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Identity and the Facts of the Matter

1 Old Number One

In 1990, the specialty car company Middlebridge Scimitar Ltd contracted with the vintage car collector Edward Hubbard to buy the Bentley racing car known as Old Number One from him. Middlebridge agreed to pay Hubbard ten million pounds in cash and company assets. The price was so high because Old Number One was the most famous racing car in British history, dating from a period when motor racing was dominated by British cars and drivers. It was in Old Number One that Captain Wolf ('Babe') Barnato, diamond heir and leading light of the 'Bentley boys', had won his second and third Le Mans 24-hour races in 1929 and 1930. The 1929 race was a procession, with Bentley taking the first four places, but in 1930 there were more powerful German cars competing, and Barnato should not have been on the podium. But by a combination of skill and guile, he won again, ahead of Mercedes Benz.

After(!) signing the agreement with Hubbard, Middlebridge did some more historical research, as a result of which it refused to perform the contract. Hubbard sued, and the case went to the High Court in London, Queen's Bench Division, where it was heard before The Honourable Mr. Justice Otton, later Sir Philip Otton, Lord Justice of Appeal.[1] Middlebridge's objection was that the car Hubbard was trying to sell to them wasn't really Old Number One, the car they believed they had contracted to buy. After the 1929 race, the company argued, so many repairs, modifications and upgrades had been carried out that the car which came into Hubbard's possession could not be said to be the car that won in 1929.

Middlebridge was particularly concerned about events in 1932. After the 1930 race, Barnato had retired from competitive driving and Bentley had withdrawn from motor racing. Barnato bought Old Number One from the company, hired the Bentley mechanic, Wally Hassan, who had been responsible for the car, and raced it with mixed success. After entering it for the 1932 Brooklands 500, Barnato asked Hassan to upgrade the car substantially, which he did, and these changes were the ones Middlebridge found most objectionable.[2] Worse, the car crashed during the race, killing its driver, Clive Dunfee, and it seemed to be a write-off. However, Hassan testified that 'The body was of course ripped off but all the mechanics, the mechanical parts, were all perfectly ok. We were just able to clean it up and we had a new body built for it, a coupé body this time.'

In addition to the modifications of 1932, the car had undergone other

[1] Much of the information I am relaying here comes from the transcript of Otton's verdict made by Cater, Wash & Co., and posted at http://www.gomog.com/articles/no1judgement.html. This document is the source of the quotes.

[2] Hassan was still alive to testify in 1990 (at 85), and had remarkable powers of recall: 'We started with a 4 litre chassis frame which was stronger than the old 6.5 litre because we feared that it would break or crack. We used all the existing parts of the older car – that is, the radiator, the clutch, the gear box, the axles, the scuttle, the electrical equipment and pedals, and we finished it up in the form it is now. It was ready for the 500 miles race in that September but Captain Barnato thought it would be a bit faster with a bigger engine, so we obtained an 8 litre engine and I built that into the car.'

changes after winning in 1929. The end result, according to Michael Hay (an expert on the history of the Bentley saga) was, as Otton reported in his verdict, that 'None of the 1929 [car] survives [in Hubbard's car] with the exception of fittings which it is impossible to date. Of the 1930 [car] Hay believes that only the following exist on the car as it is now, namely pedal shaft, gear box casing and steering column. Of the 1932 car, the 4 litre chassis and 8 litre engine form in which it was involved in the fatal accident, he believes that the following exist: the chassis frame, suspension (i.e., springs, hangers, shackles and mountings), front axle beam, back axle banjo, rear brakes, compensating shaft, front shock absorbers and mountings, the 8 litre engine, some instruments and detailed fittings.'

So Middlebridge had a point. On the other hand, there was plenty of testimony to the effect that Hubbard's car *was* Old Number One, and that this had been Barnato's own opinion. Some of this testimony came from people who had elsewhere said that Hubbard's car was *not* Old Number One. But despite these conflicts, all based on the same information, Otton came down conclusively on Hubbard's side. This was mainly because of the weight he gave to continuity considerations: 'Here the entity which started life as a racing car never actually disappeared…Any new parts were assimilated into the whole at such a rate and over such a period of time that they never caused the car to lose its identity, which included the fact that it won the Le Mans race in two successive years. It had an unbroken period of four seasons in top-class racing.' And perhaps with the possibility of reassembly of the 1929 car's 1929 parts at the back of his mind, Otton concluded his verdict with the following Nozickian flourish: 'There is no other Bentley, either extinct or extant, which could legitimately lay claim to the title of Old Number One or its reputation.'[3]

If a case like this did not already exist, we would have to invent one.[4]

2 An Alternative Verdict

There are two other verdicts Otton might have reached. He might have decided in favor of Middlebridge, for we can certainly imagine courses of events concerning which Otton would judge that the rate and assimilation of new parts into the whole *did* cause the car to 'lose to its identity'.[5] And those who think he should have decided in favor of Middlebridge anyway can surely imagine courses of events with less radical amounts of change, spread out more gradually, which they would regard as making a pro-Hubbard verdict reasonable.

But there is another option, which is perhaps the most reasonable of all, both in the actual circumstances and various mild variations of it. For in

[3] Of all the larger than life characters figuring in this story – Hubbard, Barnato, his daughter, W. O. Bentley – perhaps none was so large as the car itself. Otton said "It was produced for my inspection in Lincoln's Inn. It looked beautiful, and the magic and sheer power of its engine evoked excitement and nostalgic memories of the past." Anyone who was a British schoolboy of my generation or earlier will have no difficulty understanding how Otton's pulse must have raced.

[4] I may have taken some artistic license with my description of the case. It appears that at least to some extent the dispute was over whether Hubbard had in fact contracted to provide Middlebridge with the car that won in 1929, as opposed to, say, the car that he had acquired in such-and-such a way after a certain course of events (described neutrally *vis à vis* identity with the 1929 winner). Still, I shall take Otton's claim that the car never lost its identity because of the slow rate of assimilation of new parts to imply a philosophical view about persistence.

[5] It is unclear from the transcript that Otton was right about the continuity facts. The upgrade for the 1932 Brooklands 500 race that Hassan described (see fn. 2) appears to have involved attaching some older parts to a new chassis – cannibalization of the 1930 car – as opposed to replacing an old part with a new part in a standing car.

view of the disagreements over whether Hubbard's car was Old Number One, disagreements which are not underpinned by any disagreement over facts that are independent of whether Hubbard's car was Old Number One, Otton might well have concluded that there is simply *no fact of the matter* whether Hubbard's car was Old Number One. We could put such a verdict into his mouth in these words:

> Sometimes there is no fact of the matter whether a statement is true or false. We are familiar with clear cases of people who are bald. Yul Brynner, for example. And with clear cases of people who are not bald. David Chalmers, for example. But there are people who have some but not much hair. They are not close enough to either paradigm for there to be sufficient similarity to settle that they are bald, or that they are not. Nor is there any linguistic rule required for mastery of 'bald' which we can apply to settle that they are bald, or that they are not. These are people for whom there is no fact of the matter whether or not they are bald.
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> What holds for 'bald' holds for 'being the same car as Old Number One'. We have certain clear cases of persistence through time. If Old Number One had been put in storage immediately after winning in 1929, had remained completely assembled since then, and had undergone no changes of parts, and Mr. Hubbard had purchased it but not causally interacted with it in any way, there would be no doubt that the car Middlebridge contracted to buy from him is Old Number One.
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> If Old Number One had been completely destroyed in the 1932 crash and consumed in fire, so that only a few broken fittings and twisted pieces of metal were salvageable, and these pieces were incorporated in the construction of a car at Hassan's workshop, which then passed on to Hubbard as the actual car

> did, there would be no doubt that the car Hubbard proposed to sell to Middlebridge, the one the company contracted to buy, is not Old Number One.
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> But the actual history is not so obliging: it has aspects of both types of case. At some point, perhaps immediately after the preparations for the 1932 race, or immediately after the post-crash reconstruction, we find ourselves in a no-man's-land between cases of persistence and cases of replacement by something new. Nor is there any linguistic rule required for understanding such phrases as 'continues to exist' or 'ceases to exist' to settle whether the post-crash reconstruction is the car that won in 1929, Old Number One. No sufficient condition for persistence holds, nor does any necessary condition fail.
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> The case before us therefore concerns a dispute which has no correct resolution: the facts simply do not determine whether or not Mr. Hubbard's car is Old Number One. The court therefore rules the contract "void for uncertainty", and the case is dismissed.

This, I think, is what Otton should have said. And it has considerable initial plausibility, making it well worth our while to investigate whether there is a consistent account of identity through time which can accommodate 'no fact of the matter' in such cases.

3 Other Cases And The Uniformity Constraint

Otton's verdict for Hubbard rested on continuity considerations that were only available because a car, perhaps occasionally in a disassembled state, existed at each time. But if we replace repair and upgrade with gradual destruction, continuity considerations no longer suffice to stave off indeterminacy. Suppose, for example, that Hubbard had been trying to sell a

Brancusi bronze to Middlebridge, but before delivering it, had melted it down a certain amount. Whether or not Middlebridge gets the statue it thought it was getting depends on how much melting down has happened; certainly, receiving a molten pool of bronze would entitle it not to perform the contract. But it is rather implausible that there is a precise moment in the melting-down process at which the original statue, or any statue at all, ceases to exist. Rather, there will be a range of points such that, if Hubbard stops at one of them, there is simply no fact of the matter whether the original statue still exists.

There are other examples which do not involve temporal persistence but which seem to be puzzles of the same kind. There is a modal variant of the case of Old Number One, usually known as Chisholm's Paradox (since it originates in Chisholm 1968), pithily summarized by Quine in the dismissive remark 'you can change anything to anything by easy stages through some connecting series of possible worlds' (Quine 1976:861).

For example, let g be the 8-litre engine that Hassan put into Barnato's Bentley in 1932. We are unlikely to accept a conditional of the form 'if g could have been originally built from *these* parts according to *this* design, then g could have been originally built from *those entirely different* parts according to *that strikingly different* design', at least if we think that there must be restrictions on what *de re* stipulations make sense. But taking the conditional to be of the form $\diamond\phi_1(g) \rightarrow \diamond\phi_{100}(g)$, it is a logical consequence of a connecting chain of conditionals of the form $\diamond\phi_i(g) \rightarrow \diamond\phi_{i+1}(g)$, $1 \leqslant i \leqslant 99$. Here ϕ_1 is a predicate specifying the actual parts of h and their actual configuration, or something very close to this, while ϕ_{i+1} specifies parts and configuration very little different from ϕ_i. But as *i* increases, the degree of resemblance to the original configuration steadily decreases and the overlap with the ϕ_1-parts uniformly decreases. Each conditional in the chain is true, according to the *tolerance* principle that any artifact that could have originated from certain parts in a given configuration could also have originated from slightly different parts in a slightly different configuration. But the result of chaining the conditionals is false.

Despite its being modal , the puzzle here is not much different from the one that confronted Otton. We would like to say about it that for some *i*, there is no fact of the matter whether $\diamond \phi_i(g)$. And there are other examples, superficially more different, of which the same seems to be true. For instance, (Salmon 1986:113) has a case, the Storage Room puzzle, of the same type. Suppose that some furniture movers have to deliver n+1 items of the same design to a storage facility. To place each item in the storage room, it is necessary to disassemble it, pass its pieces through the inconveniently narrow entryway, then reassemble it on the other side (evidently, a British storage facility). Things go well with the first piece, but as the day goes on, the movers get more and more careless, damaging more and more pieces of each item they try to store, and replacing them in the reassembly process from a cache of spare parts they brought with them. The last piece of the day is totally destroyed in disassembly, and is replaced in the storage room by a piece of furniture constructed there from the cache of spare parts. More formally, let $a_0,\ldots,a_n$ be $n + 1$ distinct pieces of furniture, each with $n + 1$ parts (fixed n), and each capable of being disassembled and reassembled. For each a_i, let b_i be the object which results when a_i is disassembled, then reassembled with replacement of i-many parts. We have, for each i, the seemingly true conditional 'if $a_i = b_i$ then $a_{i+1} = b_{i+1}$', yet we would hardly agree to 'if $a_0 = b_0$ then $a_n = b_n$', which looks straightforwardly false. But this last conditional is of course entailed by the others. Again, we would like to say that for at least one i, there is no fact of the matter whether $a_i = b_i$.

There is a tolerance principle at work in this case too, namely, that if in case i the same piece of furniture is disassembled and reassembled, then in case $i + 1$ the same piece of furniture is disassembled and reassembled. And there was a tolerance principle at work in the case of Old Number One, namely that if Old Number One survived any repair or upgrade or modification, it survived the next one. (Those who doubt this about the actual course of events in that example can produce a variant in which this principle is very plausible, though it leads to the conclusion that if Old Number One survived the first change it survived them all.)

Since all the puzzles involve tolerance principles, a uniform approach to them will involve some way of preventing these principles from generating awkward consequences, or some persuasive reason to reject the principles or to accept their consequences. But uniformity requires rather more than this. For I have said that our three puzzles are essentially the *same* puzzle. If that is so, the apparatus we invoke to defuse them should be *essentially the same apparatus* in all three cases. I call this constraint the *Uniformity*

Constraint. And what kind of apparatus are we envisaging? Since they are generated by tolerance principles, these puzzles appear to be of a familiar kind: they are Sorites paradoxes, of the same general sort as the Bald Man paradox, that if a man with n hairs on his head is bald, so is a man with n+1 hairs, hence, if a man with no hairs on his head is bald, so is a man with thousands. The Uniformity Constraint would be met by taking some treatment of vagueness and applying it in the same way to the three puzzles.

The Constraint immediately rules out certain approaches to Chisholm's Paradox. Modal conditionals like the ones we considered may be translated into two extensional possible-worlds languages, one invoking *relative possibility* ('accessibility') and the other *counterparthood*, as illustrated in (1b) and (1c) below:

(1) a. $\Diamond\psi(g) \rightarrow \Diamond\theta(g)$

b. $(\exists w)(R_{\Diamond}@w \wedge \psi'(g,w)) \rightarrow (\exists u)(R_{\Diamond}@u \wedge \theta'(g,u))$

c. $(\exists w)(\exists x)(Cxgw \wedge \psi'(x,w)) \rightarrow (\exists u)(\exists y)(Cygu \wedge \theta'(y,u))$.

According to (1b), (1a) has the truth condition that if for some world *possible relative to the actual world* ('$R_{\Diamond}@w$'), g is ψ-at-that-world ('$\psi'(g,w)$'), then for some world possible relative to @, g is θ there. According to (1c), (1a) has the truth condition that if there is a possible world w and some x such that x is both a counterpart of g at w ('$Cxgw$') and ψ-at-w, then there is a possible world u and some y such that y is both a counterpart of g at u and θ-at-u. For (1b), see (Salmon 1981:240–52), and for (1c), (Forbes 1983).

The approaches to Chisholm's Paradox which run into trouble with the Uniformity Constraint are ones which try to transfer certain non-classical semantics for languages with vague predicates to either of these extensional languages.[6] There is no reason why any of the vocabulary in ψ or θ should merit non-classical treatment, since we can make the specification of the parts and configuration of g arbitrarily precise. And a non-classical status for any of the conditionals (such as 'neither true nor false') would have to be inherited from their antecedents or consequents. So the modal operator $\diamond$ must be at the root of the vagueness. In the extensional languages, this means looking to either the existential quantifier, or the special predicates $R_\diamond$ and C for relative possibility and counterparthood.

[6] Two approaches to vagueness which may apply uniformly to all our puzzles are *epistemicism* and *contextualism*. According to the epistemicist, the tolerance principles are simply false: at some point, a very small change tips the balance (there may be reasons in principle why we cannot know where that point is). According to some contextualists, there is also a tipping point, but we cannot say or think what it is without moving it. For epistemicism in general, see (Sorenson 1988), (Williamson 1994), and for a version restricted to puzzles about identity, (Salmon 2002). For contextualism, see (Raffman 1994), (Soames 1999 Ch. 7), and also (Robertson 2000) for criticism of the latter. Much of the rationale for epistemicism depends on alleged shortcomings of (all) non-classical semantics. And contextualism does not seem to help with the purely conditional versions of the puzzles I use here. We assent to all the conditional premises of a Sorites on the very same non-truth-functional ground, that the states of affairs described by antecedent and consequent are too similar in relevant respects for the contentious condition to hold in the former state and fail in the latter. So there is no relativity to pairs, or to any "fluid" psychological context, that would allow Raffman's apparatus for defusing forced-march Sorites to get a grip (my internal homunculus accepts *all* the conditionals, one after the other, since they are all equally plausible, even as their consequents grow increasingly implausible). Soames's apparatus requires that we detach and assert the consequents (to change the context), but the apparent truth of the premise conditionals combined with the clear falsity of the conclusion conditional is by itself paradoxical. Of course, transitivity of the indicative conditional has been challenged, and some counterexamples may arguably be said to involve a shift in context; for example, with "if Jones doesn't compete, Smith will win" and "if Smith wins, Jones will get the silver" it's likely that the "Smith wins" worlds we consider in evaluating the second conditional are not among the "Jones doesn't compete" worlds that settle the first conditional. But a process of judging the Sorites conditional premises, even one by one, does not involve anything like this. However, I agree with Edgington (1996:309, n.15), that there is a special case where a Raffman-style contextualism would be appropriate, namely, with 'looks' versions of Sorites conditionals: if x looks red/bald/tall and y looks the same as x in respect of color/head-hairiness/height, then y looks red/bald/tall.

And while an existential formula can have a non-classical status, this in turn is inherited from the non-classical status of its scope. So we are led to the proposal that such formulae as $R_\diamond @u$ or *Cygu* should have a non-classical semantics, one that makes room for there being no fact of the matter whether $R_\diamond @u$ or whether *Cygu*.

In the simplest version, we allow $R_\diamond$ to be undefined for some pairs of worlds, or *C* to be undefined for some triples consisting in two worldbound individuals and a world. Generally, we have three truth-value *statuses*, true, neither true nor false, and false, written and ordered as $\bot < \infty < \top$. Conditionals have a 'sustaining' semantics, on which $(\top \rightarrow \infty) = (\infty \rightarrow \bot) = \infty$, $(\infty \rightarrow \infty) = \top$, and $\bot$ only results from $(\top \rightarrow \bot)$. So it might be that (1a) turns out to be neither true nor false, because the antecedents of (1b) or (1c) are true while the consequents are neither true nor false.

In application to (1b), we may have the antecedent straightforwardly true, but worlds *w* where $\psi'(g,w)$ are on the verge of possibility relative to @, so that when we look at worlds *u* such that $\theta'(g,u)$, we find that the best case is $R_\diamond @u$ undefined: because $\theta'(g,u)$, there is no fact of the matter whether $R_\diamond @u$. Treating $\exists$ as infinitary disjunction and disjunction as least upper bound, $(\exists u)(R_\diamond @u \wedge \theta'(g,u))$ would in such a case be neither true nor false. So (1b) is $\top \rightarrow \infty$, that is, ∞. Thus we get the result that while none of the conditional premises in Chisholm's Paradox is false, some are neither true nor false, so the Paradox is an unsound argument.

The corresponding non-classical semantics for (1c) produces the same result, for while $(\exists w)(\exists x)(Cxgw \wedge \psi'(x,w))$ may be true, it may also be that in any world u where some y is such that $\theta'(y,u)$, we find *Cygu* either false or neither true nor false: at best, there is no fact of the matter whether such a y is a counterpart of g at u. Granted some u where *Cygu* is neither true nor false, the reasoning of the previous paragraph gets us to conditionals of the form (1c) which are neither true nor false, so this counterpart-theoretic interpretation of Chisholm's Paradox also makes it unsound.[7]

But the relative possibility approach conflicts with Uniformity because it does not transfer to the case of Old Number One. This is because transitivity of 'is in the future of' cannot fail. Hence all conditionals of the form $\mathsf{F}\phi_i(\#1) \rightarrow \mathsf{F}\phi_{i+1}(\#1)$ are straightforwardly true, where the antecedent asserts Old Number One's survival of the i'th change and the consequent, of the $i+1$'th. Or, if this is not so, their semantics must be explained in very different terms. Either way, a generalization has been missed.

[7] Salmon (1981, 1986) argues that there are two puzzles, a Sorites-type one with material conditional premises $\Diamond\psi \rightarrow \Diamond\theta$, and a specifically modal one with strict implication premises where paradox is obtained by repeated application of the rule (C), $\Box(\psi \rightarrow \Diamond\theta)$, $\Box(\theta \rightarrow \Diamond\lambda) \vdash \Box(\psi \rightarrow \Diamond\lambda)$. The first paradox unsound, since some $\Diamond\psi \rightarrow \Diamond\theta$ is untrue, and the second, though it has true premises, is invalid, since (C) requires that relative possibility be transitive, which it is not. He suggests (1989:4–5) that a non-transitive $R_\Diamond$ is demanded by intuitions about certain cases (also Peacocke 1999:196): the idea is that even if, say, $\phi_3(g)$ is impossible as things stand, nevertheless, *had* $\phi_2(g)$ been the case, then $\phi_3(g)$ *could have* been the case: $\phi_2(g) \mathrel{\Box\!\!\rightarrow} \Diamond\phi_3(g)$. We also have $\Diamond\phi_2(g)$, so we get $\Diamond\Diamond\phi_3(g)$ even though $\neg\Diamond\phi_3(g)$. But the counterpart theorist can accommodate the intuition that the counterfactual is true. It means that some $\phi_2(g)$-world where $\Diamond\phi_3(g)$ holds is more similar to @ than any $\phi_2(g)$-world where $\neg\Diamond\phi_3(g)$ holds. In the framework of (Forbes 1983), this existential will have the highest degree of truth of its instances, a degree of truth that is *indiscernibly close* to absolute truth in cases where the counterfactual strikes us as true. So the intuitive plausibility of $\phi_2(g) \mathrel{\Box\!\!\rightarrow} \Diamond\phi_3(g)$ cannot differentially support an approach employing a non-transitive $R_\Diamond$. In fact, even those who are sure there are two paradoxes, a B-invalid modal argument and an unsound Sorites argument, may be better served by counterpart theory. For the counterpart-theoretic semantics can be recast to invoke counterparthood with each modal operator (as in Lewis 1968), so that $\Diamond\Diamond\phi_3(g)$ means that for some w and u, g has a counterpart at w that has a counterpart at u that satisfies ϕ_3. $\Diamond\Diamond\psi \rightarrow \Diamond\psi$ now fails, but we have a better explanation why. All the counterexamples to the transitivity schema are *de re:* ψ contains either a name or a free variable. That it is a non-transitive counterpart relation that is doing the work explains why there are no *de dicto* counterexamples.

A transfer of the counterpart-theoretic account might be objected to because it requires us to adopt a certain view of what identity through time consists in, the standing in a counterpart relation of uncountably many thing-stages. But this might be a way of *meeting* the Uniformity Condition (however unattractive), not a failure to meet it. The failure comes with the Furniture Storage puzzle. We would like to say that for some values of i, there is no fact of the matter whether the conditional 'if $a_i = b_i$ then $a_{i+1} = b_{i+1}$' is true or false, and it is now proposed to explain this in terms of there being no fact of the matter whether the counterpart relation holds between certain piece-of-furniture stages. The problem is that a judgement such as '$a_{21} = b_{21}$' is a plain-vanilla identity judgement, lacking any of the operators to whose semantics the intrusion of the counterpart relation can be attributed. We can imagine someone reading a document that uses only 'a'-terms in listing the inventory of the factory where the furniture is first assembled, and a document that uses only 'b'-terms in describing the contents of the storage room. To such a reader, the judgement '$a_{21} = b_{21}$' is entirely intelligible, though he has no reason to think it (or any other $a_i = b_j$) true. We should be sceptical that there are hidden tense operators in the proposition that $a_{21} = b_{21}$ which this person grasps.[8]

[8] For someone happy to discern hidden operators in such identity statements, and willing to endorse the analysis of persistence in terms of stages and counterparts, the counterpart-theoretic approach remains quite appealing. Objections to it fall into two groups, (A) objections to the underlying extensional many-valued or partial logic (though the approach is consistent with using supervaluations instead), and (B) objections to the counterpart semantics for the intensional operators.

(A) The main A-type objections are to allowing contradictions to be truth-valueless, or to have an intermediate degree of truth (dt). In (Forbes 1983) I used the principle ($\wedge$) that $dt(p \wedge q) = \min\{dt(p),dt(q)\}$. Because $dt(\neg p) = 1 - dt(p)$, we have $dt(p \wedge \neg p) = .5$ if $dt(p) = .5$ (but see Edgington 1996 for an alternative). However, (Williamson 1994:136) insists that whatever

By contrast, the concepts Otton employs in my imaginary verdict about Old Number One transfer smoothly to the other cases. The crucial concept is that of there being no fact of the matter about a certain claim of identity. In the case of the Furniture Storage puzzle, the identity claims are quite explicit, and the idea is that indeterminacy can be attributed *directly* to the identity proposition, not to some element which only emerges on analysis. In Chisholm's Paradox there are no explicit identities, but a trivial reformulation introduces them: replace $\Diamond\psi(g)$ with $\Diamond(\exists x)(\psi(x) \wedge x = g)$. Certainly, this formulation is still amenable to an account cast in terms of counterparts or relative possibility of why there might be no fact of the matter about certain cases. But it also promotes the thought that, where $\Diamond(\exists x)\psi(x)$ is true, $\Diamond(\exists x)(\psi(x) \wedge x = g)$ may be neither true nor false because necessarily, anything that possibly satisfies $\psi(x)$ is at best something that satisfies neither $x = g$ nor $x \neq g$. In that case we can dispense with both counterparts and relative possibility, and use the simplest S5-semantics. On all three

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the facts, they must falsify $p \wedge \neg p$. This appears to me to overreach from the correct 'whatever the facts, they cannot verify $p \wedge \neg p$' (Williamson says "'He is awake and he is asleep' has no chance at all of being true", but this is agreed to by everyone). We have no difficulty with the idea that if a sentence S is so anomalous that it fails to express a proposition, and so fails to possess a truth-value, then $S \wedge \neg S$ will also be truth-valueless. If p and $\neg p$ each fail to be verified by the facts, and fail to be falsified by them, the issue is what recursive implication this should have for $p \wedge \neg p$. If falsification of the whole has to flow through one or other conjunct, then $p \wedge \neg p$ may be non-false. It appears that the critic of ($\wedge$) will have to employ some such notion as 'false solely in virtue of meaning'. But see also n.11 below.

(B) Fara and Williamson (2005:18–20) object to counterpart semantics that it cannot accommodate an 'actually' operator. The particular counterexamples they offer depend on the semantics (i) permitting a single object to have multiple counterparts at a world, and (ii) introducing distinct counterpart quantifiers for distinct *occurrences* of a variable or name directly within the scope of a $\Box$ or $\Diamond$. (ii), which makes $(\forall x)\Box(x = x)$ invalid, I now think to be more trouble than it is worth, but so long as we have (i), there are likely to be difficulties in the bivalent case. In the present non-classical context, of course, the objectionable examples will simply be like $p \wedge \neg p$, sometimes non-false, and can be lived with. Alternatively, we could cut the Gordian knot by rejecting (i), since the option of providing an object with two same-world counterparts plays no role in the resolution of Chisholm's Paradox.

approaches, of course, we can say that what there is no fact of the matter about is whether possibly being ψ is a property of g, or whether being ψ is a possibility for g, or some such. The differences are in the underlying machinery that makes such 'no fact' claims true.

In saying that there may sometimes be no fact of the matter about an identity judgement, are we making a claim about the *concept* of identity, the *objects* themselves, or about something else, such as the reference relation? The idea that the reference relation is the basic factor seems to get things exactly the wrong way round. It is implausible to hold that there is no fact whether Old Number One is Hubbard's car *because* there is some indeterminacy in the reference of 'Old Number One' or "Hubbard's car". If there is no fact of the matter whether 'Old Number One' refers to Hubbard's car, that indeterminacy would be because the facts of the case do not decide whether Old Number One, the car that won in 1929, *is* Hubbard's car. So when identity judgements fail to be bivalent, a fundamental account will look to the concept, or the objects, not the terms. Here I am assuming that 'Old Number One' refers determinately to *something*, say, the car that crossed the finishing line in first position at Le Mans in 1929. So my point would be rejected by one who holds that there are uncountably many precise cars which did that, and the problem is that we have not settled on one as the referent of 'Old Number One'. This is a view according to which the persistents of our ordinary ontology don't really exist. But I am pursuing a reconciliation of indeterminate identity with our ordinary ontology.

Deciding between concept and objects is harder, and it may be that these are equivalent descriptions of the same phenomenon. We can eliminate some indeterminacy by stipulating more precise conditions of persistence, conditions which, had they been in force in 1990, would have made the court case simple to decide. Since this is a conceptual fix, it suggests indeterminacy is in concepts. But the objects have to be a certain way as well; as the imaginary verdict says, it's easy to imagine ways they could have been on which "Old Number One is Hubbard's car" would be true, or would be false, no argument. So I am unsure if there is anything of substance at issue here, resolving which would illuminate our way to a solution.[9]

[9] In the version of the paper from which my St. Andrews talk was drawn, there followed a section on Leibniz's Law (LL) and the use made of it by Evans and Salmon in arguing against indeterminate identity or vague objects. For reasons of space I have deleted this material, but I give a brief statement of my main points here. The basic argument underlying (Evans 1978) and (Salmon 1981, 2002) is that if there's no fact of the matter whether $a = b$, and it's a fact that $b = b$, then $a \neq b$, since b is such that it's a fact that *it* is b, and a is *not* such that it's a fact that it is b. So if there's no fact of the matter whether $a = b$, then $a \neq b$. So there's a fact of the matter, period. This appears to involve a contrapositive of LL, from $(\neg Pa \wedge Pb)$ to infer $\neg(a = b)$. But, as emphasized in (Parsons 2000:§2.4), contraposition is not reliable when there is a third status for propositions. Define $p \vDash q$ to mean that for every three-status valuation V, if $V(p) = \top$ then $V(q) = \top$. Then $p \vDash q$ does not guarantee $\neg q \vDash \neg p$; for if $V(\neg q) = \top$, $V(q) = \bot$, and so, if $p \vDash q$, we can conclude $V(p) \neq \top$, hence $V(\neg p) \neq \bot$. But for $\neg q \vDash \neg p$ we need the stronger $V(\neg p) = \top$, excluding ∞. The very case at issue illustrates this, and also the failure of the Leibniz Law conditional scheme $LL^{\rightarrow}$, $a = b \rightarrow [\phi(a) \leftrightarrow \phi(b)]$. Using $\rhd$ for being determinately the case, we have the instance $a = b \rightarrow [\rhd(a = b) \leftrightarrow \rhd(b = b)]$. But if $V(a = b) = \infty$, the biconditional is $\bot \leftrightarrow \top$, so the whole conditional is $\infty \rightarrow \bot$, which is ∞ or $\bot$ on any account.

Since the classical principles used against indeterminate identity in the Evans-Salmon critique are put into question by the very cases under discussion, the critique seems to have no more force than a *reductio* of constructivism which boldly wields Excluded Middle. However, (Salmon 2002:245) writes that those who would reject the standard Leibniz schemes or the contrapositive of LL need to show that 'a weaker alternative is independently intuitive, and…its historical omission was a logical oversight, akin to the Aristotelean logician's inadvertently overlooking the fact that the inference from ⌜All S are P⌝ to ⌜Some S are P⌝ is invalid without the tacitly assumed premise ⌜Some things are S⌝'. I think we can meet this challenge. First, modern logic grew out of the attempt to formalize the canons of reasoning characteristic of classical mathematics, whose subject-matter is the domain *par excellence* where sharp cut-offs reign. When we move away from that domain and abandon bivalence, we bring to unfamiliar territory our near-automatic reflex to equate 'not true' and 'false' for meaningful statements. This carries over to our assessment of the significance of certain distinctions. In particular, we inadvertently overlook the possibility that while any difference at all between a and b with respect to properties establishes that $a = b$ is untrue, there

4 Higher-Order Indeterminacy

(Parsons 2000) defends a many-status logic in which there is one non-classical semantic status. However, there are reasons why we might prefer to use a semantics that generalizes this. One such semantics, *fuzzy logic*, has the real interval $[0,1]^{\mathcal{R}}$ as possible semantic values, called *degrees of truth*, and as a result can offer a plausible explanation of why, for each conditional premise of an effective Sorites argument, that premise seems true to us (if not, there would be no Sorites *paradox*), and also, *de dicto*, why it seems to us that every conditional premise is true. A plausible explanation is one that attributes to each conditional an overwhelming appearance of unqualified truth. One clause for $\rightarrow$ that does this is (2), in which $\dot{-}$ is cut-off subtraction:

(2) $dt[\phi \rightarrow \psi] = 1 - (dt[\phi] \mathbin{\dot{-}} dt[\psi])$.

In an effective Sorites argument, the worst case is that a conditional premise has an antecedent whose degree of truth (dt) is marginally greater than the dt of its consequent. For this case, clause (2) produces a dt for the whole conditional that is only marginally less than complete truth. So the

might be a special and unusual category of property, difference with respect to which *only* establishes untruth, not falsity. Second, we have a near-automatic reflex to equate *p* and '*p* is true' (an entire theory of truth is based on this reflex). So we fail to notice that there is a weaker version of $LL^{\rightarrow}$ which provides all we need in non-contested applications, namely, $LL^{\rightarrow}_{\triangleright}$, $\triangleright(a = b) \rightarrow [\phi(a) \leftrightarrow \phi(b)]$. Uncontested applications of Leibniz's Law are saved by $LL^{\rightarrow}_{\triangleright}$, which disagrees with the standard scheme only in the cases under discussion; so it is quite question-begging to use the standard scheme against indeterminate identity. Third, in all of philosophy there is no question more contested than that of the meaning of 'if'. On some approaches, e.g., the suppositional one of (Barnett 2006), evaluating a conditional requires supposing the antecedent to be *true*. No wonder the gap between $LL^{\rightarrow}$ and $LL^{\rightarrow}_{\triangleright}$ goes unnoticed. So a "logical oversight, akin to the Aristotelean logician's" is not so far-fetched.

conditionals falling under this case are semantically indiscriminable from all the others, which are themselves completely true.[10] By contrast, a supervaluational account that identifies truth with supertruth makes it a *gross* error that we should think that every conditional premise is true, since 'at least one is false' is supertrue. And a three-status account is only a slight improvement over a two-valued account, since that there is a sudden transition from true antecedent to neither true nor false consequent does not seem much more likely than that there is a sudden transition from true antecedent to false consequent.[11]

For our identity puzzles, the analogue of a many-conditionals Sorites paradox is the following style of argument, which Otton did not produce, either in fact or in my fiction:

(3) a. Old Number One is Old Number Four.
b. Old Number Four is the car Dunfee crashed in.
c. The car Dunfee crashed in is the car Hassan rebuilt.
d. The car Hassan rebuilt is the car Hubbard bought.

[10] By 'semantically indiscriminable' I mean that a competent speaker in full possession of the facts (that don't logically entail an assignment of statuses to antecedent and consequent) would be unable to provide good reasons for assigning antecedent and consequent different semantic statuses.

[11] Crispin Wright has emphasized that Sorites paradoxes can be formulated with premises of the form $\neg(p \,\&\, \neg q)$ ("it's not the case that this man's bald and his neighbor isn't") which seem as plausible as their counterpart conditionals ("if this man's bald so's his neighbor"), and thus should have as high dt's; see, e.g., Wright 1987. But the standard treatment of & as min in fuzzy logic produces the wrong result, for $\neg(p \,\&\, \neg q)$ has a middling dt in a Sorites if p does. However, revisions to the fuzzy logical account of & along the lines of those proposed in (Edgington 1996:306–8) seem to have good prospects of handling this difficulty.

e. The car Hubbard bought is the car he sold to Middlebridge.

f. Therefore, Old Number One is the car Hubbard sold to Middlebridge.

We can employ even more descriptions and descriptive names to increase the number of premises from which (3f) is inferred, perhaps breaking down the controversial (3b) into multiple separate identities, with a new description or descriptive name for the car that exists after each new part that Hassan installs. The fact that neither Hubbard's counsel nor Otton produced such an argument suggests, not that they missed an opportunity, but that they knew fallacious reasoning when they saw it.

We would like to duplicate the success of fuzzy logic in explaining why all the premises of an effective Sorites seem true, even though some are untrue. However, the requirement that any proposal be applicable to (3) rules out degrees of truth, insofar as degrees of identity are unappealing. It would also be useful to work with something that can be explained more easily than degrees of truth seem to be (Keefe 2000:91–3). My goal in the rest of this paper will be to *mimic* degrees of truth with a different kind of semantic status that becomes available once we recognize the phenomenon of *higher-order* vagueness.

Higher-order vagueness may be introduced by iterating the considerations that motivate *some* non-classical status for vague expressions in the first place. For standard examples of vague predicates, we deny that there is a specific point on the relevant spectrum (e.g., for the predicate 'tall', the spectrum of possible heights) at which they abruptly cease to apply and their fixed-point negations start to apply, because we cannot discern any feature of the world or any aspect of what is involved in mastery of the predicate *in virtue of which* some specific point would be singled out as the tipping point. So if F is such a predicate, it is conceivable that there is an object x and a proposition p saying that x is F, and there is no fact of the matter whether p, and no fact of the matter whether $\neg p$. Let us label the semantic status of such a p 'indeterminate'.

So conceivably, for some objects x, the proposition, that x is F, is indeterminate. But the main consideration of the previous paragraph applies over again: there is no specific point on the relevant spectrum at which F abruptly ceases to apply and 'no fact of the matter whether F' starts to apply, and no specific point at which 'no fact of the matter whether F' ceases to apply and 'not F' starts to apply. In both cases, this is because, as before, there is no empirical or linguistic fact which could *make* any point such a tipping point. So it is conceivable that there is an object x and a proposition p saying that x is F, and there is no fact of the matter whether p and no fact of the matter whether it is indeterminate that p: there is no fact of the matter whether p or it is indeterminate that p.[12] This is also a semantic status, and it has a counterpart on the other "side" of indeterminacy, the status of there being no fact of the matter whether it is indeterminate that p and no fact of the matter whether $\neg p$. So we now have

[12] This embedding of a *wh*-complement induces ambiguity. I intend what Groenendijk and Stokhof call the *alternatives* reading (1982:193).

five statuses linearly ordered, and the same considerations about the inconceivability of tipping points motivates the introduction of four more, one between each adjacent two of the first five. And so on; each time a new semantic status s is introduced between two statuses s_1 and s_2, there is a refinement introducing two more statuses, one between s_1 and s and the other between s and s_2, following the indicated pattern: the one between s_1 and s is the status of being a proposition p such that it is indeterminate whether p has the status s_1 or the status s, while the one between s and s_2 is the status of being a proposition p such that it is indeterminate whether p has the status s or the status s_2.[13]

Suppose we use $\top$ and $\bot$ for the first two statuses. For convenience, we identify other statuses with pair sets, where $\{x, y\}$ is the status introduced as that of being indeterminate between the status x and the status y. Thus, by the two previous paragraphs, there is also the status $\{\top, \bot\}$, which we regard as 'above' $\bot$ but 'below' $\top$. It is convenient to associate $\top$ with 1 and $\bot$ with 0. We may then construct a dense linear array of semantic statuses embedded in the rational interval $[0,1]^{\mathcal{Q}}$ in an order-preserving way, starting by associating $\{\top, \bot\}$ with 0.5. Of course, almost all of these statuses are unintelligible, but we can grasp the first few and extrapolate:

(4) a. S^0: Statuses s_1 and s_2, $s_1 > s_2$: $s_1 = \top$, $s_2 = \bot$.

b. $S^1 = S^0 \cup \{s_3\}$; $s_3 = \{\top, \bot\}$; $s_1 > s_3 > s_2$

[13] The existence of higher-order vagueness is nevertheless controversial; see (Wright 1992), (Heck 2003: 123–4), and also (Varzi 2003) and references therein. All I have done in these two paragraphs is gesture at how I would argue for the phenomenon.

c. $S^2 = S^1 \cup \{s_4, s_5\}$; $s_4 = \{\top, \{\top, \bot\}\} = \{\top, s_3\}$,

$s_5 = \{\{\top, \bot\}, \bot\} = \{s_3, \bot\}$; $s_1 > s_4 > s_3 > s_5 > s_2$.

d. $S^3 = S^2 \cup \{s_6, s_7, s_8, s_9\}$; $s_6 = \{\top, \{\top, \{\top, \bot\}\}\} = \{\top, s_4\}$,

$s_7 = \{s_4, s_3\}$, $s_8 = \{s_3, s_5\}$, $s_9 = \{s_5, s_2\}$;

$s_1 > s_6 > s_4 > s_7 > s_3 > s_8 > s_5 > s_9 > s_2$.

s_2 is the status of the first order of vagueness, s_4 and s_5 are the statuses of the second order, and s_6, s_7, s_8 and s_9 are the statuses of the third order. The full set of statuses S produced by this construction is the union of a strictly increasing chain C of finite linearly ordered sets $S^0, S^1, S^2, \ldots$; the first four members of C are as in (4). Given S^i, we form S^{i+1} by adding to S^i a new status between each pair of adjacent statuses in S^i: if s' and s'' are adjacent in S^i, we add $s = \{s', s''\}$. With an indexing scheme starting $^*0(\top) = 1$, $^*0(\bot) = 0$, we extend the indexing $^*i$ to new elements by $^*i{+}1(s) = (^*i(s_1) + {}^*i(s_2))/2$. For any $s \in S$, $^*(s) = {}^*i(s)$ for the first (some, any) $^*i$ defined for s.[14]

Note that once we have the whole construction, none of the heuristic linguistic descriptions used in introducing the statuses are any longer applicable. For example, relative to S^2, s_4 is the status of being indeterminate between s_1 and s_3. But this is not intrinsic to s_4: in S^3, s_4 lies between s_6 and s_7, and so a proposition with status s_4 determinately lacks the statuses s_1 and s_3. Alternatively, we can think of each s as initially comprising

[14] The image of * is the subsequence of the rational interval $[0,1]^{\mathbb{Q}}$ which has the same endpoints and includes in addition exactly the rationals $m/2^n$, $1 \leqslant m < 2^n$, m odd, $n \in \mathbb{Z}^+$, the *dyadic* fractions in $[0,1]^{\mathbb{Q}}$. Each S^i is indexed by the set of rationals of the form $m/2^i$, with m ranging from 0 through 2^i. To accommodate quantifiers, limits should be added to S.

a region of indeterminacy which shrinks to a point as the construction proceeds.

Thanks to * (the indexing by $[0,1]^{\mathcal{Q}}$) we can use essentially clause (2) for the semantics of negation and the conditional. Where ν is an assignment of statuses to sentence-letters, we define an extension $[\![\ ]\!]$ of ν to all formulae of $\mathcal{L}^{\neg}_{\rightarrow}$:

(5) a. $[\![\pi]\!] = \nu(\pi)$;

b. $[\![\neg\phi]\!] = {*^{-1}}(1 - {*}[\![\phi]\!])$, where $*^{-1}$ is the inverse of *;

c. $[\![\phi \rightarrow \psi]\!] = {*^{-1}}(1 - ({*}[\![\phi]\!] \dot{-} {*}[\![\psi]\!]))$, where $\dot{-}$ is cut-off subtraction.

Because of (5c) we get the desired diagnosis of the irresistibility of an effective Sorites paradox: each conditional premise is either true, or has a status that is very close to true in the sense of *. But repeated chaining by transitivity of '→' accumulates a large number of small departures from ⊤ into a single large departure. If a *valid* finite-premise form never allows its conclusion to have a lower status than the *–least-in-status of the premises then →-chaining is actually invalid (but see Williamson 1994:124 against this definition of 'valid'). If validity is simply guaranteed ⊤-preservation, a standard Sorites is valid, but it still has an untrue premise. It is because the status difference between antecedent and consequent in an untrue premise is so slight that all the premises seem to us to be true. But so long as one premise is not quite true, the argument is unsound.

It might be objected that we have only achieved the desired diagnosis by means of an *arbitrary* association of statuses with elements of $[0,1]^{\mathcal{Q}}$. To this I would reply that while the association has some stipulative aspects, the amount of arbitrariness is small, and smaller than in any genuinely different alternative. The crucial stipulations are two: first, that being the case is associated with 1 and being not the case is associated with 0; and second, that if s is introduced on S' between members of an adjacent pair $\langle s^a, s^b \rangle$ from the previous S'', then any extension of the indexing of the statuses on S'' to S' must respect the constraint that s should be equidistant between s^a and s^b. Any violation of the second constraint would produce an unjustifiable asymmetry and be *more* arbitrary than the scheme we have chosen.[15]

So we have achieved our goal of capturing the advantages of the fuzzy logician's diagnosis of standard Sorites paradoxes, and moreover, we have done so without saddling ourselves with having to explain degrees of truth, and surely worse, degrees of identity. However, before turning to the application of this apparatus to the various puzzles, we should address a point that many readers will have been wanting to interject for some while now: that if we have taken on board some of fuzzy logic's advantages, we may have taken on board some of its disadvantages as well.

The standard objection (e.g., Sainsbury 1991:11; Tye 1994:14) is that fuzzy logic simply replaces an implausibly exact classification of cases into two groups with an equally exact but vastly more incredible classification of cases into infinitely many groups. And it shares with all many-valued

[15] Thanks to Peter Milne for prompting this paragraph.

approaches the prediction that there is a specific premise in any Sorites paradox which is the *first* premise to be less than wholly true. I would argue, however, that the sharpness of the classification scheme is simply an artifact of the model, not a representational feature of it.[16] What we have succeeded in modelling is how a sequence of true and almost but not quite true conditionals can carry us from a complete truth to a total falsehood. That we have traded notions such as 'almost but not quite true' for precise semantic statuses is simply to facilitate the proof of possibility: once we have seen how the paradox deceives us, using the precise framework, we can accept that the same process goes on when the statuses of propositions are themselves vague. We have also succeeded in making differences of semantic status reflect relevant quantifiable differences among objects, at least for countable sets of objects: for if a_1, a_2, a_3 and a_4 are all in some borderline area, and the difference between a_1 and a_2 with respect to *F*-ness is roughly the same as the difference between a_3 and a_4, then the semantic status difference between the members of the two pairs will be about the same as well. So the status model has useful representational features, without committing us to there being a fact of the matter which propositions of the form Fa_i have exactly the status, say, s_3.[17]

[16] See (Shapiro 2006:50–54) on this contrast, and (Cook 2002) for extended discussion of how it might apply in the present context.

[17] I have little to say about the problem of the first less than wholly true premise. For some premises, there will be no *de re* fact of the matter whether they are wholly true or slightly less, but it seems that it must be a *de dicto* fact that in a listing of Sorites premises in their natural order, some premise is the first to be less than wholly true. If there were no fact about this, there would be no fact whether a Sorites is unsound, but, since its conclusion is false, it had better be unsound. I suspect (*de dicto*) that when the workings of the status semantics are the subject of discussion, there is some reason why it is appropriate to supervaluate over all natural assignments of statuses to the propositions in question.

5 Troubles With Transitivity

To apply the apparatus of the previous section to the Storage Room paradox, we need interpretations whose domains of discourse include objects identity propositions over which sometimes have a status other than $\top$ or $\bot$. For example, we might have an interpretation with domain D including all the pieces of furniture $a_0,\ldots,a_n$ brought to the storage facility for storage, and all the pieces of furniture $b_0,\ldots,b_n$ left in the storage room by the movers at the end of the day. $[\![=]\!]_{\mathcal{I}}$ would be a function from $D_{\mathcal{I}}^2$ into the set of statuses S, and we would have the obvious clause

(6) $[\![t_1 = t_2]\!]_{\mathcal{I}}$ is identical to $[\![=]\!]_{\mathcal{I}}(\langle [\![t_1]\!]_{\mathcal{I}}, [\![t_2]\!]_{\mathcal{I}} \rangle)$.

In a *standard* interpretation $\mathcal{I}$ for many-status identity, $[\![=]\!]_{\mathcal{I}}$ maps to $\top$ exactly the pairs $\langle x,x \rangle$, $x \in D$. A *natural* interpretation is a standard one which, as before, is faithful to the indeterminacies in the situation of the application. For the pieces of furniture, the statuses assigned by $[\![=]\!]_{\mathcal{I}}$ to $\langle [\![a_i]\!], [\![b_i]\!] \rangle$ in a natural interpretation move from $\top$ towards $\bot$ tracking increases in i reasonably closely. So by (5c), some conditionals of the form 'if $a_i = b_i$ then $a_{i+1} = b_{i+1}$' are less than wholly true, because the status of '$a_i = b_i$' is higher than that of '$a_{i+1} = b_{i+1}$'. In addition, there will be no difference in status between $a_i = b_i$ and $a_j = b_j$ that is very much larger or smaller than the difference between $a_k = b_k$ and $a_l = b_l$ when the number of new parts in b_j exceeds the number of new parts in b_i by about the same as the number of new parts in b_l exceeds the number of new parts in b_k. So we can be confident that although natural assignments will make some conditionals of the form ‘if $a_i = b_i$ then $a_{i+1} = b_{i+1}$’ less than wholly true, they will only be slightly less than wholly true, and they will be closer to wholly true the larger the number of furniture-items that get stored.

To meet the Uniformity Constraint, we have to extend this treatment to intensional puzzles such as Old Number One and Chisholm’s Paradox, so that these puzzles get defused in essentially the same way. We will use Chisholm’s Paradox for illustration. We let D be a set of possible objects, and as before, the identity or otherwise of some $x \in D$ and some $y \in D$ can have a non-classical status. We let W be a set of possible worlds, and we assign all of D to every $w \in W$ as the domain of w. We want to arrange matters so that for some i, $\diamond\phi_i(g) \rightarrow \diamond\phi_{i+1}(g)$ has a status slightly less than $\top$.

Since the ϕ-predicates simply record the parts from which g is made, we can assume them to be precise. So we need a world where $\phi_i(g)$ is closer to $\top$ than is $\phi_{i+1}(g)$ at any world. The basics can be exhibited just with monadic atomic predicates F and H. V assigns a rigid designation in D to each individual constant, and we let $V(F)$ be a function which for each world as input, outputs a function from D into S. Each such function $V(F)(w)$ is constrained by $[\![=]\!]_1$ in the following way: for each $x \in D$ such that the status of Fx at w is non-classical, for each $s \in S$, the status of Fx at w is s iff for some $y \in D$, (i) the status of Fy at w is $\top$; (ii) the status of $x = y$ is s; (iii) $\nexists z \in D$: the status of Fz at w is $\top$ and the status of $x = z$ is higher than s. In addition, the status of Fx at w is $\bot$ iff $\nexists y \in D$ such that the status of Fy at w is $\top$ and the status of $x = y$ is higher than $\bot$. And *mutatis mutandis* for H. So given $V(F)(w)$’s mappings to $\top$, the rest of $V(F)(w)$ is determined by $[\![=]\!]_{\mathcal{I}}$.[18]

Writing $[\![\sigma]\!]^{w}_{\mathcal{I}}$ for the status of σ at w in $\mathcal{I}$, we then have the evaluation clause

(7) $[\![Fg]\!]^{w}_{\mathcal{I}} = [V(F)(w)](V(g))$

and *mutatis mutandis* for Hg. It should now be clear that we can arrange for $\diamond Fg \rightarrow \diamond Hg$ to have a status at w that is arbitrarily close to $\top$ but still less than it. For example, we may have a w such that $[\![\diamond Fg]\!]^{w}$ is s_6 (see (4d)) because (i) $\nexists u \in W$: $[\![Fg]\!]^{u} = \top$; (ii) $\exists x \in D$, $\exists u \in W$: $[\![Fx]\!]^{u}$ is $\top$ and $[\![=]\!](\langle x, g\rangle)$ is s_6; and (iii) $[\![=]\!](\langle y, g\rangle) \leqslant s_6$ for any other $y \in D$, $u \in W$, with $[\![Fy]\!]^{u} = \top$; but max($\{[\![Hg]\!]^{u}$: $u \in W\}$) is s_4 (see (4c)) because the best $[\![=]\!]$ can do for any $y \in D$ for which $\exists u \in W$ with $[\![Hy]\!]^{u} = \top$ is $[\![=]\!](\langle y, g\rangle) = s_4$. So $[\![\diamond Hg]\!]^{w}$ is s_4. If we then generalize the account of conditionals in (5c) to intensional models, we will have $[\![\diamond Fg \rightarrow \diamond Hg]\!]^{w} = s_6$.

There are obvious affinities here with the counterpart-theoretic solution. But a counterpart relation is non-transitive: nothing prevents the degree of truth of '*a* is a counterpart of *c*' being d, $d < 1$, even when the degrees of truth of both '*a* is a counterpart of *b*' and '*b* is a counterpart of *c*' are 1. Whereas, of course, $a = b$, $b = c \vDash a = c$. So if there is *any* non-zero amount of change in relevant respects consistent with transworld identity, we will not be able to get the result $\top > [\![\diamond Fg \rightarrow \diamond Hg]\!]^{w} > \bot$ in any case where

[18] The effect of these conditions is to make the extensions of F and G at w what Woodruff and Parsons (1999:477–8) call *tight* sets: only by being indeterminately identical to a classical member of a set x is an object's $\in$-status with respect to x non-classical. Tight sets are the appropriate ones for the extensions of precise predicates over a domain with indeterminate identity.

$[\![\diamond Fg]\!]^{w}$ is $\top$.

We can illustrate the difficulty with the case of Old Number One. Suppose Hassan does the 1932 modifications over a 5-day period, making equal and accumulating modifications each day. We might like to say that the same car is in his workshop on adjacent days – the Monday car is the Tuesday car, the Tuesday car is the Wednesday car, and so on – but the same car is not present across a larger timespan – the Monday car is not the Wednesday car, say. Unfortunately, the Monday car being the Tuesday car and the Tuesday car being the Wednesday car *entails* that the Monday car is the Wednesday car. Nothing changes if we switch to a variable-domain semantics or relativize identity to times in the manner of non-logical predicates. The Tuesday car is Tuesday-identical to both the Monday car and the Wednesday car, so these cars exist on Tuesday, and by transitivity, the Monday car is Tuesday-identical to the Wednesday car. So the one-day-of-modifications limit on persistence is violated.

Hume would have said that this is to be expected. Identity, he held, is incompatible with *any* change: 'in its strictest sense' identity may be applied only to 'constant and unchangeable objects' (*Treatise*, Bk. 1, Pt. 1, §5). There is a looser way of speaking, in which we attribute identity in a way that is tolerant to certain amounts and kinds of change. But Hume regards this looser way of speaking as erroneous, as resulting from *overlooking*, for this or that reason, the changes – *Treatise*, Bk. 1, Pt. 4, §6).

Within the framework developed here, a version of Hume's view is significantly more palatable than ordinarily thought, for two reasons. First, Hume says that any change conflicts with identity, which presumably includes such changes as ones in location, size and shape. But the problematic changes are really only those a large number of which, each of undetectably small magnitude, can accumulate into a change so great that it threatens persistence through time or transworld identity (for statues, shape-change is admittedly one such). And these changes are equally ones which the accessibility theorist must regard as slightly reducing relative possibility and the counterpart theorist as slightly reducing degree of counterparthood. Secondly, Hume's error thesis has not been well-received because his accounts of the errors and why we are susceptible to them creak. However, fuzzy logicians have a better error thesis: those who are bewildered by Sorites reasoning accept certain conditionals – ones that involve standard vague predicates like 'heap' and 'bald' – that are not strictly true, and their acceptance (however reluctant) is explained by the shortfall of the conditionals from truth being undetectable in normal circumstances. The credibility of this should carry over to the apparatus of statuses, for the same types of conditionals. But then, if we consider undetectably small amounts of change of the sort we have been concerned with, a parallel error thesis will have the same credibility: we are mistakenly taking an identity-judgment to have status $\top$ when it only has status s_n, where s_n is as near true as to *be* true, for all we can tell. Once we combine a sequence of such judgements (e.g., the premises of (3)), with transitivity playing the role of *modus ponens*, the problem becomes evident, or, as we might put it, imperceptible errors have an *evidently* erroneous consequence. Or at least, if not evidently erroneous, then evidently *debatable*, something we might end up in court over.[19]

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