Properties, Concepts and Empirical Identity

Abstract

Properties and concepts are similar kinds of thing in so far as they are both typically understood to be whatever it is that predicates stand for. However, they are generally supposed to have different identity criteria: for example, heat is the same property as molecular kinetic energy, whereas the concept of heat is different from the concept of molecular kinetic energy. This paper examines whether this discrepancy is really defensible, and concludes that matters are more complex than is generally thought. The distinction between canonical and non-canonical designators, as applied to such entities as propositions, properties and concepts, is examined, as are causal realist accounts of the semantics of such terms as 'electricity' and 'mass'.

Keywords: property; concept; identity; Putnam; Kripke

1 INTRODUCTION

Properties and concepts are similar kinds of thing in so far as they are both typically understood to be whatever it is that predicates stand for. Thus if we consider the sentence 'X is hot', and ask what role the predicate '__ is hot' has, we might reply that it stands for the property of being hot, or equally that it stands for the concept of being hot. The fact that we could do either suggests a parallel between properties and concepts, if not outright identity. After all, both properties and concepts are 'predicate-shaped'.

However, there nevertheless seems to be an important difference with regard to identity criteria. We may well want to say that scientific research has shown that heat is the same property as molecular kinetic energy, but it is surely false to say that the concept of heat (or of being hot) is the same as the concept of molecular kinetic energy (or of having molecules with high kinetic

energy). A scientifically ignorant person will not possess the latter concept at all, but may still possess the former. Yet thermodynamics has, apparently, shown us that we have here just one and the same property. How do we explain this discrepancy?

It might be thought that the situation is broadly the same as with empirical identities elsewhere. Thus it is established, as a matter of scientific fact, that water = H_2O. But this is an empirical truth, not a conceptual one: the concept of water is very different from the concept of H_2O, and it is quite possible to possess the former but not the latter. There is no particular mystery here, or so it might be argued, and likewise no more so with the case of heat and molecular kinetic energy. This paper will argue, however, that we do not have a straightforward parallel here, and that empirical identities between properties, as opposed to objects, are much more controversial.

The paper is structured as follows. In §2, I introduce the Kripke/Putnam 'direct reference' theory, and examine how it might be extended to properties as well as kinds of stuff. I present an argument that apparently proves that heat is the same property as molecular kinetic energy, but show that it unfortunately could also be adjusted so as to prove, wrongly, that the concept of heat is the same as the concept of molecular kinetic energy. I also examine a parallel argument that apparently proves a false identity between properties. In §3, I argue for a distinction between canonical and non-canonical designators as applied to such entities as propositions, concepts and properties, but not to things. Canonical designators tell us what the property (etc.) actually is, whereas non-canonical designators merely pick out a unique property (etc.) without telling us which property it is. I suggest that what goes wrong with the crucial argument in §2 is that it uses non-canonical designators in an illegitimate way. In §4, I examine the possibility that the latter argument could be rectified if we adjust the scopes of certain operators. However, the problem remains that it is hard to see how a rectified argument should not equally apply to concepts, thus giving us false conclusions. In §5, I consider causal realism, as expounded by, for example, Newton-Smith. Several related ideas are examined. Firstly, I

consider whether non-canonical designators are all alike, and whether definitions that relate specifically to causes are legitimate. Secondly, I examine the distinction between explicating the sense of a term and fixing its reference, and argue that, when applied to theoretical terms such as 'electricity', it is not as straightforward as Kripke and Putnam maintain. And thirdly, I consider again whether properties and concepts have been adequately distinguished, especially in the context of the fact that concepts can evolve in time. §6 summarizes the paper.

2 The Direct Reference Theory Applied to Properties

To see the background, let us look at the concept of water. There are several theories of how the word 'water' gets its meaning. One of them, a basically Lockean one that was very influential until the 1960s, equates water with its ordinarily identifiable qualities, what Locke (1975, Book III) called its 'nominal essence', or the 'idea' we have of water. This is a plausible looking theory in so far as it does not go beyond what the ordinary language user is required to know about water. Its drawback, as Putnam (1975b, 'The Meaning of "Meaning"'), Kripke (1980) and others have argued, is that it fails to account for certain modal phenomena, about what water would be if certain facts were to obtain.[1] Suppose, for example, that on Twin-Earth, the 'watery stuff' which has all the ordinary qualities of water in fact is not H_2O but some quite different substance XYZ. This stuff, it is argued, would not be genuine water, though would have to be on a Lockean account. The Lockean account is therefore wrong and 'water' does not mean 'watery stuff'. What, then, does it mean? We could argue that water is by definition H_2O, but although we may want to say that water is necessarily H_2O, this cannot be a conceptual or definitional truth, since it is empirical, not *a priori*. It plainly does not correspond to the definition actually used by a scientifically ignorant but linguistically competent user. The alternative, 'direct reference' theory, which is now very influential, is that water is defined to be any stuff with the same (possibly unknown) internal constitution (or Lockean 'real essence') as *this* (ostensively

[1] For a recent collection of articles on the subject, see Beebee & Sabbarton-Leary 2010.

identified) stuff. Such a definition is available to the scientifically ignorant language-user, but gives the right results with regard to the Twin-Earth possibilities.

Can we argue similarly with heat? Locke does not suppose that the distinction between real and nominal essence applies to modes as well as to substances, but it is possible that the idea can be extended there. Thus the nominal essence of heat consists of all the ordinary features of overt thermal phenomena, whereas its real essence is molecular kinetic energy. A Lockean definition of heat is along the lines of:

(1) *x* is hot iff *x* exhibits overt thermal phenomena

But we want it also to be true that

(2) *x* is hot iff *x* has molecules with high kinetic energy

However, (2) is an empirical fact and so cannot be definitional. At best, (2) is a nomological, or causally necessary truth, and it is unclear why this should yield an identity between properties. After all, laws of nature are typically contingent truths: it is a contingent truth, for example, that the world does not exhibit a caloric theory as opposed to a thermodynamic one. Yet it is generally accepted that there are no contingent identities, and *a fortiori* no contingent identities between properties. The Kripke/Putnam trick is to define heat instead (along the lines of)

(3) *x* is hot iff *x* has that (possibly unknown) property, call it φ, which causally underlies overt thermal phenomena[2]

[2] Kripke (1980) himself defines heat as whatever it is that typically causes heat sensations. But it is better to talk of overt thermal phenomena in general, rather than specifically phenomenological features, if only so as to preserve the analogy with Putnam's discussion of water. It may be wondered whether (3) could possibly be definitional given that (2) is contingent. But we could rectify the problem by insisting that in a possible world where something other than molecular kinetic energy underlies overt thermal phenomena it is equally the case that it is not *heat* that so underlies

This is analogous to the definition of 'water', and it apparently tells us that

(4) heat = φ

Scientific discovery, however, tells us that

(5) φ = molecular kinetic energy

and this is philosophically uncontroversial, so it evidently follows that

(6) heat = molecular kinetic energy

and this is the (controversial) empirical identity between properties that we want.

Does this work? A source of unease is that it remains unclear why we cannot produce a parallel argument to show an identity between concepts. If it is part of the concept of heat that

(7) *x* is hot iff *x* falls under some possibly unknown concept (call it φ) which causally explains overt thermal phenomena

and it is unclear why this should not be true, even if it is a rather strained way of phrasing things, then we ought, as above, be able to show that the concept of heat = the concept of molecular kinetic energy, a conclusion which is surely false. It may be protested that this is to invoke a rather confused notion of a concept. If concepts can 'explain', then they are perhaps to be

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it. Rather, we have 'fools's heat'. The point is that 'that property which underlies overt thermal phenomena' can be understood as a rigid designator (perhaps replacing 'that' by Kaplan's 'dthat' would make it clearer). If 'hot' is defined in that way, then (2) is arguably a necessary truth. See also below.

understood as mind-independent entities 'out there', in which case the above conceptual identity statement is not so implausible after all. But if we treat concepts as the sort of things which do not exhibit empirical identity, then (7), or any condition relevantly like it, becomes rather harder to formulate. However, this objection is not insuperable. We can say of a concept, understood as a mental item, that it is of primary significance when it comes to grasping an explanation of the relevant phenomenon, for example, and this is surely enough to give us a suitable way of understanding (7) and of sustaining our unwanted inference. True, there are many further metaphysical issues about the nature of properties and concepts that perhaps need addressing, but not much needs to be said here. We have a number of pre-theoretical intuitions about identity with regard to both properties and concepts that do not hinge on taking a particular metaphysical line, or at least could be used in order later to develop such a line, and these intuitions are sufficient for present purposes.

It may be protested that this is not as convincing as it needs to be. True, we have a number of pre-theoretical intuitions about identity with regard to both properties and concepts that do not hinge on taking a particular metaphysical line, or at least could be used in order later to develop such a line, and these intuitions are certainly valid as far as intuitions go. However, there are many further metaphysical issues about the nature of properties and concepts that we have been presupposing, and they tend to point us in the other direction. Specifically, it could be insisted that properties are mind-independent entities in a way in which concepts are not. There are certainly some very deep issues here which go back at least as far as Plato, and the question of whether the Forms are universals or instead abstract particulars. More relevantly still, we have the case of Frege whose conception of a concept (*Begriff*) is very far from standard (he had virtually nothing to say about properties). We ordinary suppose that concepts are essentially cognitive in the way in which abstract particulars cannot be; and yet (7) speaks (with Frege) of 'falling under a concept', a famously strange phrase that indicates that Frege's concepts are not much like other people's. Frege's attitude towards the abstract realm is often described as

'Platonist' (though such description is seldom defended explicitly), and if we adopt a more mind-dependent conception of a concept, then we are much less tempted into supposing that we can have empirical identity between concepts. What does this show? I think it would be a mistake to read too much into it. The reality is that pre-theoretical intuitions on any topic often do form an inconsistent set, particularly if they are about contentious notions such as property and concept. Even such stalwarts like truth, causation and knowledge resist convincing analyses—if it be required of them that that they be (a) profound, (b) rigorous, and (c) consistent with all our pretheoretical intuitions (a fact which ensures that a certain old-fashioned conception of philosophical analysis is not fit for purpose). It must be emphasized that I am not arguing for a definite conclusion in this paper: only that matters are far more complex than they are often supposed to be. In which case, many of these controversies can be put on hold.

However, it is not just equivalences such as (7) that need attending to. Its property-analogue (3) and the inference from (3) to (4) is also suspect. To see why, consider another empirical identity between properties, namely

(8) Mercy = the quality most favoured by Portia

Evidently, this is not definitional, but suppose we try to get a definition out of it. In particular, let us define 'Portia-favouredness' as

(9) *x* is Portia-favoured iff *x* exhibits the quality, whatever it is, most favoured by Portia

Is Portia-favouredness the same property as mercy? There are reasons to think that it cannot be. For if it were, then

(10) *x* is merciful iff *x* is Portia-favoured

would have to be a necessary truth as identical properties are necessarily coextensional. (9) is also a necessary truth since it is definitional. But (9) and (10) together yield

(11) *x* is merciful iff *x* exhibits the quality most favoured by Portia

and (11) is not a necessary truth: Portia did not have to favour mercy, and '*x* is merciful' and '*x* exhibits the quality most favoured by Portia' have quite unrelated satisfaction-conditions. It evidently follows that we have different properties here, and that Portia-favouredness is not the quality most favoured by Portia (if this seems impossible, then reflect on how self-centred Portia would have to be for it to be otherwise).[3] But then it equally becomes problematic to see how (4) can be true, and the inference from (3) to (4), which looked perfectly solid, is put into doubt. With it goes our argument for the possibility of empirical identities between properties.

3 Canonical and Non-canonical Designators

We may suspect a base trick here, and wonder if phrases such as 'the quality most favoured by Portia' can possibly be definitional. After all, although it is a phrase which picks out a unique property, it does not tell us what the property *is*. It only specifies it indirectly, and until we know what it picks out, we cannot use it in the way suggested above. This points to a quite general point about properties, and shows a way in which they are quite different from objects. With objects or persons, there is no clear distinction between designators which tell us what the object or person is, and those which do not. Thus, I may refer to a person as 'David Cameron', but equally I may refer to him by means of a definite description, such as 'the British Prime Minister'. Both designators tell us which person we are talking about, and it is as much in order to say 'the British Prime Minister' in answer to the question 'Who is David Cameron?', as it is to

[3] A similar argument may be found in Schnieder 2005. He uses a different example, however, namely 'red' versus 'the colour of ripe tomatoes', and does not consider its implications for empirical identity. See also LaPorte 2006.

say 'David Cameron' in answer to the question 'Who is the British Prime Minister?'. True, it would be odd to treat other descriptions, such as 'the man that Jones voted for', as actually telling us who the man is, but for all that, there is no hard and fast distinction between those designators that tell us which individual we are talking about and those designators which successfully pick out a unique individual, but which do not tell us which individual is picked out. At most, it is a matter of degree. True, we still have a sharp distinction between rigid and non-rigid designators, and the question of whether 'Y' is an appropriate answer to the question 'Who is X?' is bound to depend on context and the interests of the questioner. But the distinction between those designators that tell us who or what the entity referred to *is* and those that do not is not quite the same as that between those that are rigid and those that are not. The former is elusive and context-dependent in a way in which the latter is not.

This might be disputed, and once again intuitions vary. However, I think that almost everyone would hesitate before insisting that the designator 'Boris Johnson's mother' tells us who that person is. But that is not because it is non-rigid: if Kripke's views about the necessity of origin are to be accepted, it is actually as rigid as a proper name! A similar point may be made about general terms, as opposed to singular ones. The rigid/non-rigid distinction is therefore rather beside the point, even in the case of concrete, worldly items. In consequence, the former will not give us much of a purchase here.[4]

With other sorts of entities, however, we clearly do have a distinction, and a very sharp and definite one. Consider, for example, propositions. I can refer to a proposition *p* by means of the designator 'The proposition that all men are created equal', and this certainly tells us what the proposition is. The description is one which actually *expresses* the proposition, and we may call it a *canonical designator*. With such designators, what you see is what you get. But I may also refer to *p*

[4] Kripke himself simply made a mistake when he attempted to define rigidity of 'X' in terms of whether X might not have been X. If 'X' is 'the mother of Mary', then it is true that X might not have been X – for this woman (St Anne) was not forced to have children. However, nobody else could have been X if we accept Kripke's story about the necessity of biological origin (a story that, incidentally, is now less plausible given what we know about genetic engineering), thus making 'X' rigid. For further examination of Kripke and the essential/accidental distinction, see Unwin 2020.

by means of the designator 'The proposition to which the USA is dedicated'. This is a designator of a clearly different kind. Although it successfully picks out a definite proposition, indeed the same as that designated by 'The proposition that all men are created equal', according to Lincoln, it itself does not tell us what the proposition in question is. It does not *express* the proposition it refers to. Now, suppose we try to argue that there can be empirical identities between propositions. This is undoubtedly a surprising claim. It is at best an empirical fact, for example, that <*x* is hot> and <*x* has high molecular kinetic energy> have the same truth value, and it is just for this reason that we suppose the propositions to be different. Propositions are intensional entities, with very fine-grained identity criteria. But suppose we cite

(12) The proposition that all men are created equal = the proposition to which the USA is dedicated

as an example of an empirical propositional identity. Is this convincing? Hardly. It is little more than a joke, and the reason is that 'the proposition to which the USA is dedicated' is not a canonical designator. Only identity statements between canonical designators will count—and obviously so, we may add. We do not get this objection with identities between persons, objects or kinds of stuff.

But the problem is that properties (and concepts), being predicate-shaped, are closely linked to propositions, so much so that we are tempted to think that they too exhibit an equally sharp distinction between kinds of designator. The designator 'The quality most favoured by Portia' does not tell us what the quality is, and it provides a very odd answer to the question 'What is the quality of mercy?', so (8) above does not count as a legitimate example of an empirical identity, any more than (12) does, we may insist. Nor, more worryingly, does (3), since 'that (possibly unknown) property, call it φ, which causally underlies overt thermal phenomena' is most certainly not a canonical designator either. It refers to φ, i.e. uniquely specifies it, but does

not tell us what φ *is*. This sort of thing does not matter with the example of water and H_2O, since water, being a kind of stuff not a property, does not exhibit this sharp distinction between canonical and non-canonical designation. This is the crucial objection to the Kripke/Putnam theory as applied to properties.

Putnam (1975a, 'On Properties') makes a distinction between two kinds of properties, what he calls *properties*$_1$, which are traditional predicate-shaped properties, and *properties*$_2$ which are 'physical magnitudes'. The implication here is that physical magnitudes have broader identity criteria than traditional properties. He gives the examples of heat and electricity elsewhere (1975b, 'Explanation and Reference') when defending causal realism, and these phenomena are not obviously *properties* as such. Arguably, we do not get the very sharp distinction between canonical and non-canonical designators here, and this might seem to prevent the above difficulties from arising. But in so far as we are talking about properties as ordinarily understood, we still have a problem if we declare, as many do, that we can have empirical identities, and it is with this thesis that I am concerned.

4 Some Scope Ambiguities

It might be thought that the Portia problem arises only because of some form of scope confusion. Thus

> '*x* exhibits the quality of mercy'

and

> 'Concerning the quality of mercy: *x* exhibits that'

have essentially the same meaning, and there is no difference in their satisfaction-conditions, although the property-descriptions have different scopes. However, there is a difference between

'*x* exhibits the quality most favoured by Portia'

(or one way of reading it) and

'Concerning the quality most favoured by Portia: *x* exhibits that'

and it could be argued that our problems will resolve themselves if we focus instead on the latter expression, and always read the scope in that way, for it then will have the same satisfaction-conditions as

'Concerning the quality of mercy: *x* exhibits that'

(the property-designators are now in extensional contexts). An adjusted version of (11) thus comes out as a necessary truth after all, and our problems evaporate.

Issues of modal scope are evidently relevant here, as they are with water and H_2O. We need to read (3) in a particular way if the inference from it to (4) is to go through, as noted. Moreover, just as our intuitions say that a possible world (or a Twin-Earth) where watery stuff is not H_2O is a world where the stuff is not *water*, so likewise we have intuitions (though rather less strong) that a possible world (or a Twin-Earth) where overt thermal phenomena are explained by the presence of caloric (or whatever), and not by molecular kinetic energy, is a world where things which exhibit overt thermal properties are not genuinely *hot*, even though they feel that way. (What we have, rather, is 'fool's heat'.) It is precisely for this reason that, following Kripke and Putnam, many prefer (3) to (1) as a definition of 'hot' (indeed, (1) is actually going to be false

on this view, and not merely non-definitional, unless it too is re-scoped). But this will only work if the property-description in (3) is given large scope.

Will this resolve the problems? One reason for thinking otherwise is that we still have a problem with concepts. Why can we not establish a (we suppose, bogus) identity between the concept of heat and the concept of molecular kinetic energy using similar methods, given the similarity between concepts and properties? Specifically, consider these three concept-designators:

A. 'The concept of heat'
B. 'The concept of molecular kinetic energy'
C. 'The concept whose instantiation explains overt thermal phenomena'

We may read C is such a way as to make it co-designative with B. But B and A are not co-designative (we ordinarily suppose), so it follows that A and C are not co-designative, and *a fortiori* do not have the same sense. But why can we not define heat in that way, i.e. declare that A is to be defined as meaning C? If it instead be declared flatly that that is not how heat is defined, then let us define a new term 'q-heat' in that way (since we have a genuine neologism, there is no obvious objection to our doing this). But something will count as q-hot necessarily and *a priori* if and only if it is hot, so we shall have all our earlier problems: heat and q-heat cannot be convincingly separated. If A is defined as meaning C, and B and C are co-designative, then we shall have to conclude, counterintuitively, that A and B are also co-designative, and we have our paradox again. But the most natural response, surely, is to declare that C is a thoroughly perverse sort of description, a non-canonical designator *par excellence* which cannot be used to *define* a concept even if it manages to pick one out. A therefore cannot have the same sense as C. Appeals to scope and to modal ambiguities are not going to help us at all, for the canonical/non-canonical distinction is not quite the same as the rigid/non-rigid one. But then why should the

definitions attempted in (3) and (9) be any more successful? Why should properties differ from concepts inasmuch as non-canonical designators of the former, but not the latter, can be definitional?

5 CAUSAL REALISM

It might be thought that non-canonical property-designators are not all alike, and that we should not treat 'the property which causally underlies overt thermal phenomena' and 'the quality most favoured by Portia' as being on a par. The former can be definitional, perhaps, even if the latter cannot be since there is something special about causal underpinning: causality underlies meaning and reference in a way in which favouredness does not. It is unclear how this will help us with our problem of distinguishing properties from concepts, to be sure, but it points to a general line of argument in the philosophy of science which cites the Kripke/Putnam approach, and is of some relevance. This is an argument endorsed by Newton-Smith (1981: 164–73) in his critique of Kuhn's claim that different scientific theories are incommensurable. Ostensibly, Newtonian mechanics and the Special Theory of Relativity contradict each other inasmuch as the former implies 'Mass is invariant', whereas the latter implies 'Mass varies with velocity'. Kuhn (1970) argues, however, that the word 'mass' has different meanings in the two theories, thus showing that we do not have a genuine contradiction after all. Theoretical terms, according to Kuhn, get their meanings from the theories in which they occur, so different theories will yield different theoretical concepts, a phenomenon which Newton-Smith calls 'radical meaning variance'. We thus cannot logically compare Newtonian and relativistic mechanics, or at least not in any straightforward way. This rather unintuitive result can be blocked, according to Newton-Smith, if we adopt instead a causal realist account of theoretical terms. If we were to define 'mass' as 'that property, whatever it is, which causally underlies inertia', or something along these lines, then it will have the same meaning within both theories, and our ordinary intuitions can be recovered.

Causal realist theories are primarily concerned with fixing reference rather than explicating sense. Indeed, Putnam (1975b, 'Explanation and Reference') is sceptical about the idea that theoretical terms such as 'electricity' have an intension or sense conceived traditionally as a set of defining features. Early electricians, as they called themselves, did not agree on what the features were, and this would lead to massive reference failure if reference were to be determined by features in a Fregean sort of way. Rather, what secures the fact that they are all successfully talking about the same thing, namely electricity, is that it is electricity that causes the 'introducing events' (i.e. overt electrical phenomena) which lead electricians to talk electrically. Causality thus plays an essential role in reference, and designators such as 'The property which causally underlies [such-and-such] phenomena' perhaps thereby gain a kind of legitimacy even though they are non-canonical.

A possible disanalogy here is that heat is not as theoretically remote a phenomenon as electricity, and there is more temptation to define it in a Lockean way, i.e. simply in terms of its overt features, which are themselves less controversial than those which may accurately be described as electrical. A further complicating feature is that the term 'electricity', loosely defined, could refer to several different (legitimate) electrical magnitudes. For example, electrical charge, electric current and electrical field strength are different magnitudes measured in different units (Coulombs, amperes and volts per metre, respectively), an ambiguity we do not seem to have with the case of heat. Which of these were the early electricians referring to? It may be unclear in some cases, which shows that issues of reference have not been completely resolved. 'Electricity' is a very vague and elastic term, and this may mislead us into thinking that reference can be secured more easily than it actually can. The only way to strengthen reference ties, surely, is to pay more attention to traditional descriptive features that make up the senses of the relevant terms, and this brings us back to the original question of whether non-canonical designators, such as 'that property, whatever it is, which causally underlies [such-and-such] phenomena', can

determine the sense of a predicate. The mere fact that it concerns causality rather than favouredness, for example, to return to the earlier point, does not seem to prove very much.

There are other examples which illustrate this indeterminacy. For example, in the seventeenth century, there was much debate about a magnitude called the 'quantity of motion' of a body, in particular about whether it varied proportionally with its velocity or the square of its velocity. In Newtonian mechanics, we recognize two quite distinct magnitudes, linear momentum and kinetic energy, the former proportional to velocity, the latter proportional to the square of velocity. Which of these were these seventeenth century thinkers referring to? What about the relativistic 4-momentum, which combines features of both? Or one of the several unknown magnitudes that may be explicitly referred to in the mechanics of the twenty-fifth century? It is evidently unhelpful to speak of 'that magnitude, whatever it is, which underpins quantity of motion' without substantial additional constraints. These advanced concepts were not available to physicists of the seventeenth century. But were they able to refer to the relevant properties, as opposed to the concepts concerned? Putnam and Newton-Smith presumably think that they could. But the properties are just as arcane as the concepts, so it is unclear how this can be so. The only way it could be is if we can refer successfully to a property without being able to grasp the sense of any predicate which canonically designates it, and this makes properties mysterious once again.

Could concepts also be mysterious in this way? Consider, for example, the quantum mechanical concept of *spin*. The spin of a particle is something like the spin of a cricket ball in so far as it is a kind of internal angular momentum, but the analogy is very weak. It is an arcane concept that makes sense within the mathematical context of quantum mechanics, but cannot really be explained outside this context. Now, consider the grasp of this concept by a student who is learning the notion. This grasp will be weak, and yet something is grasped. What perhaps is grasped (among other things), and which plays a central stabilizing role, is a non-canonical concept designator along the lines of 'that concept, whatever it is, designated within the physics

community as 'spin', which satisfies [such-and-such vaguely specified] features'. But what does this amount to? Does the student have any grasp of the concept of spin at all? Or does she have the (perfect) grasp of some entirely different concept, one which relates to that of spin as the concept of heat, defined in the Kripke/Putnam way, relates to that of molecular kinetic energy? Does she attach the same meaning as her tutor does to the sentence 'Particle p has spin-up', or an entirely different one? The point is not obvious that we should not be forced into the second option rather than the first.

A further complicating feature is that concepts themselves seem to evolve through time. It might be thought that the above example of the student's limited understanding of spin despite accurate reference merely illustrates what Putnam calls the 'division of linguistic labour' and the fact that experts can fix references for the rest of us. But similar problems emerge even for experts. The concept of spin is rather different now from the way it was when first introduced by Goudsmit and Uhlenbeck in the 1920s, and it is still evolving. Yet we suppose also that experts are still referring to the same magnitude throughout this evolutionary process, and it is unclear how this is to be explained without appeal to some sort of Kripke/Putnam non-canonical designation. The concepts will also have to be structured in this way if they are to latch on to the magnitude. At any rate, there does not seem to be a fundamental difference between a mature grasp of an immature concept and an immature grasp of a mature concept, and this ensures a parallel between the student's grasp and the early expert's.

The problem is not confined to highly technical concepts. Even our ordinary concept of heat evolves to some extent. For suppose we ask a physicist what she understands by 'heat'. Most likely, she will talk about thermodynamics, and may require extensive philosophical tutoring before she can be persuaded to give either a Lockean or a Kripkean answer. Should the general level of scientific knowledge increase among people in general, then the concept of heat will very likely fuse with the concept of molecular kinetic energy, though this will not exactly be an *empirical* identity between concepts, even though it is sustained by empirical research (the

fusion is too strong for that). The situation is now very complex indeed, and all the different options seem to have converged into one.

6 Conclusion

In summary, it is not at all clear that we really can have empirical identities between properties. Notwithstanding our intuitions about 'fool's heat', we should perhaps stick to a Lockean account of properties, define heat in terms of (1) instead of (3), and deny the possibility of empirical identities between both properties and concepts (and affirm a general parallelism between them). There are still many metaphysical questions that remain unresolved, but the evidence favours an intensionalist conception of both properties and concepts, one which yields fine-grained identity criteria, and a sharp distinction between canonical and non-canonical designators. The Kripke/Putnam definition of heat makes essential use of non-canonical designators, and this seems unfair. Such designators can only have the role assigned to them if we are to make quite radical changes in our ordinary assumptions about how language works. Nevertheless, the matter is not conclusive and such radical changes could perhaps be made. If we do make them, however, then the difference between properties and concepts tends to diminish once again, but this time to the extent that empirical identities between concepts seem less absurd than is generally supposed. At any rate, a sharp distinction between properties and concepts in this respect seems unwarranted whichever option we choose.

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