THE PHONE BOOTH PUZZLE*

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In a 1997 paper Jennifer Saul adduces various examples of simple sentences in which the substitution of one co-referential singular term for another appears to be invalid. I address the question of whether anti-substitution is *logically* justified by examining the validity and soundness of substitution of co-referential singular terms in three simple-sentence arguments each exhibiting a different logical structure. The result is twofold. First, all three arguments are *valid*, provided Leibniz's Law is valid with respect to simple sentences (something Saul herself does not doubt). Thus, as far as these arguments are concerned, there is no logical problem with substitution in simple sentences. Second, two of the arguments cannot be *sound*, because their respective sets of premises are inconsistent. Thus, it would be logically irrational to commit oneself to all the premises of the respective arguments. To the extent that the origin of Saul's puzzles is in logic (rather than pragmatics, say), I suggest, tentatively, that substitution may appear to be invalid because the issues of validity and soundness have not been kept separate. I then consider in depth Saul's first sentence, "Clark Kent enters a phone booth and Superman exits". Obviously, two-way substitution is trivially valid, if the expressions are co-referential semantically (and not just grammatically) proper names, the conclusion being but a rephrasing of the premise. However, I argue that a non-trivial semantic analysis of this sentence should take account of the diachronicity of Clark Kent's entrance and Superman's exit while preserving the internal link between being Superman and being Clark Kent. I propose the following. 'Superman' and 'Clark Kent' refer to two distinct *individual concepts*. "Superman is Clark Kent" then no longer expresses the self-identity of an individual bearing two names, but that two named concepts are held together by the *requisite* relation: wherever and whenever someone falls under the concept of Superman the same individual also falls under the Clark Kent concept, whereas there are exceptions to the converse. This semantic analysis always validates the substitution of 'Clark Kent' for 'Superman', but validates the substitution of 'Superman' for 'Clark Kent' only if the additional condition is met that somebody should fall under the Superman concept when Clark Kent enters. The analysis is accompanied by a device of extensionalisation from individual concepts to individuals and two rules of predication.

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Introduction

The discussion of the semantics, pragmatics and logic of so-called simple sentences like "It is raining" has received renewed attention over the last ten years in the form of a substitution puzzle involving 'Superman' and 'Clark Kent'. The discussion is due to Saul (1997). According to Saul's (negative) characterisation, *simple sentences* are "sentences which contain no attitude, modal, or quotational constructions" (1997, n. 1, 102). Examples of simple sentences would be, "Mary is happy", "Mary is happy, and the sun is shining", the latter containing a truth-functional connective, "Some boy dances with all girls", containing two quantifiers, and "Once there was a king", containing a temporal adverb (and also either an existential quantifier or a predicate of existence). Excluded from the domain of simple sentences are, e.g., "There might have been a king", "Mary hopes that the sun is shining", and "The Swedish name for Turku is 'Åbo'". Several papers have offered various solutions to Saul's puzzle with, e.g., Graeme Forbes (1997, 1999) denying substitutivity and Joseph G. Moore (1999) advocating it. I side with Forbes in being broadly 'neo-Fregean' in the sense of making extensive use of modes of presentation and deploying an elaborate semantic theory, while siding with Moore in validating substitution, though not unconditionally.

In her (1997) Saul adduces various examples of simple sentences in which substituting one co-referential singular term for another appears to be invalid. I address the question of whether anti-substitution is *logically* justified by examining the validity and soundness of substitution of co-referential singular terms in three simple-sentence arguments each exhibiting a different logical structure.

The result is twofold. First, all three arguments are *valid*, provided Leibniz's Law is valid with respect to simple sentences (something Saul herself does not doubt it is). Thus, as far as these arguments are concerned, there is no logical problem with substitution in simple sentences. Second, two of the arguments cannot be *sound*, because their respective sets of premises are inconsistent. Thus, it would be logically irrational to commit oneself to all the premises of the respective arguments. To the extent that the origin of Saul's puzzles is in logic (rather than pragmatics, say), I suggest, tentatively, that substitution may appear to be invalid, because the issues of validity and soundness have not been kept separate.

The negative point of this paper is that these three cases, at least, are not logical puzzles at all. Two-way substitution is trivially valid, if the expressions are co-referential semantic proper names, the respective conclusions being but a rephrasing of a premise in the respective arguments. The positive point is that substitution can be rendered non-trivial. For, arguably, there are indeed rational intuitions driving at least one of the three puzzles I investigate here. The puzzle in question substitutes 'Clark Kent' for 'Superman' in "Clark Kent enters the phone booth and Superman emerges". Only a 'Millian' semantics of singular terms is incapable of giving the intuitions their due. If the anti-substitution intuitions are correct, then (*) will at at least one world/time pair have this distribution of truth-values:

(*)	(1)	Clark Kent enters and Superman emerges	*TRUE*
	(2)	Superman = Clark Kent	*TRUE*
	(3)	Clark Kent enters and Clark Kent emerges	*FALSE*

But then (*) would have to be an *invalid* argument. Yet, if (as Saul assumes) 'Superman' and 'Clark Kent' are 'Millian' names of individuals and if Leibniz' Law is valid, then the substitution of 'Clark Kent' for 'Superman' in (3) does go through. Hence, Saul's puzzle thrives on the collision between a valid argument and an intuition to the effect that the argument is, or ought to be, invalid.

The semantic solution I am proposing validates (*), whereas another argument, namely

(*')	(1)	Clark Kent enters and Superman emerges
	(2)	Superman = Clark Kent
	(3')	Superman enters and Superman emerges

will come out invalid.[1]

The solution is an extensive elaboration of one of the several candidate solutions that Saul herself considers and rejects. The solution goes a long way toward accommodating her anti-substitution intuitions by validating only one-way substitution. At the same time, it also contains the extra means to validate two-way substitution in those cases when this ought to be validated, and to block it when it should not be validated.

[1] Saul's original puzzle might equally well have substituted 'Superman' for 'Clark Kent' in (3) to engender (3'), so whatever rationale there may be for blocking (3) carries over to (3').

Not so with the 'Millian' construal of 'Superman', 'Clark Kent', which validates two-way substitution *tout court*.

These are the general forms of one-way and two-way substitution, respectively:

$\underline{\ldots a \ldots b \ldots}$	$\underline{\ldots a \ldots b \ldots}$	$\underline{\ldots a \ldots b \ldots}$
$\ldots a \ldots a \ldots$	$\ldots b \ldots b \ldots$	$\ldots b \ldots a \ldots$
(*one-way*$_1$)	(*one-way*$_2$)	(*two-way*)

The full solution is pivoted on, first, making both 'Superman' and 'Clark Kent' denote *individual concepts* rather than individuals and, second, imposing an *a priori relation* between these two concepts. Saul gives the first step short shrift by claiming that individual concepts (what she calls 'ordinary senses' of singular terms) cannot have any of the properties that apply to individuals, such as entering and emerging from phone booths. Of course, they cannot. But Saul overlooks the fact that if an individual concept is *extensionalised* then an individual fully capable of entering and exiting from phone booths will emerge.

More specifically, I argue that a non-trivial semantic analysis of the example should take account of the diachronicity of Clark Kent's entrance and Superman's exit while preserving the internal link between being Superman and being Clark Kent. I propose the following. As I said, we start by making 'Superman' and 'Clark Kent' refer to two distinct individual concepts (modelled as functions from possible worlds to functions from instants of time to individuals). "Superman is Clark Kent" no longer expresses the self-identity of an individual bearing two names, but the fact that two named concepts are held together by the *Requisite* relation: wherever and whenever someone falls under the concept of Superman the same individual also falls under the Clark Kent concept, whereas there are exceptions to the converse. This semantic analysis always validates the substitution of 'Clark Kent' for 'Superman', but validates the substitution of 'Superman' for 'Clark Kent' only if the additional condition is met that somebody should fall under the Superman concept when Clark Kent enters. The analysis is accompanied by a logical device of extensionalisation from individual concepts to individuals and two rules of predication.

I

So, is one-way or even two-way substitution of 'Superman' and 'Clark Kent' valid, on the assumption that "Superman is Clark Kent" is true? The question is well-known from the sphere of attitude ascription. Consider this argument:

Lois believes that Superman is an alien
Superman is Clark Kent
———————————————————
Lois believes that Clark Kent is an alien.

Is it valid? Straight off, the answer ought to be in the affirmative, for it seems that identicals have merely been swapped for identicals in the context expressed by "Lois believes that …" in accordance with Leibniz's Law. Subtleties aside, this Law is as follows:

Fa
$a = b$
———
Fb.

Thus, if F is "Lois believes that x is an alien", 'a' replaces 'x' and 'a' and 'b' are co-referential then '$F(b/a)$' ought to be true as well. Yet, it is often assumed, and rarely argued, that believing that a is an F is one thing and believing that b is an F is another, even though a is identical to b.

What speaks against an answer in the negative is that *if* 'Superman' and 'Clark Kent' are mere labels of one and the same individual *then* they *are* trivially substitutable in any and every sort of context, including delicate attitude contexts. It is the ascriber, and not the ascribee Lois, who is responsible for using the names 'Superman' and 'Clark Kent'. The ascription need not presuppose, in order to be true, that Lois know either name. To think so is to run together two distinct perspectives: the perspective of the interior agent (ascribee) and the perspective of the exterior agent (ascriber). It is immaterial that it is possible for the same individual to assume both perspectives by filling both roles (thereby becoming a 'self-ascriber'), because what is true of the occupant of one role need not be true of the occupant of the other.[2]

[2] Having said that, there is, in fact, a way to obtain non-substitutivity even when 'Superman' and 'Clark Kent' are labels without confusing the roles of ascriber and ascribee; namely, by means of *sententialism*. Then the ascription requires, in order to be true, that Lois should know and master both 'Superman' and 'Clark Kent', something which is not guaranteed by Leibniz's Law, as long as we interpret the Law objectually/materially (in

Jennifer Saul believes that the misgivings about substituting 'Superman' for 'Clark Kent' (and probably also *vice versa*) that rear their head when embedded in a complement clause preceded by an attitude verb also arise when occurring in simple sentences. Her first, and best, example is

"Clark Kent enters the phone booth and Superman exits".

The verbs 'to enter', 'to exit' are well-chosen, since they are just as 'non-attitudinal' as the standard example of such a verb, namely 'to kick'. Saul's 1997 paper spawned an ongoing controversy which has focused largely on the semantics/pragmatics interface. To the best of my knowledge, however, the question was never raised whether her arguments would be logically *sound*. As it happens, some are, while others are not, because their sets of premises are inconsistent. On the other hand, all of the arguments that I have come across are valid, provided Leibniz's Law is valid and provided 'Superman' and 'Clark Kent' are labels of individuals, such that "Superman is Clark Kent" expresses the self-identity of an individual bearing these two names. At least one of Saul's puzzles reminds us of the fact that the notions of validity and soundness should not be conflated: all sound arguments are valid, while some valid arguments are not sound. One possible source of the phone booth puzzle, then, may be that the issues of validity and soundness have not been properly segregated.

terms of *a*, *b*) and not linguistically/formally (in terms of '*a*', '*b*'). A famous puzzle that arises for sententialist theories of attitude ascription is Mates' puzzle concerning "…chew…" and "…masticate…" where the occurrences of both verbs are preceded by an attitude verb to place them in an attitude context (see Mates 1950). Mates' puzzle revolves around synonymous *sentences*, and not equivalent or identical *propositions*, where propositions are non-linguistic entities. Mates' puzzle does not arise for non-sententialist theories of attitude ascription, for the simple reason that "…chew…" and "…masticate…" are *synonymous*, since 'to chew', 'to masticate' are assumed to be synonymous. Thus, non-linguistic substitution would be of a proposition/hyperproposition for – itself. This is so whatever your notions of proposition/hyperproposition and sentential meaning are, as long as your propositions/hyperpropositions are your sentential meanings. (For discussion of Mates' puzzle, see Bealer 1982, pp. 69ff.). In case it is denied that 'ordinary', or grammatical, proper names lack sense, the concept of synonymy, or sameness of sense, does not apply to them. As a surrogate, the concept of co-referentiality applies instead, and it is equally hard to see how a puzzle could arise if the names are assumed to be co-referential.

Saul'z puzzle bears some resemblance to another, older, puzzle from around 1970 due to Barbara Partee.[3] The Partee puzzle is this:

The temperature is 90° F
The temperature is rising
———————————
90° F is rising.

Both the premises and the conclusion qualify as simple in Saul's sense, and the premises seem at first blush to invite a smooth substitution of '90°F' for 'the temperature' in the context "…is rising…" by Leibniz' Law. Yet the conclusion is indisputably either false or nonsensical.

I am going to address Saul's puzzle rather than Partee's, for two reasons. First, Partee wished to come up with a flawed argument to make a particular point within a particular historical discussion; and her argument obviously is flawed. The challenge that her argument presents is evidently to construct a logical analysis that will block the inference. Saul also wishes to come up with a flawed argument in order to make a point, but it is less than obvious that any of the examples of her puzzle is indeed flawed, at least in the way she intends them to be. So in Saul's case it is less obvious that we are confronted with invalid arguments.

Second, Saul allows grammatical proper names in subject position, whereas I fail to see how this would work for Partee's puzzle. What is awkward about such terms is that if we interpret '*a*', '*b*' as semantically proper names then "*a* is *b*" is true if, and only if, they refer to the same individual, thus aligning its truth-condition with the one of the triviality "*a* is *a*" (or "*b* is *b*"). This outcome is undesirable, for two reasons. Firstly, it pre-empts the question whether the inference of "…*b*…" from "…*a*…" should be blocked, because it cannot be, provided Leibniz' Law is valid. Intersubstitutivity would be trivially valid. Secondly, it blocks the discussion of an alternative semantic construal of '*a*', '*b*', should we decide to opt for substitutivity, because we already have such a means. However, it is desirable to indeed consider an alternative construal, because at least some of the examples Saul deploys to dramatise her puzzle invite a reading of "*a* is *b*" that does not predicate self-identity of an individual bearing two names.

It is important that the anti-substitution intuitions that Saul addresses revolve around *singular terms* occurring in simple sentences. Singular

[3] For discussion, see Yagisawa (2001), Moschovakis (2004, p. 13), and Partee (2005, p. 43).

terms are terms that single out *individuals*. Saul wishes to extend the puzzles to include not only grammatical proper names, but also definite descriptions and demonstratives (1997, n. 13, p. 108). I will restrict myself to grammatically proper names, however, as does Saul in her examples. I follow Saul and her commentators in pretending that none of her simple sentences forms part of a discourse in or on fiction despite the occurrences of 'Superman' and 'Clark Kent', such that we may pretend that they denote real people.

The *rule of substitution* that Saul tacitly assumes when formulating her puzzles is the standard rule of substitution of identicals for identicals, a rough-and-ready version of which was presented above. In its worked-out, general formulation the rule is as follows, 'Φ' an n-ary predicate and 'μ', 'ν' singular terms:

(*Sub*) $\quad \Phi<\mu_1, \ldots, \mu_n>$

$\mu_i = \nu_i$

$\Phi<\mu_1, \ldots, \nu_i, \ldots, \mu_n>$, for any $i \in (1, \ldots, n)$.

The three cases I discuss below are all instances of *Sub*, as is easily verified. Saul's puzzles, in other to be of any interest, need to be cases in which *Sub* either fails or at least appears to fail to transfer truth from the premises to the conclusion. The name of the game is that even if there is only one instance of failure of substitutivity, there will be a simple sentence that defies substitution of one co-referential singular term for another, and Sub will stand unmasked as an invalid rule. Now, apparently there would be a swift way of guarding against this ever happening. We could simply introduce *Sub* as a valid rule, point out that all conceivable arguments allegedly exhibiting failure of substitutivity were instances of a valid rule, and conclude that they were all valid arguments, after all. However, this strategy is no dialectic option. It would be question-begging to assume that Sub is valid when taking on Saul's puzzles, and it would render any further inquiry into her puzzles pointless, if still assuming that 'Superman', 'Clark Kent' are singular terms. What I do, instead, is point out that the test arguments are, indeed, instances of (various variants of) Sub, such that *if* Sub is valid *then* so are they. Though I see no reason to doubt the validity of Sub in simple-sentence contexts, I am assuming an agnostic stance concerning its validity. However, as I claimed in the Introduction and shall try to show later on, at least one of her puzzles thrives on rational intuitions against unrestricted substitution.

Below follow individual characterisations of the three groups of logically different simple-sentence substitution puzzles. (*) through (***) are argument schemata, while the three examples are put forward as concrete instances of these schemata. (*) and (**) are culled from Saul (1997, p. 102, p. 103, respectively), while I have adopted (***) from "Superman leaps tall buildings more frequently than Clark Kent", originally occurring in Joseph G. Moore (1999, p. 92, n. 1). Moore's example fits the template of (**), while in (***) I consider a logical structure I myself have so far not come across in the literature. I conceived of (***) in order to test an additional case that ought to be appealing to at least some advocates of anti-substitutivity, because (***) appears to generate a contradiction where we probably would not expect one. First-order predicate logic with identity suffices throughout to spell out the relevant measure of logical structure. It is obvious what the logical structure of the respective arguments is, once we assume this logical framework and accept Saul's assumption that the terms involved are singular.

The arguments of the first group are modelled on this logical structure:

(*)
$$\begin{array}{ll} Fa \wedge Gb & (1) \\ a = b & (2) \\ \hline Fb \wedge Ga & (3). \end{array}$$

The paradigmatic example is:

Clark Kent enters the phone booth, and Superman exits
Clark Kent is Superman

Superman enters the phone booth, and Clark Kent exits.

We need *Sub'* in (*) and (***).

(*Sub'*)
$$\begin{array}{l} \Phi(\mu_1) \\ \mu_1 = \nu_1 \\ \hline \Phi(\nu_1). \end{array}$$

The notation is meant to mean that if the sentences "$\Phi(\mu_1)$", "$\nu_1 = \mu_1$" express truths, then 'ν_1' may be validly substituted for 'μ_1' in the context "$\Phi(\mu_1)$" to generate the context "$\Phi(\nu_1)$".

The arguments of the second kind are modelled on this structure:

(**)
$$\begin{array}{ll} Rab & (4) \\ a = b & (2) \\ \hline Rba & (5). \end{array}$$

The paradigmatic example is:

Superman is more successful with women than Clark Kent
Superman is Clark Kent

Clark Kent is more successful with women than Superman.

The substituends for 'Φ' are now predicates denoting binary relations defined over ordered pairs of individuals, so *Sub* must be rewritten as *Sub''*:

(*Sub''*) $\Phi<\mu_1, \nu_1>$
$\nu_1 = \mu_1$
$\Phi<\nu_1, \mu_1>$.

The arguments of the third group are modelled on this structure:

(***) $Fb \wedge \neg Fa$ (6)
$a = b$ (2)
$Fa \wedge \neg Fb$ (7).

The paradigmatic example is:

Superman leaps tall buildings, and Clark Kent does not
Superman is Clark Kent

Clark Kent leaps tall buildings, and Superman does not.

In sections II through IV follow separate logical analyses of (*) through (***).

II

How is the conclusion of (*) formed? By rolling two instances of *Sub'* into one single schema by means of the conjunction in (1), (3). That is, first from '*Fa*' to '*Fb*', then from '*Gb*' to '*Ga*'; or in reverse order, if you prefer. (Hence, of '*a*' and '*b*' one is logically redundant.) If (2) is true, (1) and (3) attribute the same properties *F*, *G* to one and the same individual. (1) and (3) are, therefore, at least strictly equivalent, or else identical, depending on how finely sentences, or the meanings they express, are individuated.

Someone who harbours anti-substitution intuitions is likely to argue that it does matter which names we use for the individual who enters and for the individual who exits, respectively, and that anyone who is oblivious to the difference between the different names must have a tin

ear. If, the argument continues, we shift between using two different names, such as 'Superman' and 'Clark Kent', there is supposed to be some pragmatically salient reason for doing so other than a mere whimsical wish for stylistic variation. The inversion of the order of appearance of 'Superman' and 'Clark Kent' does not sit well with the (alleged) implicatures that the guy claimed to enter is timid, bespectacled, and works 9 to 5, while the guy claimed to exit is assertive, has X-ray vision, is able to fly, and whatnot. Implicatures activated in a premise are violated in the conclusion, which is why those language-users who pick up the implicatures will tend to hesitate to embrace the conclusion.

A natural way of continuing this train of thought would be this. Yes, we may well be prepared to grant that substitution is valid in simple sentences like (*). But, although we *may* validly substitute, we *ought* not to do so at least in certain simple sentences. There are pragmatic constraints on the uses of '*a*', '*b*' that are not reflected in the semantics of the names and hence not in (*) either. Pragmatically speaking, '*a*', '*b*' are not mutually interchangeable. Consonantly with this, Saul says, when outlining a similar response,

> We accompany our favourite standard semantic account with the explanatory claim that such truth-preserving substitutions may well yield sentences which are quite misleading, due to false pragmatic implicatures. (1997, p. 106.)

This amounts to a two-tiered policy combining valid substitution with false implicatures. The perhaps most important consequence of this policy is that it locates the origin of Saul's puzzle in pragmatics, not in semantics or logic. I definitely think this sort of cohabitation between pragmatics and semantics has something to be said for it. It pretty much allows us to have our cake and eat it. We may admit that the conclusion is contrived or baffling, and so on, while at the same time leaving the validity of *Sub'* unscathed by (*). Analogously, the 'paradoxes of material implication' are both almost universally deemed unnatural and at the same time valid in classical logic.

If someone finds the conclusion of (*) rubs them up the wrong way, one natural move, then, would be to elaborate the cohabitation strategy. However, one constraint to observe when setting out to develop this strategy is that the pragmatist account must be compatible with the constraint that the singular terms are to figure in *simple* sentences. Though not explicitly stated by Saul in so many words, I take her notion of simplicity to exclude contexts with a suppressed epistemic factor, including

background knowledge had by the parties to a discourse. If I am right about this, then solutions such as those advanced by Barber (2000) and Predelli (2004) are non-starters. They embed the respective sentences within pragmatic contexts, raising the question when it would be conversationally appropriate to utter this or that sentence. By my lights this comes too close to treating Saul's sentences as though they occurred within intensional contexts without actually admitting this. Barber and Predelli calibrate the adequacy of making an utterance of this or that sentence in accordance with the background knowledge of the speakers and their audience. I am not certain this would be the way to go. Firstly, as I noted, they find themselves studying sentences that occur within some sort of (suppressed) epistemic context. But this is in breach of the purity that I take to be the very point of operating with a notion of simple sentence. Secondly, Barber allows that a sentence 'is semantically false but can be used to convey a truth' (2000, p. 303). This sort of double bookkeeping combining literal falsehoods with conveyed truths strikes me as paradoxical. The notion of 'non-semantic' truth at play here is not clear to me, so I am not sure I understand the solution Barber is proposing. Thirdly, Predelli lists "Kent is more successful with women than Kent" among sentences it 'would not always be appropriate' to utter (2004, p. 107). But I am not sure I know when it would be appropriate ever to utter a sentence with an irreflexive predicate defined over two occurrences of the same name. As a matter of fact, the situation seems to be no different with "Superman is more successful with women than Kent", which is claimed to be capable of being true, even though 'the sole semantic function' of 'Superman' and 'Clark Kent' is to refer to the same individual Superman/Clark Kent (2004, p. 118). However liberally laced with pragmatic context-sensitivity the semantics of this sentence may be, it remains beyond me how it could possibly be ('semantically') true. So this would seem to be a case where Predelli's semantics (unaided by pragmatic paraphernalia) is not strong enough to accommodate his Semantic Dignity constraint (cf. 2004, p. 119). In fact, Predelli's example matches case (**) and is, therefore, unsound.

A second move would be to declare *Sub* invalid even in simple-sentence contexts. But this would require developing an argument that I, at least, have not encountered yet. A third reaction would be to deny the truth of at least one of the premises. David Pitt pursues such a strategy in his (2001) by having the identity premise come out false. If we apply

his strategy to (*), the resulting argument forfeits its soundness. Since the argument is now unsound, the logical form of the argument and the particular truth-values of the premises are unable to establish the truth of the conclusion.

Let us take a closer look at this third option. In order to make the identity sentence false, Pitt launches an unusual semantic theory of proper names. His theory is that '*a*' denotes the individual *c* when and only when *c* fills the role ('alter ego') as *a*, and '*b*' denotes *c* when and only when *c* fills the role as *b*. Pitt's '*a*', '*b*' qualify as singular terms, since they denote individuals, the alter egos of *c* being time-slices of *c*. Since *c* never fills the two roles simultaneously, '*a*' and '*b*' never co-refer, it being a tacit premise that *co*-reference of any two names must be *simultaneous* reference to the same individual. Therefore, "*a* is *b*" is never true, since its truth-condition, that the two roles should be filled simultaneously, is never satisfied. Hence, the reason why we can never substitute is because '*a*', '*b*' never co-refer. Pitt concludes, "Since the names of persons and the names of their alter egos are not coreferential, there is no puzzle about why they are not intersubstitutable, even in simple sentences." (2001, p. 552.)

What are we to make of this solution? I think it should be rejected on grounds of principle. For one thing, it takes all the fun and all the punch out of the *Superman* plot by having "Superman is Clark Kent" come out false. As semanticists we may well quarrel over what the *meaning* of (2) should be, but the plot dictates that the sentence "Superman is Clark Kent" must express a *truth*, whatever truth this might be.

But the fundamental problem is that, by denying that '*a*', '*b*' co-refer, Pitt is no longer discussing Saul's puzzle, but something else, namely whether some particular pair, *in casu* {'Superman', 'Clark Kent'}, is an example of two co-referential singular terms. Saul's puzzle, however, is all about the substitutivity of the *co-referential* singular terms '*a*', '*b*' in simple sentences. This is made clear from the very outset of her (1997) where Saul says, "[l]ittle attention […] has been paid to substitution of co-referential names in [simple] sentences". Of course, as Pitt points out, there is nothing puzzling about non-co-referential singular terms falling short of substitutivity. However, if we generalise Pitt's strategy, it comes down to this: there can be no instances of Saul's puzzle, because there are no pairs of co-referring singular terms. This would be a risky strategy, since it cannot be excluded that there are, have been, or will be, pairs

of co-referential names of individuals, even though {'Superman', 'Clark Kent'} may not be one such pair. If someone does come along with a suitable pair, Pitt will be at a loss for an answer to the question whether substitution would be valid. For in Pitt the fundamental question of the validity of substitution – *if* (1), (2) were true, *then* would (3) be the conclusion of a valid argument? – is bound to remain unanswered. His (2001) is geared to make (2) false in order to generate unsound arguments, not to assess the validity of (*) through (***) or any other argument schema bearing on Saul's puzzle.

The fact that the validity issue is *the* issue to be addressed is the reason why it is not an option, as Pitt appears to assume, to treat (2)'s being true merely as 'an intuition that no doubt many will share', such that we can 'nevertheless' assign False to it (2001, p. 543). In order to be generated, Saul's puzzle demands that (2) be true, no matter what our intuitions about its truth or falsity might be. That is, we need to treat (2) as a *fact*. That is our starting-point, and Saul herself is adamant that (2) must be true (1997, p. 104). Moreover, we must treat (1) as an *assumption* to provide the context within which to carry out the substitution. Introducing (1) as an assumption is unproblematic, since it is logically compatible with (2). In general, any alleged attempt to tackle (*) that does not satisfy the dual condition that both (2) and (3) should be treated as true is, in my view, irrelevant to the puzzle. However, the general constraint that both premises of this argument must be considered true does not exclude the possibility that an investigation of one or more of the other puzzles may reveal that it, or they, cannot be generated in the first place, exactly because the corresponding dual condition cannot possibly be satisfied. In fact, I shall deploy just this strategy of puzzle-(dis)solving in the next two sections.

III

Is (**) an argument whose premises are true and whose conclusion is false? Consider the paradigmatic sentences exemplifying (**), which involve the relation *being-more-successful-with-women-than*. This relation is *irreflexive*. An irreflexive binary relation defined over ordered pairs of individuals requires two different individuals as elements for, e.g., "$a > b$" to express something that is possibly true. Hence, if it is true that Superman is more successful than Clark Kent, then 'Superman' and 'Clark

Kent' cannot co-refer. They must refer instead to two different individuals, such that the referent of 'Superman' is more successful than the referent of 'Clark Kent'.

Once *R* is interpreted as irreflexive, (**) cannot possibly be sound: its set of premises is inconsistent. This fact, however, cannot be read off of the form of the argument, since it is an enthymeme. If we add the premise that *R* is irreflexive, it becomes evident that the argument is unsound of necessity.

(**') $\forall x\,(\neg Rxx)$ (4')
Rab
$a = b$
———————
Rba [or: Raa, or: Rbb].

Premise (2), on the other hand, requires exactly one individual in order to be true. The reflexive binary relation of identity as defined over individuals requires one and the same individual twice over as its arguments for, e.g., "$a = b$" to express a truth. Hence, the two terms must co-refer for (2) to be true.

Now the situation is this. If both (2) and (4) are true, '*a*', '*b*' are used in one way in the first premise and in another in the other. It is, however, a minimal requirement on logical notation that it not contain ambiguous terms. So this truth-value assignment is not worth going along with. With equivocation spelt out, the schema would be of this invalid form.

(**'') $\forall x\,(\neg Rxx)$
Rab
$c = d$
———
Rba.

If (**'') were the logical form of one of Saul's puzzles, the puzzle would be easily dissolved by pointing out the equivocation on 'Superman' and 'Clark Kent'. But it is not, for her puzzles demand the same pair of terms {'*a*', '*b*'} throughout. Anyone who balks at the conclusion of (**'') is, trivially, perfectly justified in doing so.

On the other hand, if the notation is not ambiguous, then, necessarily, the truth of either (2) or (4) is inconsistent with the truth of the other. In this case we have an argument where, necessarily, at least one premise is false. That is, since the correct logical structure of Saul's concrete example is (**'), it is seen that her example cannot possibly be a sound argument. The example needs to be misconstrued as (**), by suppressing (4'),

for a puzzle to arise. If we analyse it as (**′) straightaway, no puzzle will arise, since its necessary unsoundness is manifest. It ought to be obvious as well why no argument with *R reflexive* would make it as a puzzle candidate. For instance, if Superman is the same height as Clark Kent, and if Superman and Clark Kent are identical, then Clark Kent is the same height as Superman. No whiff of puzzle here.

When characterising Pitt's non-co-referentiality solution in section 2 as irrelevant to Saul's puzzle, I argued that her puzzle demands that we treat the first premise of the respective schemata as an assumption and (2) as a fact, i.e., both premises as true. Yet I just pointed out that (**′) fails to enable this distribution of truth-values. Have I thereby rendered my own solution irrelevant, too? No. Pitt's attempt at a solution, remember, is to make (2) false from the outset. He therefore never gets around to considering what will happen if all the premises are true, or whether they are compatible. I, by contrast, make no such stipulation at the outset. Instead my strategy is to go along with Saul's stipulations as long as possible to see what happens. It turns out eventually that Saul's example contains the tacit premise $\forall x\ (\neg Rxx)$, and the logical structure of the example is unpacked as (**′). But now the puzzle cannot be generated, for (**′) cannot be an argument all of whose premises are true and whose conclusion is false. Hence, (**′) is no counterexample to *Sub″*.

IV

The argument (***) is like (*) in consisting of two instances of *Sub′* rolled into one argument. As in (*), 'Φ' is now a one-place predicate.

The premises of (***) are incompatible, as in (**′). The truth-condition of (6) is that *b* should be an *F* and *a* fail to be an *F*. If (2) is true, then (6) is necessarily false. For then (6) requires, in order to be true, that the same individual should be an *F* and at the same time fail to be one. But nobody can, for instance, both leap tall buildings and simultaneously fail to do so. And the other way around, if (6) is true, then, necessarily, (2) is false:

$$\frac{Fb \wedge \neg Fa}{\neg(a = b).}$$

(***) is parallel to (**′) by having an inconsistent set of premises and thereby not forming a counterexample to *Sub*′.[4]

The obvious reaction to (***) would be the same as with (**′) – point out the incompatibility of the premises and single at least one of them out as false. In the case of (***), if you want Superman to leap tall buildings and Clark Kent not to, then Superman and Clark Kent need to be two different individuals, and 'Superman' and 'Clark Kent' cannot co-refer. You may decide to have it the other way around instead. Then Superman and Clark Kent are the same individual, 'Superman' and 'Clark Kent' co-refer, and it is not true that Superman leaps tall buildings and Clark Kent does not. If we attempt to generate Saul's puzzle, (2) must be true. As with (**′), the consequence is that we cannot consistently introduce a sentence such as (6) as an assumption into a set of premises that already contains (2).

V

The situation at this point is the following. Two-way substitution is trivially valid, if 'Superman', 'Clark Kent' are co-referential semantic proper names, the conclusion being but a rephrasing of the first premise.

However, consider (*) again. I argue that a non-trivial semantic analysis of a case such as this should take account of the *diachronicity* of Clark Kent's entrance and Superman's exit while preserving the internal link between being Superman and being Clark Kent. I propose the following. 'Superman' and 'Clark Kent' refer to two distinct *individual concepts*.[5] "Superman is Clark Kent" no longer expresses the self-identity of an individual bearing two names, but that two named concepts are held together by the *requisite* relation: wherever and whenever someone falls

[4] Puzzle (***) shows why it is important that we restrict the substituends of '*F*' to non-modal predicates. For the following valid argument may well have a consistent set of premises:

$\Diamond(Fb) \wedge \Diamond(\neg Fa)$ (6′)
$a = b$ (2)
———————
$\Diamond(Fa) \wedge \Diamond(\neg Fb)$ (7′).

(7′) should not be confused with (7″), which is inconsistent if (2) is true:

$\Diamond(Fa \wedge \neg Fb)$ (7″).

I owe the observation to Marián Zouhar.

[5] Cf. Bealer concerning Frege and Church: "there is no genuinely intensional language; when *prima facie* intensional language is properly analysed, it turns out to be extensional language concerning intensional entities." (1982, p. 148)

under the concept of Superman that very individual also falls under the Clark Kent concept, whereas there are exceptions to the converse.[6] (I shall also say that an individual is the 'occupant' of a concept instead of 'falling under' one.)

This semantic analysis validates two-way substitution only if the additional condition that somebody fall under the Superman concept when Clark Kent enters is met, while the substitution of 'Clark Kent' for 'Superman' in "…exits…" follows unconditionally. So we always have one-way substitution, but two-way substitution only conditionally. The asymmetry between one-way and two-way substitution is due to two factors. One is the diachronicity between Clark Kent's entrance and Superman's exit. The other is that I construe both Superman and Clark Kent as individual concepts, which are arranged in the following asymmetric relation: necessarily, whoever falls under the Superman concept falls under the Clark Kent concept, but not always *vice versa*. In plain English, if you are Superman then you are also Clark Kent, while if you are Clark Kent then you may, or may not, be Superman.

The rest of this paper is devoted to setting out what it takes to arrive at two-way substitution by means of two individual concepts asymmetrically related as just described.

VI

As I understand the *Superman* plot, it imposes two constraints on any analysis of "Clark Kent enters and Superman exits". Firstly, as noted above, "Superman is Clark Kent" must express a *truth*, whatever this truth may turn out to be. Secondly, there must be some element of *surprise*, or even shock, to the fact that "Superman is Clark Kent" is true.

One obvious way to meet the surprise constraint would be to make use of the 'friction' between the individual concepts of Superman and Clark Kent, as being Superman seems barely compatible with being Clark Kent. (Cf. the almost complementary offices of Dr Jekyll and Mr

[6] The idea of operating directly with specified individual concepts and only indirectly with unspecified individuals is one of the three approaches that Aloni considers in her (2005). She both rejects operating with 'bare individuals' and 'ways of specifying [bare] individuals' (i.e., individual concepts), opting for 'individuals specified in one determinate way' (see, for instance, p. 27). Despite the length of her paper, I am not sure the third notion becomes crisp enough so as to theoretically underpin the solutions Aloni offers to various puzzles such as Quine's notorious Ortcutt puzzle.

Hyde.) My solution is another, however, relying as it does on two-way substitution not being unconditionally valid, even though "Superman is Clark Kent" is necessarily true.

The way the truth constraint is met is bound to be more elaborate, since "Superman is Clark Kent" now expresses the occupation of two named concepts by the same anonymous individual. What the complications buy us, however, is the asymmetry between two concepts. Accordingly, in virtue of Leibniz's Law, whatever is true of the occupant of the Superman concept is true of the occupant of the Clark Kent concept, while the converse is not always true.[7]

My take on "Clark Kent enters and Superman exits" differs from Saul's not only concerning the semantic status of 'Superman', 'Clark Kent' and "Superman is Clark Kent", but also concerning the semantic status of the entire sentence. Also "Clark Kent enters and Superman exits" will have an intensional semantics assigned to it. By 'intensional' I mean 'involving possible-world intensions'. The sentence is formed by conjoining two atomic sentences by means of a truth-functional connective, and as such qualifies as 'simple'. But while the English sentence "Clark Kent enters and Superman exits" may be simple thus understood, it does not follow that its logical analysis must be so, too. In fact, the linchpin of my analysis is that "Clark Kent enters and Superman exits" is a modal context. The modality in question is contingency. It is only at some worlds and times that somebody occupies the Clark Kent concept or both concepts. And it is only at some of the latter worlds and times that Clark Kent enters a phone booth and Superman exits from the very same phone booth. So whenever "Clark Kent enters the phone booth, and Superman exits" expresses a truth, it is a contingent one. Therefore, the English sentence to be logically analysed actually reads, "*Contingently*, Clark Kent enters, and Superman exits". A contingent truth is, formally, one that obtains within a proper subset of the logical space (while it may or may not obtain at all instants of time), such that the actual world is a member of this equivalence class. In general, what makes a context modal is not exclusively the presence of modal operators or modal expressions like 'necessarily' and 'possibly'. It is enough that the context has a modal profile, in this case contingency.

[7] The asymmetry might just as well have been the other way around, of course, but since the sentence to be analysed is "Superman is Clark Kent" and not "Clark Kent is Superman" the asymmetry is in this particular direction (see Saul, 1997, p. 104, display [11]).

We need to also consider temporal variability, though. It was already argued that it is only sometimes that one or both concepts are occupied and that it is only sometimes that Clark Kent enters a phone booth and Superman emerges from it. But time is also an issue within "Clark Kent went into the phone booth, and Superman came out" itself. We need to operate with two distinct instants of time, for Clark Kent's entering the phone booth cannot be simultaneous with Superman's exiting it without rendering 'Superman is Clark Kent" false – nobody, including superhuman aliens, can enter and exit in one go. So Clark Kent's entrance must precede Superman's exit. To bring out the temporal profile of "Clark Kent went into the phone booth, and Superman came out" in the logical syntax, the truth-conditions spelt out below come with an explicit time indication to capture temporal variability. Let W be the possible world we stipulate the story to be set at, whileT_0, T_1 are moments of time, such that T_0 precedes T_1. These two times are those of Clark's entrance and Superman's exit, respectively.[8] Thus: the Clark Kent concept being a requisite of the Superman concept, if the occupant of the Superman concept exits at WT_1 then so does the occupant of the Clark Kent concept at WT_1, hence 'Clark Kent' may be substituted for 'Superman' in the second conjunct. But the occupant of the Clark Kent concept enters at WT_0 without the occupant of the Superman concept entering at WT_0 in case the Superman concept is vacant at WT_0. As it stands, the argument does not allow us to infer that the concept is occupied. Hence, 'Superman' may not be substituted for 'Clark Kent' in the first conjunct. The key to two-way substitution, then, consists in adding the premise that the Superman concept is occupied at WT_0.

Schematically, the asymmetric interplay between occupancy and vacancy is as follows. If X is occupied at wt then Y is also occupied at wt. If X is vacant at wt then Y is either occupied or vacant at wt. If Y is occupied at wt then X may or may not be occupied at wt. If Y is vacant at wt then X is also vacant at wt.

The asymmetry between X and Y is decisive for which predications are true. If at wt the occupant of X has the property P then at wt the occupant of Y is also P. But if at wt the occupant of Y is P then either X is

[8] An alternative handling of the diachronicity of (*), not to be pursued here, would be to replace the extensional $\wedge$ by *progressive conjunction*, e.g., as is done in constructive type theory (see Ranta 1994, p. 65, using dependent types) or in the shape of von Wright's connective 'and next' (1969, §7). I owe the reference to von Wright to Venanzio Raspa.

occupied and its occupant is *P* or *X* is vacant and it is not true that the occupant of *X* is *P*. This difference underlies the two rules of predication to be set out below.

What about the truth and surprise constraints? Since the requisite relation between any two concepts holds for all worlds and times, "Superman is Clark Kent" now expresses a necessary truth. So the truth constraint is easily accommodated. However, the way the truth constraint is accommodated entails that the surprise factor cannot be accounted for, e.g., in terms of any 'friction' between two sets of barely compatible, yet co-instantiated properties. Anyone who is able to individuate the Superman concept from among other concepts is someone who knows, *inter alia*, that the concept of Clark Kent is part of the package. Similarly, anyone who knows what concept the papacy is is someone who knows, *inter alia*, that the concept of the Archbishop of Rome is one of its requisites (though they may not use the very notion of requisite when describing their knowledge). The element of surprise inherent to the *Superman* story-line is not one I can account for by arguing why it should be surprising that "Superman is Clark Kent" is true. This is not to say that the approach I am pushing for would be at a loss for a solution, though. What is surprising is, instead, that although "Superman is Clark Kent" is necessarily true, two-way substitution is *invalid — unless* the additional assumption is made that the Superman concept is occupied simultaneously with the Clark Kent concept. Similarly, although "The Pope is the Archbishop of Rome" is necessarily true, two-way substitution is invalid, unless the papacy is occupied during any interval in which the concept of Archbishop of Rome is. Absent this assumption, the following inference is *invalid*:

> The concept of Archbishop of Rome is a requisite of the concept of Pope;
> The Archbishop of Rome enters the Sistine Chapel, and the Pope leaves
>
> ---
>
> The Pope enters the Sistine Chapel, and the Archbishop of Rome leaves.

Despite the first premise, this argument is compatible with a scenario in which, at the time of entrance, the papacy is vacant and, at the time of exit, the individual who entered as Archbishop is not the same individual as the one who exits as Pope and, therefore, also as Archbishop.[9]

[9] My solution complies with three of the four constraints Predelli imposes on an account of simple sentences. The one I fail to comply with is (not surprisingly) this: "'Superman' and 'Clark Kent' are co-referential names [Co-Referentiality]." (2004, p. 108.) But notice

Let me dwell on this point for a minute. It is not a requisite either of the Superman concept or of the Clark concept that whoever is its occupant at some given instant must be identical to whoever is the occupant either of the Superman concept or the Clark concept at some earlier or later moment. In other words, it is not necessary that there be *diachronic co-occupation* of both concepts by the same individual 'throughout' the conjunction "Clark Kent enters and Superman exits". (What is necessary, as noted above, is only synchronic co-occupation by the same individual 'within' any conjunct in which whoever occupies the Superman concept either enters or exits and where, therefore, the Superman concept is occupied.) Thus, for instance, it is possible that whoever occupies the Clark concept at T_0 is *not* identical to whoever occupies the Superman concept at T_1. Consequently, if this possibility is realised, the one who is Clark at T_0 is not the one who is Clark at T_1. (Similarly, when in a monarchy the previous king is dead and a new king is proclaimed – "The king is dead. Long live the king!" – the old king and the new king are two different individuals.) Odd it may be; impossible not. There is no logically compelling reason why, for instance, the following scenario should not obtain: the occupant of the Clark concept enters the phone booth at T_0 and ceases occupying the concept upon entering, whereas someone else already waiting inside exits at T_1 either as the occupant of the Superman concept (hence, also of the Clark concept) or as the occupant of the Clark concept (though not necessarily as the occupant of the Superman concept). Such a scenario cannot be articulated in a language that construes 'Superman' and 'Clark Kent' as 'Millian' names. Any such language obliterates the differences between (being) Superman and (being) Clark Kent and makes the diachronicity between Clark's entrance and Superman's exit irrelevant, since the one who enters must be identical to the one who exits.

To sum up this section, the general purpose of my intensionalist approach is to demonstrate a particular kind of interplay between

that I do comply with the constraint that pairs of simple sentences and their substituted counterparts should "differ only for occurrences of 'Superman' and 'Clark Kent' [Syntactic Innocence]" (*ibid.*), because my 'Superman' and 'Clark Kent' denote concept. This compliance is something I consider to recommend my requisite account over Forbes' (so-called!) logophoric account, which introduces logophors that receive no mention in the sentences under analysis. What also speaks against Forbes' proposal is, as Predelli observes (2004, p. 112), that Forbes' allegedly simple sentences are not simple, logophors being a quotational device.

concepts rather than between concepts and individuals.[10] For example, let Joseph Ratzinger be an individual, and the Pope and the Archbishop of Rome, concepts. The point I wish to make is that, whereas it is *contingent* that Ratzinger is the Pope, it is *necessary* that whoever is the Pope be also the Archbishop of Rome, while it is not necessary that whoever is the Archbishop of Rome be the Pope. The relationship between these two concepts is fixed by the definition of *Pope*, according to which it is a necessary, though not sufficient, condition for being the Pope that one be the Archbishop of Rome.

VII

In this section I set out the key formal properties of the requisite relation and explain the notion of predication *de re* that are the two cornerstones of my solution. Let me begin by placing its underlying intensionalist approach in context.

Something in the vein of an intension-based solution is broached at least twice in the discussion of the 'Superman' puzzle. Saul briefly brings up the technique of having terms denote their 'customary senses' also in simple sentences, dismissing it as 'nonsense': "A sense cannot be successful with women [or walk in and out of phone booths]." (1997, 103-4) And Moore says, "in order for my theory to work, aspects need to be bits of the world with properties so they can walk, be successful with women, and so on. Since collections of properties, even 'modal-temporal' ones, can't be successful with women, aspects must be distinct from these." (1999, 103, n. 17)

Here Saul and Moore are putting forward the routine objection to individual concepts, that theories taking them on board find themselves attributing properties of individuals to concepts. However, what both Saul and Moore lack is a notion of *intensional descent* or some other means of *extensionalisation*. Their objection has bite only in the absence of

[10] The extensive reliance on intensions such as individual concepts is 'pre-revolutionary' in the general sense that TIL has not joined the current orthodoxy laid down by Kaplan, Kripke, etc, that began as a 'revolution' against Carnap, Church, etc. Simchen (2004, esp. pp. 528-540) provides a precise description of the change in perspective and priorities that the 'revolution' brought about. For instance, TIL fully agrees that "the conditions [i.e., "purely qualitative manners" of presenting "portions of our surroundings", p. 543] …should be just as they are in the complete absence of any world to satisfy them" and that "the world [supplies] mere satisfiers for independently constituted conditions" (p. 530, p. 531, resp.). This is because TIL is realism *ante rem*.

extensionalisation. Intensional descent is the descent from an intension to its extension at *wt*. If an concept is extensionalised, the result is an individual, and individuals are the sort of things that can be successful with women, walk in and out of phone booths, etc. I know of two devices of extensionalisation. One is an extensionalisation operator, as in the intensional logics of George Bealer and Edward Zalta (see Bealer, 1982, and Zalta, 1988). The other is the operation of functional application, whereby intensional descent is triggered by applying an intension to an argument. The latter is the device I prefer.

The absence or presence of extensionalisation of an individual concept (or some other intensional entity) enables us to distinguish between predication *de re* and *de dicto*. An example of predication *de re* would be, "The US President is a black woman", which says that the *occupant* of the concept at *wt* belongs to the set of black women at *wt* (i.e., is an element of the intersection of the extensions of the intensions *being a woman* and *being black* at *wt*). An example of predication *de dicto* would be, "The US President is elected every four yours", which says that the *concept* belongs to the set of concepts at *wt* whose respective occupant is elected every four years.

Notice that the variability of the subject of predication is located in the notion of logical (as opposed to linguistic) context. Thus, 'Superman' refers invariably to the Superman concept, and 'Clark Kent' invariably to the Clark Kent concept; but the concept occurs either *de dicto* or *de re* depending on whether or not there is intensional descent.[11] Intensional descent is what renders viable my claim that 'Superman' and 'Clark Kent' denote intensions, for without it predication *de re* of the occupant of an concept would not be feasible. Henceforth, let 'Clark Kent' refer to concept *A*, 'Superman' to concept *B*.

Intensional descent is also a prerequisite of the Principle of Substitutivity *de re* that we shall need below. Here is the Principle, *P* and *Q* being concepts.[12]

[11] I am making a short-cut with respect to what Tichý introduces as the bearers of supposition *de re* and *de dicto*; see his (1988, §41). It is *constructions* of, e.g., intensional entities such as individual concepts that may occur with supposition *de dicto* and *de re*. I believe the short-cut is justifiable, because nothing in my discussion above hinges upon constructions.

[12] The principle was originally formulated in Tichý (1978, p. 9).

Let "…*Q*…" be a sentence arising from sentence "…*P*…" by putting the term '*Q*' for some *de re* occurrences of '*P*' in "…*P*…". Then the argument

P at *wt* is *Q* at *wt*
…*P* at *wt*…
———————————
…*Q* at *wt*…

is valid.

The rationale behind the Principle is that what is predicated of the occupant of *P* at *wt* is what is predicated of the occupant of *Q* at *wt* on condition of co-occupation of *P* and *Q* at *wt*. That is, even though "…*P* at *wt*…" and "…*Q* at *wt*…" may have different truth-conditions, their truth-values coincide at every *wt* at which "*P* at *wt* is *Q* at *wt*" expresses a truth.

The Principle is characterised by making it unambiguously clear that the subjects of predication are the extensions of intensions rather than those intensions themselves. This distinction is obscured by the notation "*a* = *b*" and "*Fa*", which could also be used to express that two concepts are identical or that a concept has a property, respectively. Moreover, whether the predication be *de dicto* or *de re*, this notation fails to distinguish between contingently and necessarily true or false predication.

We are now able to specify the truth-conditions of the premises and conclusion of Saul's phone booth argument when specified in accordance with my intensionalist solution. Here is the argument in (slightly stilted) prose first. From now on, let *F* be the property of entering some particular phone booth, and *G* the property of leaving that very same booth.

(i) The Clark Kent concept is a requisite of the Superman concept
(ii) At WT_0, the Superman concept is occupied
(iii) At WT_0, the occupant of the Clark Kent concept enters, and at WT_1, the occupant of the Superman concept exits

———————————————————————————

(iv) At WT_0, the occupant of the Superman concept enters, and at WT_1, the occupant of the Clark Kent concept exits

Before proceeding to the formal proof, we need to briefly pause to define the requisite relation and one of its formal properties. *Req* is a relation-in-extension between two intensions and is defined as follows in case both intensions are individual concepts.

DEFINITION 1 (*Requisite*).
$[Req\ Y\ X] =_{df} [\forall w \forall t\ [[\mathrm{Occ}_{wt}\ X] \rightarrow [X_{wt} = Y_{wt}]]]$ □

Gloss *definiendum* as, "Y is a requisite of X", and *definiens* as, "Necessarily, if X is occupied at wt then whoever occupies X at wt also occupies Y at wt."

The requisite relation is actually a family of relations. One kind of requisite relation is a weak partial order when defined over intensions that may be occupied/exemplified to an equal degree. But another kind of requisite relation is a *strict order*. This is the sort of relation we need here, since the Superman office is strictly less occupied than the Clark Kent office.[13] Only the asymmetry of this relation is relevant to the logic of the phone booth puzzle.

DEFINITION 2 (*Asymmetry*).
$[[Req\ Y\ X] \rightarrow \neg[Req\ X\ Y]] =_{df}$
$[[\forall w \forall t\ [[\mathrm{Occ}_{wt}\ X] \rightarrow [True_{wt}\ \lambda w \lambda t\ [X_{wt} = Y_{wt}]]]] \rightarrow$
$[\exists w \exists t\ [[Occ_{wt}\ Y] \wedge \neg[True_{wt}\ \lambda w \lambda t\ [X_{wt} = Y_{wt}]]]]]$ □

The asymmetric interplay between occupancy and vacancy set out in §VII goes into symbols as follows. As usual, in order that the argument be valid, the conclusion needs to be true for all valuations of $\langle w, t \rangle$ for which the premises are true.

$[Req\ Y\ X]$	$[Req\ Y\ X]$
$[Occ_{wt}\ X]$	$\neg[Occ_{wt}\ Y]$
$[Occ_{wt}\ Y]$	$\neg[Occ_{wt}\ X]$.

On the other hand, if $\neg[Occ_{wt}\ X]$ then $[Occ_{wt}\ Y]$ does not follow. And if $[Occ_{wt}\ Y]$ then neither $[Occ_{wt}\ X]$ nor $\neg[Occ_{wt}\ X]$ follows.

So much for the logic of *Req*. We now turn to the logic of predication *de re*. The special kind of predication *de re* that matters to my solution is one that adds *Req* to the Principle. Predication *de re* works in two directions. One direction is from X_{wt} to Y_{wt}, the other from Y_{wt} to X_{wt}. Let us take a look at what the consequences are, since I need to formulate two rules of inference that I am going to need in the argument below. First, the direction from X_{wt} to Y_{wt}.

[13] If being Superman is a *sufficient* condition for being Clark Kent, whereas being Clark Kent is a *necessary* condition for being Superman, it follows that there are more worlds and times at which the Clark Kent concept is occupied than there are at which the Superman concept is occupied. Suppose we rank individual concept in terms of the number of worlds and times at which they are occupied according to the rule that a rarely occupied concept is higher up the hierarchy than a frequently occupied one. Then the Superman concept is higher up than the Clark Kent concept. Likewise, the concept of Pope is higher up than the concept of Archbishop of Rome. One could also say that the concept of Pope is, in a quite literal sense, more *exclusive* than the concept of Archbishop of Rome.

First Rule of Predication de re (*P1*)
[*Req Y X*]
[H_{wt} X_{wt}]
———————
[H_{wt} Y_{wt}].

The occupancy of *X* at *wt* follows from the truth of the second premise. It is a logical presupposition for any occupant of *X* to have any property whatsoever at *wt* that *X* be occupied at *wt*. The occupancy of *Y* at *wt* follows from the occupancy of *X* at *wt* and the fact that *Y* is a requisite of *X*. Because *Req* holds for ⟨*Y*, *X*⟩ their occupancy at *wt* must be co-occupation. Therefore, the Principle applies. Second, the direction from Y_{wt} to X_{wt}.

Second Rule of Predication de re (*P2*)
[*Req Y X*]
[Occ_{wt} *X*]
[H_{wt} Y_{wt}]
———————
[H_{wt} X_{wt}].

The occupation of *X* at *wt* does not follow from [H_{wt} Y_{wt}], because the Principle applies only if there is co-occupation at *wt*. The way to obtain co-occupation is by adding the premise [Occ_{wt} *X*].

We are now ready to spell out the logical form of the argument underlying the three-premise analysis of the inference of "Superman enters the phone booth and Clark Kent exits" from "Clark Kent enters the phone booth and Superman exits". The proof of the validity of the substitution is straightforward, once the rules *P1*, *P2*, and the requisite relation have been introduced. *w* is a possible-world variable, and t_0, t_1 time variables, such that t_0 precedes t_1.

(1)	[F_{wt_0} Y_{wt_0}] ∧ [G_{wt_1} X_{wt_1}]	assumption
(2)	[*Req Y X*]	assumption
(3)	[Occ_{wt_0} *X*]	assumption
(4)	[F_{wt_0} Y_{wt_0}]	1, ∧E
(5)	[F_{wt_0} X_{wt_0}]	2, 3, 4, *P2*
(6)	[G_{wt_1} X_{wt_1}]	1, ∧E
(7)	[G_{wt_1} Y_{wt_1}]	2, 6, *P1*
(8)	[F_{wt_0} X_{wt_0}] ∧ [G_{wt_1} Y_{wt_1}]	5, 7, ∧I.

The two intermediate conclusions are (5) and (7). The main conclusion, (8), then follows by adjoining them by means of conjunction introduction.

One-way$_2$ substitution (invalidating two-way substitution) is obtained by leaving out (3), so that (5) cannot be inferred. This is how (*′) mentioned in the Introduction is rendered invalid: possibly, the first conjunct of (3′) is false while the first conjunct of (1) is true.

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