facts. They are conventions. Our choice among all possible conventions is guided by experimental facts; but it remains free, and is only limited by the necessity of avoiding every contradiction, and thus it is that postulates may remain rigorously true even when the experimental laws which have determined their adoption are only approximate. (1902/2001, 45. Emphasis in original.)

Here, we see that the only strict limitation Poincaré places on our choice in conventions is non-contradiction. This, of course, means that we should not choose conventions which contain logical contradictions. But it also means that we need to avoid contradictions when

we attempt to *apply* our conventions to anything. So, when we hope to use conventions, such as the geometrical axioms, in empirical science, our choice is limited to only those conventions which are consistent with the totality of empirical facts. Experimental facts then continue to “guide” us to choose which, from this limited set of conventions, are most convenient for our purposes.

It is important to understand that, when Poincaré writes “rigorously true” in the passage above, he does not mean this literally. Just a few words later he declares that the question “Is Euclidean geometry true?” has “no meaning”. He writes that we “might as well ask if the metric system is true, and if the old weights and measures are false.” By “rigorously true” he means that postulates are immune to empirical correction because they are *definitions* (in disguise). They are “remain rigorously true” in the same sense that it is always “rigorously true” that a ‘gram’ is a gram and a ‘metre’ a metre, no matter what happens in an experiment (Poincaré 1905/2001, 324). Poincaré extends this notion also to the principles of mechanics. For example, according to Poincaré, the laws of motion *define* what force is. No experiment could ever show that force is not the product of mass and acceleration because there is no clear notion of what ‘force’ means outside of that definition.²

This suggests an answer to the second question I posed above: this kind of convention is not the type that we choose to adopt because we do not *know* the ultimate truth of the matter. We choose to adopt these conventions because there *is* no ultimate truth of the matter. The matters they decide are not only stipulative by necessity – they are stipulative by nature. To adopt a convention in this sense is not to decide what is true but to make a determination on a matter to which truth and falsity do not apply. Ben-Menahem regards this as essential to conventionalism in philosophy: “To the conventionalist, the very idea of truth by convention

² See Ivanova (2015) for a detailed summary of Poincaré’s conventionalism in geometry and the principles of mechanics. Ben-Menahem (2006) has an extended exegesis.

is as incongruous as that of meaningful nonsense” (2006, 1). If it is in this sense of convention, then, that Poincaré claims that the existence of the external world is a convention, he is not claiming that we cannot know whether it exists or not, he is claiming that there is no ultimate truth of the matter of whether it exists or not. I will demonstrate that this is indeed the sense in which he means his claim (*pace* Zahar 1997 and Giedymin 1991). That is why his ontology, at least in the sources that I am investigating, deserves the title of ‘radical’.

We must be careful here, however. Even if “the external world exists” is a convention, it does not seem like it could be a definition of anything. Because of that, it does not seem that the analogy between this proposition and the geometrical axioms or principles of mechanics can go the distance. One might also wonder whether the ontological result I described is only attainable if we adopt peculiar rules about what counts as a truth-valued metaphysical claim, hence Zahar (1997, 215) argues that the geometrical conventionalist relies on a “positivist principle” that is “highly questionable”; namely that the empirical equivalence of various possible descriptions implies that there is no objective fact of the matter of which is accurate. It is this sort of rigidity that Putnam (1975) objected to, saying that it reduced conventionalism to dogmatic essentialism. In Section 4, I will argue that Poincaré’s radical ontological conventionalism arises neither from the definitions-in-disguise move that we have seen, nor from the mere stipulation of any positivist principle describing what kind of claims count as truth-bearing. It arises rather from his strong neo-Kantian perspective on the nature of metaphysics and reality.³

Finally, it is critical for the reader to recognise from the outset that, in claiming that the existence of the external world is a convention, Poincaré is *not* claiming that the external

³ It might be argued that he does uphold the positivist principle *because* of his neo-Kantian metaphysics, but in that case he is being neither an essentialist nor obviously dogmatic.

world really does not exist. It should be clear from what I have said already that if some proposition is a convention, then its negation *is also a convention*. We could not have the choice to accept or reject p if we did not have the choice to accept or reject not- p . For Poincaré, “the external world exists” being a convention does not mean that the negation of that proposition is true; the situation is quite the opposite: its negation *cannot* be ultimately true.⁴ This being a conventional matter means that we have the freedom, *independent of questions of truth*, to stipulate whether or not the external world exists. And, contrary to the idea that he is trying to convince us that the external world doesn’t exist, Poincaré treats it as utterly obvious that he and his readers will accept the convention “the external world exists” and not even consider accepting its negation. Poincaré is not going for some kind of Berkeleyan idealism or nihilism here; he is saying, rather, that these kinds of ontological determinations can only be made as conventions. Truth and falsity don’t ultimately apply to them.

I am focusing on three primary sources: the introduction to Poincaré’s 1905 book *The Value of Science* and the final two essays in that book, entitled “Is Science Artificial?” and “Science and Reality”. These final two essays were developed from a single 1902 paper of Poincaré’s (see de Paz 2021, 453). Poincaré’s chief goal in this pair of essays is to distance himself from the radical conventionalism that he associates with Edouard LeRoy. This means he has maximum incentive in these essays to explain precisely his commitments pertaining to the nature of reality and the limits of his conventionalism. We should expect that he chose his words very carefully in these sources: he would not have wanted his readers to think that he had ontological commitments which he did not in fact have, but it would have been contrary

⁴ Carnap (1950, p.33) makes a similar point about the Vienna Circle’s rejection of “the thesis of the reality of the external world” and other metaphysical theses as pseudo-statements. “It is obvious that the apparent negation of a pseudo-statement must also be a pseudo-statement.” This is not to say that conventions and pseudo-statements are the same, but they are at least alike in this respect.

to his purpose to exaggerate his scepticism. These two essays are therefore arguably where Poincaré pays the greatest attention to the metaphysical implications of his conventionalism.⁵ The introduction to *The Value of Science* will also be an important source because Poincaré presents there a summary of his views in helpfully direct language. I will refer to these three sources collectively as ‘the VoS sources’. I will only reference Poincaré’s other writings for context or support.

This background might seem somewhat bewildering: if I am correct in claiming that Poincaré, in the identified sources, is claiming that the existence of the external world is a convention, how could his goal in these sources be to show that his conventionalism is *less* radical than someone else’s? The short answer is that Poincaré thought that science accurately represents empirical facts as they are experienced (albeit with conventional labels and categories) while LeRoy thought that empirical scientific facts were conventional creations which did not correspond with experience as it genuinely is, free from conceptual engineering. The specifics of Poincaré’s view will be clarified in this paper, but I will not explain LeRoy’s view further. For a more detailed comparison of the two thinkers, see de Paz (2021).

In the next section, I will argue that the interpretation of Poincaré as a structural realist which began with John Worrall in his seminal 1989 paper, while appropriate for his position in *Science and Hypothesis*, cannot be maintained for his position in the VoS sources. His metaphysical opinions in these two (collections of) sources are incompatible. In section 3, I will show that Poincaré thought that the only things which are truly objective are the relations between sense impressions. He thought that science, using certain conventions, enabled us to see a profound harmony among these objective phenomenological relations. I

⁵ Ivanova also highlights them as two particularly important essays for this subject (2015, p.114, footnote 1).

will argue that his relationism in the VoS sources is not a form of structural realism, but is a structuralist form of empiricism – i.e., it is meant to establish the uniquely objective status of observable facts, not to establish that we have any knowledge of the unobservable world. In section 4, I will explain how Poincaré extends his conventionalism to all external objects – observable and otherwise. Section 5 will raise a difficulty for Poincaré’s view and suggest avenues through which it can be solved.

2. Poincaré and epistemic structural realism

The first thing to note is that the common labelling of Poincaré as an epistemic structural realist is inappropriate to his position in the VoS sources. Epistemic structural realism (ESR), as defined by Ladyman (1998) to categorise the kind of structural realism advocated by Worrall (1989), holds that science teaches us the true relations among the real objects that ultimately constitute reality. It is true that a direct quote from Poincaré unambiguously describes this idea and was in fact what inspired it. Quoted often in the scientific realism literature, this passage is from his essay “The Theories of Modern Physics” found in the book *Science and Hypothesis*, published in 1902:

It cannot be said that this is reducing physical theories to simple practical recipes; these equations express relations, and if the equations remain true, it is because the relations preserve their reality. They teach us now, as they did then, that there is such and such a relation between this thing and that; only, the something which we then called motion, we now call electric current. But these are merely names of the images we substituted for the real objects which Nature will hide forever from our eyes. The true relations between these real objects are the only reality we can attain... (1902/2001, 123)

But the idea expressed in this quote is irreconcilable in important respects with the ideas expressed in the VoS sources. This represents a genuine discontinuity in Poincaré's thought.

Herein lies the conflict: the quote from "The Theories" commits Poincaré to the existence of (i) real objects, distinct in nature from the mere "images" conceived of in scientific theories, which are inaccessible to us and stand in distinct relations with one another, and (ii) that certain mathematical relations in science faithfully represent relations that these external objects have with one another. I will show that both of these commitments are irreconcilable with the VoS sources. The case of (i) will take some work to explain and only be settled in Section 4. The case of (ii), however, can be settled from a single quote from a VoS source. The following is taken from the final paragraph of the Introduction – the climax of Poincaré's summary of his metaphysical commitments:

Does the harmony the human intelligence thinks it discovers in nature exist outside of this intelligence? No, beyond doubt, a reality completely independent of the mind which conceives it, sees or feels it, is an impossibility. A world as exterior as that, even if it existed, would for us be forever inaccessible.
(1905/2001, 193)

This "harmony" is identified as "the harmony expressed by mathematical laws". Here, Poincaré is stating strongly and unambiguously that the mathematical relations he treasures so much should not be interpreted as mind-independent. They are not (or, at least, we could never know that they are) the relations which hold between external, hidden objects. As we examine the VoS sources throughout this paper, it will become clear that Poincaré's insistence on this point is not ad hoc. It is a natural component of a metaphysics which takes scepticism as a guiding methodology. There is a genuine contradiction between the two quotes above which could only be avoided by reading one of them non-literally. The upshot

is that Poincaré's view in the VoS sources is significantly less realist than his view in "The Theories" and therefore significantly less realist than standard ESR. Poincaré does claim that the "harmony" mentioned above is objective, but he clarifies that "what we call objective reality is, in the last analysis, what is common to many thinking beings, and could be common to all" (1905/2001, 193). Throughout the VoS sources, Poincaré maintains that "objectivity" is supposed to be understood as meaning intersubjective stability and nothing more.

It may be tempting to favour other interpretations of Poincaré to preserve the unity of his corpus, but there is an hermeneutic responsibility to avoid ignoring or dismissing things an author has written in order to preserve an impression of unity across their work. Though it is, of course, fine to suggest non-literal readings of passages here and there to preserve consistency, I submit that the evidence from the VoS sources which I will present in this paper cannot so easily be made consistent with the famous 'structural realist' quote from "The Theories of Modern Physics". I will not speculate here on why this discrepancy exists. The important thing is to recognise that it does so that the full complexity of Poincaré's philosophical thought is not lost to us.

Milena Ivanova (2015) and Katherine Brading and Elise Crull (2017) have recently drawn from the VoS sources to argue that Poincaré's structuralism should be understood as distinct from ESR. But they do not acknowledge the incompatibility *within* Poincaré's corpus that I have just highlighted. Ivanova argues that Poincaré's "structuralism is internalist and deeply entrenched into his neo-Kantianism and conventionalism" (2015, 121) which makes it a departure from "the view of contemporary structural realists who claim that our best theories can successfully track the structure [of] mind-independent reality" (120). That is correct, but Ivanova's study leaves room for clarification on the metaphysical character of Poincaré's position. She touches on a contrast between realism and mere empirical adequacy

(115; 120) but does not ultimately say whether or to what degree Poincaré's position holds that any scientific theories are more than just empirically adequate. In the present study, I will argue that Poincaré (in the VoS sources) does not make any claims about the metaphysical status of scientific theories which go beyond their empirical adequacy. Further, Ivanova claims that Poincaré's conventionalism "is restricted to geometry and some physical constitutive principles only" (p.120) but I will show that (in the VoS sources) he regards the existence of every object in his *ontology* – both observable and unobservable – as conventionally stipulated.

Brading and Crull draw on reconstructed systematic arguments to show that Poincaré's structuralism had different properties to ESR. Of particular interest for us is what they call the argument from objectivity (Brading and Crull 2017, 121):

1. Objective knowledge is necessarily common to all (i.e., intersubjectively stable).
2. That which is common to all is necessarily communicable.
3. That which is communicable is knowledge of relations only.
4. Therefore, objective knowledge just is knowledge of relations.

They reconstruct this argument from the VoS sources, and I agree that this is what is going on in the relevant passages (Poincaré 1905/2001, 345-6). Their point is that, while ESR as introduced by Worrall (1989) is motivated specifically as a means of upholding the no miracles argument in the face of the pessimistic meta-induction, Poincaré's structuralism is derived from his philosophical principles regarding the nature and limits of knowledge. Though Poincaré does discuss the success of science and the issue of theory change, his case for all objective knowledge being relational does not rely on these historical facts. Brading

and Crull are right to argue that this tells us that Poincaré's position is different in character to ESR. My mission here is to further interrogate the character of Poincaré's relationism in order to explain the role it plays in his ontology. What is the metaphysical status of these objective relations? What of their relata?

3. Poincaré's phenomenological relationism

Though they can be interchangeable under some interpretations, I favour the word 'relationism' over 'structuralism' for Poincaré's view.⁶ The distinction between relations and structures put to use, notably, by Russell and Carnap is that structures are the abstract patterns formed by relations. A 'pure' structure provides no information whatsoever about the nature of the relations which form it, so multiple otherwise unrelated systems of relations can instantiate the same structure. For example, the relation *is greater than* forms the same structure in the set {1,2,3} as does the relation *is bigger than* in the set {The Eiffel Tower, Australia, Jupiter}. Because some mathematical objects and physical systems will share structural properties without instantiating similar intrinsic properties or relations, structure provides fertile ground for the formal analysis of diverse classes of entities. And even if the nature of an entity is unknown or unknowable, its structure might be known. For Russell and Carnap, objectivity was to be found in structure, not in relations. But Poincaré, as we will see, took *relations* of a certain sort as being most truly objective, not structure. He was criticized by Carnap for this (1928/2003, 30), but, as I will argue below, Carnap's objection was not sound. I mention this now only to show that there is some weight to the relation/structure distinction and 'relationism' is the more appropriate label for Poincaré.

⁶ Psillos (2014) also opts for this term.

It has already been indicated, through Brading and Crull's reconstructed argument, that Poincaré's relationism is motivated by his desire to identify what in reality should be taken as objective. Let us take a closer look at how Poincaré understands objectivity and the connection he sees between it and relationality. In "Science and Reality", he writes:

What guarantees the objectivity of the world in which we live is that this world is common to us with other thinking beings. Through the communications that we have with other men, we receive from them ready-made reasonings; we know that that these reasonings do not come from us and at the same time we recognize in them the work of reasonable beings like ourselves. And as these reasonings appear to fit the world of our sensations, we think we may infer that these reasonable beings have seen the same thing as we; thus it is we know we have not been dreaming.

Such, therefore, is the first condition of objectivity; what is objective must be common to many minds and consequently transmissible from one to the other...we are even forced to conclude: no discourse, no objectivity.

(1905/2001, 345)

Notice first that in this passage 'objectivity' has not yet come to be equivalent with intersubjectivity for Poincaré. This is him establishing that connection. For the sake of this passage, 'what guarantees the objectivity of the world?' has exactly the meaning of 'what guarantees that the world is not illusory?'. Poincaré's answer is that we can be sure that there are other beings around us having similar sensations and thoughts, so we can conclude that this isn't all make-believe. Poincaré does not venture to explain *why* beings see the same things as one another. He accepts that it is true that they do and that this guarantees that those things we have in common are not made up.

What defines Poincaré's relationism is that he does not use this intersubjectivity argument to infer that we ought to trust the content of our senses. On the contrary, he points out that the qualitative content of our senses is *intransmissible* and we therefore *cannot* trust it. It is this fairly hardcore sceptical intuition that leads Poincaré to look for truth exclusively in information that is shared between persons. That is, his scepticism will not allow him to be confident that anything which cannot be *confirmed* as intersubjectively stable is not illusory. This is why he pivots from sensations to the relations between sensations:

We have no means of verifying that the sensation I call red is the same as that which my neighbour calls red. ...In compensation, what we shall be able to ascertain is that, for him as for me, the cherry and the red poppy produce the *same* sensation, since he gives the same name to the sensations he feels and I do the same.

Sensations are therefore intransmissible, or rather all that is pure quality in them is intransmissible and forever impenetrable. But it is not the same with relations between these sensations. (1905/2001, 345. Emphasis in original.)

We can confirm that red poppies and cherries stimulate the same sensation in multiple people even though we can't confirm what "red" looks like to each of them. So, the relation of *sameness* of the sensations produced upon seeing various red things is objective for Poincaré, even though the qualitative content of those sensations is not. Note that what is being transmitted are the relations experienced privately and individually by multiple people. We are not talking about relations between the sensations of different people. Poincaré continues:

From this point of view, all that is objective is devoid of all quality and is only pure relation. Certes, I shall not go so far as to say that objectivity is only pure quantity (this would be to particularize too far the nature of the relations in

question), but we understand how someone could have been carried away into saying that the world is only a differential equation.

With due reserve regarding this paradoxical proposition, we must nevertheless admit that nothing is objective which is not transmissible, and consequently that the relations between the sensations can alone have an objective value.

(1905/2001, 346)

In this way, Poincaré derives from his “first condition of objectivity” – intersubjectivity – the requirement of relationality. Let us unpack this latest quote. First of all, it would seem that Poincaré knew of a person espousing a view that sounds something like an anticipation of ontic structural realism (OSR) (see Ladyman 1998).⁷ True, it seems that Poincaré might be caricaturing the idea he is recalling but, so far as caricatures go, it is not an inaccurate summary of the form of OSR defended by Tegmark (2008), who defends what he calls the Mathematical Universe Hypothesis: “Our external physical reality is a mathematical structure.” Other OSRists are a bit harder to pin down on this matter. Ladyman and Ross say that the question of what makes the world’s structure physical and not mathematical is one which they “refuse to answer” (2007, 158). French has a nuanced discussion of the question spanning an entire chapter (2014, Chapter 8). In any case, it is clear that Poincaré wanted to distance himself from any metaphysical position where the nature of the world and the nature of mathematics become so difficult to separate. Judging by his language, he sees this as symptomatic of a lack of restraint: a person who equates the nature of the world with mathematics has, having made a genuinely profound realisation, become too eager and

⁷ In the French, it is clearer that Poincaré is here writing about a specific person whose name he apparently doesn’t remember. “Je n’irai certes pas jusqu’à dire que l’objectivité ne soit que quantité pure (ce serait trop particulariser la nature des relations en question), mais on comprend que je ne sais plus qui se soit laissé entraîner à dire que le monde n’est qu’une équation différentielle” (Poincaré 2013, 320). The “je ne sais *plus*” instead of “je ne sais *pas*” suggests that at one time he would have been able to say whom he was talking about.

jumped to a poorly motivated declaration. Poincaré is saying here that, while his views do lend themselves to this kind of view, it should be rejected.

Now, the key question we ought to direct at Poincaré here is: if “all quality” is being denied to “pure relation”, then what is left of the “nature of the relations in question” beyond the quantitative? Unfortunately, he did not elaborate on this point. However, a satisfying answer is forthcoming when we pay attention to the final line of this latest quote – to Poincaré’s claim that “the relations between the sensations can alone have an objective value.” This claim is stronger and more important than one might initially recognise from reading the passage in context. Poincaré’s position is not merely that the only objective value *in sensations* is the relations between them. His position is that the relations between *sensations specifically* are the only parts of reality that are ultimately objective. This is so important to him that he presents it as his second condition of objectivity:

An absolutely disordered aggregate could not have objective value since it would be unintelligible, but no more can a well-ordered assemblage have it, *if it does not correspond to sensations really experienced*. ... Two conditions are therefore to be fulfilled, and if the first separates reality from the dream,⁸ the second distinguishes it from the romance. (1905/2001, 346-7. Emphasis added.)

As a consequence of this, we know that Poincaré does not regard any unobservable aspect of scientific theories (relational or otherwise) as objective. An important passage for helping us understand this point appears towards the end of “Is Science Artificial?”:

Since the enunciation of our laws may vary with the conventions that we adopt, since these conventions may modify even the natural relations of these laws, is

⁸ Here, Poincaré clarifies in a footnote: “I here use the word *real* as a synonym of *objective*; I thus conform to common usage; perhaps I am wrong, our dreams are real, but they are not objective.” Emphasis in original.

there in the manifold of these laws something independent of these conventions and which may, so to speak, play the role of *universal invariant*? (1905/2001, 334)

At the very end of the essay, he answers confidently:

What now is the nature of this invariant it is easy to understand, and a word will suffice us. The invariant laws are the relations between the crude facts, while the relations between the “scientific facts” remain always dependent on certain conventions. (1905/2001, 336)

As I explained in the introduction, a convention, for Poincaré is something expressed in the form of a proposition which is accepted or rejected by choice. Note well that Poincaré claims that relations between “scientific facts” are *not* intersubjectively invariant, due to their dependence on conventional definitions. What are truly invariant are the relations between “crude facts”. To understand him properly here, we need to understand what the word “fact” meant for him, and then the distinction between crude and scientific facts.

Jerzy Giedymin provides this context for talk about facts in the relevant period:

The traditional empiricist and Comtian positivist philosophy of science, perpetuated by numerous textbooks on the subject, contrasted “positive science” consisting of facts, with theories and hypotheses. Facts were claimed to be objective, theory-independent and simply discovered, stated and collected by impartial observers. (Giedymin 1982, 199)

In “Is Science Artificial?” Poincaré is positioned as a defender of this orthodoxy (more or less) from attack by Edouard LeRoy, who claimed that scientific facts were conventional through and through. Though Poincaré is forthcoming about being sympathetic to much of what LeRoy says (1905/2001, 318), he is adamant that facts revealed by our senses are not

created by us. Poincaré then develops a technical definition of the word ‘fact’ tailored to its use in science. Instead of the general meaning of ‘something that is the case’, his sense of ‘fact’ is limited to what is given in observation.⁹ The following passage gives us a lot of information about Poincaré’s use of language in this matter:

When I say: it grows dark, that well expresses the impressions I feel in being present at an eclipse; but even in obscurity a multitude of shades could be imagined, and if, instead of that actually realized, had happened a slightly different shade, yet I should still have enunciated this *other* fact by saying: It grows dark.

Second remark: even at the second stage, the enunciation of a fact can only be *true or false*. This is not so of any proposition; if this proposition is the enunciation of a convention, it cannot be said that this enunciation is *true*, in the proper sense of the word, since it could not be true apart from me and is true only because I wish it to be. (1905/2001, 324. Emphasis in original.)

From this we know, firstly, that facts are identified with the content of a person’s senses; every miniscule difference in shade experienced is a *distinct* fact that might be enunciated by the proposition “It grows dark”. A “proposition”, for him, is a linguistic construction that may be used to enunciate a fact or a convention. Propositions which enunciate facts can be true or false; technically, on Poincaré’s formulation, when we say that a fact is true, we mean that the proposition which *enunciates* a fact is true, since the fact itself is a sense impression and not linguistic. Propositions which enunciate conventions are neither ultimately true or false (as discussed in Section 1).

⁹ My own use of the word ‘fact’ will not be limited to this technical sense. I will use either sense where it is appropriate and I believe that my intent is clear.

Now for the difference between crude and scientific facts. Crude facts are the ‘pure’, un-enunciated sense impressions that comprise facticity. They are extra-linguistic and theory-independent experiences. Poincaré explains that in order to think and converse about crude facts, we need to introduce conventional systems (i.e., systems at least partly constructed according to free choices) like language and mathematics to represent them. It is those representations that are defined as scientific facts.

[I]t is necessary to distinguish between the impression of obscurity felt by one witnessing an eclipse, and the affirmation; it grows dark, which this impression extorts from him. In a sense it is the first which is the only true fact in the rough, and the second is already a sort of scientific fact. (1905/2001, p.323)

The distinction between crude and scientific facts, then, is the difference between pure sensation and the enunciation of the content of sensations. On this view, the only difference between, say, a child reporting a fact to their sibling and a scientist reporting a fact to their colleague is that the scientist will use technical conventions tailor-made to be convenient for their purposes. Both reports fall into the broad category of scientific fact rather than crude fact. But note that when a child and scientist both witness some event, the crude facts that they experience will be in strict harmony with one another (for Poincaré, that is what it means for them to have witnessed the ‘same’ event) even if the conventions they use to describe the event are radically different. It’s this idea that there is agreement between crude facts which is preserved through any empirically adequate use of conventions that makes Poincaré’s view so much more realist than LeRoy’s. While LeRoy thought that scientific facts were virtually independent of crude facts, Poincaré insisted that “the scientific fact is only the crude fact translated into a convenient language” (1905/2001, 327).

So, when Poincaré declares that “[t]he invariant laws are the relations between the crude facts, while the relations between the “scientific facts” remain always dependent on certain conventions”, he is saying that the true invariant relations which form the beating heart of his metaphysics and epistemology exist between *sense impressions alone*. They are phenomenological in nature, not mathematical or linguistic. Mathematics and other forms of theorising are just ways of representing them so that we can reason about and discuss them in sensible, productive ways.

Let us recap briefly. According to Poincaré:

- Something is objective insofar as it is intersubjectively invariant.
- Scientific laws are constructed using conventions, which prevents them from being universally invariant.
- Only the relations between sense impressions themselves (crude facts) are truly objective.

We may now return to the question I asked earlier: if Poincaré is saying that objective relations are devoid of quality, how can he also say that they are not only quantitative in nature? We have now seen that Poincaré sees ultimate objectivity in phenomenological relations alone. This helps us understand what he must have meant. It would be odd to say that the relation of *sameness* between multiple sightings of red objects is “pure quantity”, even though we acknowledge that the qualitative sensation of redness is utterly absent from that relation. The relation, devoid of quality though it is, is still phenomenological in nature. We are not forced to treat it as an entirely uninterpreted instance of some logico-mathematical notion of sameness. Part of understanding and accepting the existence of the relation is to understand, in at least some way, what it is to experience a sensation. Though ‘universal invariant’ is a predominantly mathematical concept, Poincaré, in the relevant

discussion, identifies an ‘invariant’ as that by virtue of which different languages are capable of intertranslation (1905/2001, 336). In that passage, he makes clear that the ‘universal’ in ‘universal invariant’ means universal among beings who have similar sense faculties. He is saying that, among such a set of beings with common faculties, their scientific facts will always be intertranslatable precisely because the relations between their crude facts will be “invariant laws”. To say that objectivity is purely quantitative therefore misses much. The objective relations between sensations are relations between *sensations*, not abstract relations.

Now it is time to address Carnap’s objection. Carnap quotes Poincaré as saying that “only the relations between the sensations have an objective value” and proceeds to make these comments on Poincaré’s view:

This obviously is a move in the right direction, but does not go far enough. From the relations, we must go on to the structures of relations if we want to reach totally formalized entities. Relations themselves, in their qualitative peculiarity, are not intersubjectively communicable. It was not until Russell ... that the importance of structure for the achievement of objectivity was pointed out.

(Carnap 1928/2003, 30)

Carnap flatly denies here that phenomenological relations can be purged of their qualitative content in order to be intersubjectively communicable. For him, objectivity can only exist in structure (according to the definition that I explained at the beginning of this section). But Carnap was wrong about this. Poincaré’s argument (which Carnap doesn’t engage with) is meant precisely to demonstrate that a person can communicate to me that (according to them) poppies and cherries are the same colour and that I can verify that (according to me) poppies and cherries are the same colour, without either of us needing access to the “qualitative peculiarity” of the other’s experience of poppies or cherries. What is needed is that we both

know what it means to experience something visually and we can understand the referents of “poppies” and “cherries” using description and ostension. With those tools – and if we are both sighted people able to perceive colours – we can verify that these things are the same colour for each of us even if we have no idea what they *look like* for the other person. Carnap seems to have conflated the idea of “totally formalized” with “intersubjectively communicable”. It is true that the same-colour relation is not totally formalized: it requires familiarity with the phenomenological nature of colour. But this does not mean that the relation is incommunicable without access to the “qualitative peculiarity” of a person’s experience of colour. Thus, in pursuit of logical formalization, Carnap has glossed over the distinction between the *content* of a sense impression and the *nature* of a sense impression as sensory. Neither of these are formalizable, but only the former is incommunicable.

Poincaré’s phenomenological relationism could be described as a relationist or structuralist form of empiricism (cf. Bueno 1999). I am not claiming that Poincaré was arguing from an empiricist stance generally. His stance is neo-Kantian and to give him the title ‘empiricist’ would obscure more than it would clarify. My claim is rather that the point of Poincaré’s *relationism* specifically, in the VoS sources, is to defend the legitimacy and objectivity of observable scientific fact against attack from LeRoy, *not* to identify the knowledge we have of the noumenal or otherwise unobservable world. And, in pursuit of that goal, Poincaré rules out the possibility of objective knowledge of the noumenal or otherwise unobservable world. As we saw above, he goes so far as to claim that correspondence with “sensations really experienced” is a condition of objectivity. I find it instructive to compare this with the well-known slogan of “saving the phenomena” in van Fraassen’s (1980) constructive empiricism. While van Fraassen wants to “save the phenomena” by embedding

them (that is, embedding their *structure*)¹⁰ within the empirical substructures of theoretical models, Poincaré wants to “save the phenomenal relations” by embedding them within convention-dependent mathematical systems which enable us to see the systematic harmony between them. So, while Poincaré and van Fraassen have different philosophical orientations in several ways, they are alike in regarding the mathematical structure of scientific theories as fully in service of our knowledge of the connections between phenomena. This is a noteworthy observation because existing literature on Poincaré would have him as van Fraassen’s opponent on this very issue.

This ties directly into a contemporary debate. John Worrall and Elie Zahar, both inspired by Poincaré, have defended the use of Ramsey-sentences to formulate structural realism (appendix IV to Zahar 2001; Worrall 2007; Zahar 2007). They do so against an objection to realist interpretations of Ramsey-sentences advanced by Demopoulos and Friedman (1985). This objection, which is an adaptation of Newman’s (1928) objection to Russell’s structuralism, charges that, for any theory T, the truth of T’s Ramsey-sentence T* tells us nothing other than that T’s purely observational consequences are true (Demopoulos and Friedman 1985, 635). Ketland (2004) further developed and defended the objection, arguing that T* is equivalent to T’s empirical adequacy plus a cardinality constraint on its domain. Worrall and Zahar, who consider themselves realists, don’t recognise this as an appropriate objection to their position. They write that “on the one hand, the Ramsey-sentence does not in general logically follow from its empirical basis” and “[o]n the other hand, if the so-called empirical generalisations...were to be included in the observational content of a theory, then the Ramsey-sentence might well be one of them; in which case

¹⁰ “To be matched are two models, a data model and a theoretical model. The matching in question may be as simple as an embedding or partial isomorphism, or it may need to be some measure-theoretic refinement thereof to allow for approximation. But is in any case a mathematical relationship, and therefore purely structural. The claim of adequacy is in the first instance a claim about how two structures are structurally related.” (van Fraassen 1997, p.524)

Demopoulos's and Friedman's thesis would collapse into the trivial claim that the Ramsey-sentence follows from itself" (Zahar 2001, 240). They therefore allow that their approach is focused on the structural unification of the empirical world, not any specific claims about what the unobservable world is like. The crucial issue, for them, is not whether a true Ramsey-sentence represents the structure of some specific unobservable system, but whether it tells us something about the world that is not reducible to the atomic sentences of empirical fact which constitute its "empirical basis". Worrall suggests that the critics' discomfort comes from thinking that this structuralism cannot count as "really" realism. He urges that it ought to qualify because it takes the mathematical structure of theories to "globally reflect" the ultimate structure of reality (Worrall 2007, 153-4).

This approach of Worrall's and Zahar's is clearly not far removed from Poincaré's. But the more realist elements to do with "reflecting" mind-independent reality, while consistent with Poincaré's words in "The Theories of Modern Physics", are rejected in the VoS sources. Poincaré, in the VoS sources, thought that science taught us about reality by revealing profound harmony among phenomenological relations – a harmony that is not conventional (though we need conventions to represent it) nor dependent on any *particular* mind or group of minds. But he emphatically did not think that science taught us the ultimate mind-independent structure of 'the world' as such. The objection advanced by Demopoulos, Friedman, and Ketland is of no threat to Poincaré (in the VoS sources) because he is not committed to anything beyond the empirical adequacy of theories. Poincaré's point is that the fact that *there exist* theories which are remarkably (never entirely) empirically adequate, and equally so for everyone (when certain conventions are understood), itself demonstrates science's objective value. That so much of the world we collectively experience can be synthesised into unified mathematical structures is what is important for Poincaré in these sources – he consciously refuses to offer a metaphysical interpretation of those structures.

We have now covered the essentials of Poincaré’s relationism and seen that it is only committed to the existence of sensory experiences – our own and others’ – and stable relations between them. But what about objects? I have noted some similarity between Poincaré’s relationism and constructive empiricism, and van Fraassen regards the unqualified existence of observable objects as philosophically unproblematic. The reader may also have noticed that the example of a phenomenological relation Poincaré uses – red poppies and cherries being the same colour – is naturally stated as a relation between objects, not a relation between subjective experiences. Does Poincaré maintain that the objective relation in question is between poppies and cherries, thereby committing himself to the objective existence of those objects? Or is he only ultimately committed to the relation between the *appearance* of poppies and the appearance of cherries in a person’s consciousness? I will show in the next section that the latter is true. According to Poincaré in the VoS sources, the existence (or nonexistence) of any and all external objects is only a convention.

4. Poincaré’s ontological conventionalism

Poincaré’s original and most influential use of conventionalism in the philosophy of science was in arguing for the conventional status of geometrical axioms. His most radical application of conventions, however, is undoubtedly in his ontology. Let’s begin this section with Poincaré’s understanding of objecthood, in “Science and Reality”:

External objects, for instance, for which the word *object* was invented, are really *objects* and not fleeting and fugitive appearances, because they are not only groups of sensations, but groups cemented by a constant bond. It is this bond, and this bond alone, which is the object in itself, and this bond is a relation.
(1905/2001, 347. Emphasis in original.)

The reader will note that the existence of the bond to which Poincaré refers as “the object in itself” is not a convention. According to him, we do not have a choice as to whether such bonds, which are identified as objects, exist. But also note that he is explicitly referring to bonds between *sensations*. For him, the ‘real’ object – the object that we can say exists without qualification – is a relation between sensations exclusively. His conventionalism will come into play when we ask the separate question of what *metaphysical interpretation* we ought to give to these bonds between sensations. To this new question, his answer is that such an interpretation is only to be given as a conventional stipulation. A few pages after the quote above, Poincaré illustrates his intent by invoking one of science’s canonical non-existents – the luminiferous ether.

It may be said, for instance, that the ether is no less real than any external body; to say this body exists is to say there is between the colour of this body, its taste, its smell, an intimate bond, solid and persistent; to say the ether exists is to say there is a natural kinship between all the optical phenomena, and neither of the two propositions has less value than the other. (1905/2001, 349-50)

According to Poincaré, no object has any more reality than the luminiferous ether. The ether was a convenient way to think about optical relations when these relations were understood as mechanical. It is not that anyone discovered, factually, that there was no such object with the rise of electromagnetic field theory, but rather that this object-idea ceased to be convenient when our story about the objective relations in question changed. We could have continued to refer to the ether as the representation of the bond between optical phenomena if we wanted to (this has been argued by Wayne Myrvold (2020) – which is not to say that he shares Poincaré’s metaphysics), and in all this the ether would be no less real than any object we think of as inhabiting the external world. Poincaré continues:

And the scientific syntheses [like the ether] have in a sense even more reality than those of the ordinary senses [like tables], since they embrace more terms and tend to absorb in them the partial syntheses. (1905/2001, p.350)

Poincaré pushes his point and argues that one could consider unobservable theoretical entities *more* real, in a sense, than ordinary observable objects. This is because the theoretical structure of those objects encompasses a greater array of phenomenological relations than does the structure of ordinary objects. While the idea of a particular table represents the bond between certain colours, shapes, and tactile sensations, the idea of the ether represents a truly vast array of optical phenomena. By “partial syntheses” I think Poincaré means phenomenological “bonds” that are not “solid and persistent” but conditional, such as the various ways in which light is refracted in different conditions. Theoretical objects “absorb” these in the sense of accounting for and explaining their conditionality. This perspective of Poincaré’s is, of course, a full reversal of the standard direction of ontological scepticism. Typically in the philosophy of science, especially in contemporary times, the reality of observable objects is taken for granted and it is the theoretical objects whose reality is questioned. Poincaré turns this on its head when combining his thorough conventionalism with his relationism.

Though Poincaré’s use of conventions in ontology is only developed in the VoS sources, its radical nature is anticipated in *Science and Hypothesis* despite his apparent belief, there, in real, mind-independent objects. I have in mind his claim that “these two propositions, ‘the earth turns rounds,’ and ‘it is more convenient to suppose that the earth turns round,’ have one and the same meaning. There is nothing more in one than in the other” (1902/2001, 91). In other words, the rotation of the Earth is nothing more than a convention. Poincaré defends the idea that the Earth’s rotation is not an empirical fact by denying that there is absolute space. Without absolute space, any observation that would seem to confirm

that the planet rotates could be interpreted such that it is not rotating with no strict loss of truth. The claim that the Earth's rotation is a convention, while striking, is thus based in scientific theory and is not, on reflection, an especially radical piece of metaphysics. In "Science and Reality", however, Poincaré addresses the reactions of some of his readers to this claim with a much more aggressive metaphysical claim:

These words [about the Earth's rotation] have given rise to the strangest interpretations. Some have thought they saw in them the rehabilitation of Ptolemy's system, and perhaps the justification of Galileo's condemnation.

Those who had read attentively the whole volume could not, however, delude themselves. This truth, the earth turns round, was put on the same footing as Euclid's postulate, for example. Was that to reject it? But better; in the same language it may very well be said: these two propositions, the external world exists, or, it is more convenient to suppose that it exists, have one and the same meaning. So the hypothesis of the rotation of the earth would have the same degree of certitude as the very existence of external objects. (1905/2001, 350-51)

In an extraordinary move, Poincaré assures his readers that the Earth's rotation, though only a convention like geometrical axioms, is on firm ground because the very existence of the external world is only a convention, too!

Let us make sure we understand Poincaré's claim by looking at each example of a convention he mentions. Euclid's postulates are conventions because they are definitions; one is free to define alternative geometrical systems which are equally capable of representing all spatial facts. As we saw in Section 1, Poincaré regards the question of whether Euclid's postulates are "true" as meaningless. The only reason to use them rather than other axioms is

that other axioms would make the process of reasoning about space more difficult. The rotation of the Earth is a convention because, due to the rejection of absolute space in physics, a model wherein the Earth does not rotate might be no less accurate than one in which it does. Again, the reason we don't use such a model is that it would make reasoning about cosmology extraordinarily difficult. We can conclude, then, that when Poincaré claims that the existence of the external world is a convention, he must mean that the proposition "the external world exists" is no truer than its negation. It might be thought that he intended:

- (a) There is no fact of the matter of whether it is true.
- (b) He makes no judgment as to whether it is true.
- (c) It is meaningless.

We may immediately rule out (c) since it couldn't be more convenient to take something to be true if it were meaningless. This is why we must be careful when Poincaré suggests, as we saw in the previous section, that conventions are not true in the "proper" sense. He does not mean that they are not semantically apt for truth. In his discussion of Poincaré, Psillos observes:

Note that so far there is no tension between calling a principle [a] convention and taking it to be true. ... More specifically, though the truth of a principle is not factual, since the principle is not empirical, the principle is nonetheless true in that it is constitutive of a theoretical framework. (Psillos 2014, 110)

When we say that a convention is neither true nor false, what we mean is that it bears no truth value independent of its (or its negation) being stipulated, not that it is meaningless.

What, then, of the choice between (a) and (b)? It is clear enough that (a) is Poincaré's intention in his Euclid and rotation examples. In the former case there is no fact of the matter because the postulates are definitions. In the latter case there is no fact of the matter because

absolute space has been judged theoretically incompatible with the facts. But could Poincaré really have believed that there is no fact of the matter of whether the external world exists? Yes – he could have, and I think he did. We saw Poincaré state that “the external world exists” has the same *meaning*¹¹ as “it is more convenient to suppose that the external world exists”. There is no reasonable interpretation of that claim which both takes it seriously and frames it as a merely epistemological point. Fortunately, there is evidence for his philosophical motivation underlying this striking claim in the text.

Based on the evidence in the VoS sources, the reason that he thinks there is no fact of the matter of whether “the external world exists” is not because he somehow considers this a definition, nor because he thinks some scientific finding undermines its ability to bear a truth value. Nor is it simply that he sees this question as external to any contentful linguistic framework, as Carnap (1950) did. Nor is it because he dogmatically asserts a positivist principle which denies such a proposition a truth-value because it is not empirically verifiable. No – in the final analysis, Poincaré’s conviction seems to rest on his neo-Kantian stance. This aspect of Poincaré’s thought is well-studied as it relates to his opinions on the foundations of mathematics and science. But it must be added that, in the VoS sources at least, Poincaré is fully committed to the Kantian idea¹² that any possible physical or metaphysical judgment is limited absolutely by the innately given concepts of our understanding while reality (not ‘external reality’ but simply reality, as in the way things are) is not so restricted. That, at least, is the natural explanation of his grounds for the following vital, also from “Science and Reality”:

¹¹ Fr.: “ces deux propositions...ont un seul et même sens” (2013, 324).

¹² I do not claim that Kant had the view which I am attributing to Poincaré. I understand this as Poincaré’s own interpretation and use of Kantian ideas.

[It is not only that] science cannot teach us the nature of things¹³ but nothing is capable of teaching it to us and if any god knew it, he could not find words to express it. Not only can we not divine the response, but if it were given to us, we could understand nothing of it; I ask myself even whether we really understand the question. (1905/2001, 347-8)

According to Poincaré, it is not simply that we do not know whether or not our understanding can accurately represent the true nature of reality. He positively declares that it cannot and suggests that we might not even have the cognitive ability to frame this question sensibly.¹⁴ In that case, the concepts ‘external world’ and, indeed, ‘existence’ fail to meaningfully apply to ultimate reality. Since the external world’s existence can’t be identified with a crude fact and – by virtue of being a conceptual judgment – can’t apply to the ultimate reality, then, according to Poincaré’s view, there is no final fact of the matter on whether the proposition “the external world exists” is true or false. Note that the same reason will lead us to deny that “internal world” has an ultimate referent. For Poincaré, the internal/external divide is an imposition of our understanding. This does not mean that sense impressions are conventional after all, it simply means that framing them as ‘internal’ (or any other metaphysical description) is not to be taken as a true description of their ultimate nature (independent of whether or not we have a viable conventional choice in the matter).

Note that in the passage from the introduction to *The Value of Science* which was quoted in section 2, Poincaré writes, “a reality completely independent of the mind which

¹³ His use of “things” here should not be conflated with “external objects” (“*objets extérieurs*”), which he discusses just before this passage. Poincaré is using the phrase “the nature of things” (“*la nature des choses*”) here to gesture broadly at reality without making any specific metaphysical commitments (including commitments like ‘externality’ and ‘internality’). (Fr: Poincaré 2013, 321).

¹⁴ It is true that he is contrasting “the true nature of things” (“*la véritable nature des choses*”) with “the true relations of things” (“*les véritables rapports des choses*”) and saying that science *does* teach us the latter. But he quickly makes clear that “the true relations of things” means just those which are intersubjectively stable as he previously established (2001, 348; 2013, 322). And we have already seen that the only *objective* relations he wants to commit to here are those between sensations. He is therefore referring to relations between sensations again, which he considers real, but not things out in mind-independent reality.

conceives it, sees or feels it, is an impossibility. A world as exterior as that, even if it existed, would for us be forever inaccessible.” His phrasing here suggests that he is making an ontological, not merely epistemological point. When he does make the epistemological claim, it is prefaced by an ontological concession: “*even if it existed*”.¹⁵ Poincaré is saying that the external world *would* be inaccessible even if he is *wrong* and there ultimately existed something matching that description – a situation that he has just described as “an impossibility”.

We have established that Poincaré’s ontological position, in the VoS sources, is that “the external world exists” and “there exist external objects”, etc., are only conventions. In Section 2, I claimed that the *Science and Hypothesis* quote frequently used to identify Poincaré as an epistemic structural realist was incompatible with the VoS sources, partly because it committed Poincaré to the existence of real, inaccessible, external objects. We now see why that is. In the VoS sources, the only objects Poincaré is willing to acknowledge are conventional ones. Their reality is exhausted in their usefulness for systematising objective phenomenological relations.

Importantly, Poincaré does not regard conventions as completely divorced from all objectivity. He acknowledges that which conventions are convenient and which are not is an intersubjectively stable truth:

It will be said that science is only a classification and that a classification cannot be true, but convenient. But it is true that it is convenient, it is true that it is so not only for me, but for all men; it is true that it will remain convenient for our descendants; it is true finally that this cannot be by chance. (1905/2001, 350)

¹⁵ Fr.: “si même il existait” (2013, 183).

Science's *objective convenience* is what Poincaré defends with an early no miracles argument. It is convenient for revealing elegant mathematical harmony between countless phenomenological relations, in the form of empirically adequate theories. As should be clear at this point, Poincaré is not going to give a realist explanation of this objective convenience. The external world and everything in it remain conventional for him. But *how convenient these conventions are* is not something that anyone can freely opt in or out of. And if convenience is not itself conventional, and it is intersubjectively communicable and stable, then the convenience of science is determined by the way things actually are – it is not anyone's creation.

We have now surveyed Poincaré's radical ontological conventionalism. In Poincaré's ontology, sense impressions really exist – yours and mine. And the relations between sense impressions are objective: the same for everyone. The external world and everything in it are conventions chosen only to facilitate productive thought and discourse about phenomenological relations. Which conventions are convenient and which are not is an objective truth.

This brings us to an issue which Poincaré did not adequately address, and which might be a problem for his system: the ontological status of other minds.

5. The other minds dilemma

The first quote from Poincaré we encountered in Section 3 contained his full argument for the existence of other minds. I will reproduce it here:

What guarantees the objectivity of the world in which we live is that this world is common to us with other thinking beings. Through the communications that we have with other men, we receive from them ready-made reasonings; we

know that that these reasonings do not come from us and at the same time we recognize in them the work of reasonable beings like ourselves. And as these reasonings appear to fit the world of our sensations, we think we may infer that these reasonable beings have seen the same thing as we; thus it is we know we have not been dreaming. (1905/2001, 345)

For Poincaré, if there do not exist multiple minds capable of being in accordance with one another, there can be no objectivity. As we can see, he found it very easy to infer that minds other than his exist. But, based on what we have seen so far, is this not *too* easy? Why is the existence of other minds not a convention like the existence of external objects? The existence of another mind obviously cannot be identified with a crude fact (a pure sense impression) and, even if it could, Poincaré only wants us to trust relations between crude facts when they are confirmed by other minds. Every other entity external to our own experiences is supposed to be a mere convention used to refer to regularities in sense impressions. If the argument for the conventional status of external objects can be used with equal force for the conventional status of other minds, Poincaré might face this dilemma, which we'll call 'the other minds dilemma':

- 1st horn: Other minds only conventionally exist, and objectivity depends on other minds, so objectivity itself is dependent on a convention.
- 2nd horn: The argument for the conventional status of other minds can be defeated, but so too can the argument for the conventional status of external objects.

This dilemma is a serious threat. If, via the 1st horn, objectivity itself becomes a conventional stipulation in the same sense that we have seen so far – i.e., such that there is no fact of the matter of whether there are objective facts – then Poincaré's position will be cast even further down the antirealism path than LeRoy's. This is an unacceptable result for him. And the 2nd

horn opens the door to a realism that contradicts Poincaré's ontological conventionalism. All is not lost, however. I think that there are ways for a defender of the ontological conventionalist Poincaré to effectively respond to this dilemma without abandoning the substance of his position.

We must first take care to understand the reason why Poincaré thinks there is no fact of the matter of whether the external world exists and question whether this reason extends to other minds. I identified and explained the 'speechless god' quote we saw above as the key piece of evidence. The question, then, is whether this neo-Kantian meta-metaphysical stance results in the belief that there is no fact of the matter of the existence of other minds. I would answer: not necessarily. If we regard the proposition "other minds exist" as equivalent to or entailed by "external objects exist", then this problematic result would indeed obtain. But the problem Poincaré sees with taking "external objects exist" as a non-conventional proposition is that doing so would require us to think that, in the ultimate reality, there is a real distinction between 'things' that are mind-external and those that are mind-internal, and this is a description which Poincaré thinks just cannot apply to the ultimate reality. But we need not think that "other minds exist" requires us to impose those or analogous distinctions on the nature of reality. I – the author of this paper – know as a matter of fact that there is at least one manifold of experiences including sensations, thought, and memory: the one that I call my own. I know this through direct acquaintance. Let's stipulate, here, that 'mind' refers only to such a manifold and bracket any philosophical questions about the mind's supposed 'possessor'. Since it is factually true (I would insist) that "there is at least one mind", it would seem bizarre, if not incoherent, to insist that there is no fact of the matter of whether there is more than one. To illustrate: I have no recollection of seeing the Eiffel Tower in Paris and am not seeing it as I write this. Insofar as those are acceptable as facts, is it coherent to claim that there is no truth of the matter of whether *there are* recollections of seeing the Eiffel Tower or

present experiences of looking at it (and thus minds which are not my own)? Would believing that the nature of reality is transcendent require me to make such a claim? If I could ask Poincaré's god whether such experiences exist, would it be unable to answer? For all three questions, I think the answer is 'no'. This is not a matter which requires knowledge of the ultimate nature of the reality which underlies experience.

Due to this, it would not be inconsistent for Poincaré to say that there is a fact of the matter of whether there are other minds (once the question is interpreted correctly) even though there is no fact of the matter of whether the external world exists. There is still the epistemological question of how we might *know* that other minds exist, since our experiences are arguably consistent with solipsism. Here, the defender of Poincaré has two options: argue, as Poincaré did, that there is evidence against solipsism, or admit that there is no evidence against solipsism but argue that this is not fatal to Poincaré's position. I think that either route has potential.

For the first option, we would ideally take leave from Poincaré's own argument (quoted at the beginning of this section). But it must be given philosophical reinforcement to be convincing. Consider the following two propositions:

- (1) I encounter at least some reasonings that seem to be produced by other beings which I know are actually produced by other beings.
- (2) I experience at least some sensations whose qualities I know to be objective.

Poincaré justifies his relationism by denying (2). It is precisely because we cannot rely on our own devices to tell us whether a sensation is fabricated or distorted that we should (according to Poincaré) take as objective only what is confirmed by other people (i.e., only relations). But his argument for the existence of other minds seems to rely on the truth of (1), which seems analogous to (2). One way that Poincaré's defender might maintain (1) and deny (2) is

by arguing that reasoning is essentially self-conscious. This means defending the view that if someone is producing rational thought then they are necessarily aware that they are producing rational thought, plus the notion that reasoning cannot be evident unless someone has produced it through rational thought. There is extensive applicable literature on self-consciousness both in the ‘Western’ philosophical tradition (see Smith 2020, especially Section 4.2) and the Indian one (see Kellner 2010), so this is not at all a weird move or one that can be easily dismissed. If we accept such a view, then in cases wherein what Poincaré calls “ready-made reasonings” appear to us, we can know for sure whether or not it was us who produced it and know for sure that it was produced by a mind. This can clearly result in strong evidence that there are other minds.¹⁶

For the second option, it might be admitted that Poincaré *does* have to take the existence of other minds on faith, and argued that this singular leap of faith, which allows for objectivity and the rest of his system, should not be denied to him because of his otherwise sceptical stance. Poincaré neither declares an absolute Cartesian scepticism for himself, nor does his system logically require it. He can consistently say that it needs to be relaxed specifically for the question of other minds, and it may be argued that this puts his view in the same boat as any other metaphysical system. Attempts to disprove solipsism are rare and rarely considered successful; most philosophers simply regard solipsism as a fringe idea that does not need to be thoroughly addressed. It is not obvious that this latitude cannot be extended to Poincaré, even if we demand that his defenders provide special justification in his case.

¹⁶ The appearance of others’ reasoning in dreams or hallucinations will cause difficulty for this position, but there is perhaps an effective avenue of response in the fact that these appearances are paradigmatically not objective whether or not anything is.

I am not claiming, here, that these responses to the other minds dilemma are successful, but I am claiming that they are not obviously unsuccessful. And there are, doubtlessly, other possible responses which I have not thought of. The other minds dilemma therefore should not incite us to jump to the conclusion that the ontological conventionalist position I have attributed to Poincaré is hopeless. Furthermore, the dilemma should not be taken to make the rival ‘epistemic structural realist’ reading of Poincaré more attractive here, since that version of Poincaré faces comparably dire objections. Chief among them is Newman’s objection (mentioned in Section 3), which some scholars regard as insurmountable for the ESRist (see Ainsworth 2009). Leading efforts to save ESR from Newman’s objection (e.g., Melia and Saatsi 2006) do so by modifying the position well beyond what can be represented as Poincaré’s own view. And this, of course, is not the only objection to structural realism. So, a structural realist interpretation of the VoS sources is by no means obviously more charitable than my ontological conventionalist one. And mine, I hope to have shown, is far better supported by the text.

6. Conclusion

This paper presents three contributions to the study of Poincaré:

- It highlights the incompatibility one of Poincaré’s key metaphysical claims in *Science and Hypothesis* with his position in the VoS sources. This discontinuity has not, to my knowledge, been previously acknowledged in the literature.
- It explains Poincaré’s relationism in the VoS sources as fundamentally phenomenological and closer in metaphysical import to constructive empiricism than to structural realism.

- It explains Poincaré’s radical conventionalism regarding the ontological status of external objects and the external world.

I hope to have made clear that, in the VoS sources, Poincaré was not a realist in the contemporary understanding of the term. Poincaré thought that the existence of theories with any significant degree of empirical adequacy – i.e., theories which accurately and precisely represent regularities which hold between complex and varied phenomena – is a tremendous achievement which demonstrates the objective value of science. He thought that the existence of intersubjectively stable mathematical connections between phenomena throughout the history of science, even across generations and theory change, demonstrated that science was more than just collective imaginings imposed onto the world. What he did *not* do (in the VoS sources) was claim that these mathematical connections represented real relations between real mind-independent objects. While, in “The Theories of Modern Physics” from *Science and Hypothesis*, Poincaré considers the entities of scientific theories to be “images” which stand in for “real objects” which are forever inaccessible, Poincaré in the VoS sources unambiguously refuses to claim that science’s conventional objects represent anything other than assemblages of objective phenomenological relations. For Poincaré in the VoS sources, the ontology of science, and indeed that of the ordinary world of experience, is nothing more than a conventional construction with the sole purpose of facilitating the representation of objective relations between phenomena.

It would be incorrect to say that Poincaré was only interested in the empirical adequacy of scientific theories *instead* of their truth.¹⁷ He chose to begin *The Value of Science* with the sentence, “The search for truth should be the goal of our activities; it is the sole end worthy of them” (1905/2001, 189). However, it was Poincaré’s considered opinion

¹⁷ That Poincaré was not primarily interested in truth was alleged by Daston and Galison (2007, p.261).

that ontology did not play an objective role in the ultimate truths about reality that humans could access. “The truth we are permitted to glimpse,” he writes, “is not altogether what most men call by that name” (1905/2001, p.191). The truth which science shows us, according to Poincaré, is the mathematical harmony between various phenomenal relations. On his view, any and every metaphysical interpretation of this structure – no matter how modest – should be understood as a convention.

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