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NOTES ON REFERENCE

Abstract. This paper proposes a vocabulary for speaking on reference. The main idea is that we should sharply distinguish reference and designation. The former is essentially a pragmatic (intentional) relation between the user of a referential expression, whereas the latter is semantic in character. This distinction enables us to distinguish several cases of referring, including situations in which reference is incorrect. Reference also has some modal properties.

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In this paper¹, I try to develop some thoughts on reference by setting up a general conceptual scheme. My main device is the distinction between reference and designation. I will show that several important distinctions occurring in the philosophy of reference can be accommodated in my frameworks. I will also try to demonstrate that several puzzles of reference can be solved. I begin with some assumptions, clarifications and restrictions.

- (A) The word ‘reference’ is characteristically ambiguous. It means either ‘referring’ or ‘referent’. I will take the first meaning as basic.
- (B) I assume that referring is a relation (the relation of reference) of a subject S to an referent a^* . It is important to note that I am speaking here about referent, but not about an object.
- (C) The relation of reference is intentional, i.e. directed toward an object (referent). Thus, referents are objects of intentional acts.
- (D) The subjects refer to referents through linguistic devices. This excludes extralinguistic cases of reference from my further analysis. Nothing is assumed about referring expressions at this stage.
- (E) Strictly speaking, there are acts of referring but no reference in itself.
- (F) The thesis (E) entails that referential properties of expressions are derivative with respect to acts of referring, but not properties *an Sich* of linguistic items. Hence, if we say that expressions refer to something, we should remember that this is a metaphor.
- (G) The theses (A)–(F) imply that the considered problem has two aspects: (a) psychological or pragmatic connected mainly with intentionality, and (b) semantic which consists in a relation of expressions employed in referring acts to something external to them. This distinction reflects the derivative character of the referential properties of expressions. A simple observation justifies the point. Very often we have no access to the intentions of original producers of texts, but we clearly understand that the text in question is about something and we have no problems with identification of its referent. This means that we rely on the semantic properties of referring expressions and the entitles us to speak

¹ This paper is an abbreviated version of a longer essay “Reference and designation” which will appear in *Logical Methods in Language Theory*, ed. by W. Buszkowski and V. Sanchez Valencia (a special issue of the journal *Grammar*). In particular, I omitted here all bibliographical references.

about reference as a relation between (some) expressions and their referents. Thus, we extract the semantic aspects of reference from their psychological and pragmatic context and consider them as autonomous. Of course, this point is related to the distinction between the speaker's reference and the semantic reference, but not identical with it. I will come back to this question later.

- (H) I am interested only in so called singular reference. However, I do not enter into the problem whether we singularly refer to kinds.

The Fregean context principle (CP) plays a fundamental role in my further considerations. Simply speaking, I claim that it states the main condition for a proper treatment of reference. The principle states that words have meanings (perform semantic roles) not in isolation, but only in the context of a proposition. It is of the utmost importance that CP concerns propositions, not arbitrary contexts. Thus, the roles of words, in particular their referential properties, must be considered as relative to the functions of propositions. Since the cognitive functions of propositions are ultimately connected with their truth or falsity, reference must be investigated from the perspective of how the truth and falsity of propositions (or sentences which express propositions) contribute to reference of terms occurring inside of those propositions (later on I will use the term 'sentence' rather than 'proposition'). For reasons to be explained later, another property of terms, namely designation contributes "to the truth-condition of the whole sentence". At this point, I only stress that the semantic properties of sentences are absolutely primary in comparison with the referential properties of terms. The distinguished role of propositions for the problem of reference is parallel to their fundamental role in logic which is mirrored by the logical priority of propositional calculus in the whole system of logic. It would be strange if this fact were not relevant for the discussion on reference.

My further analysis will consist in defining several cases of reference. An auxiliary category of protoreference is the starting step. It is defined by:

- (1) A person S protorefers in a language \mathbf{L} through the content of the sentence ' a is P ' to a referent a^* if and only if (a) the sentence ' a is P ' belongs to \mathbf{L} , (b) the expression a belongs to the class of linguistic devices which S uses for the individuation of a^* (individual expressions), and (c) S assertively utters the sentence ' a is P ' or at least is ready to utter it assertively.

Although (1) describes an auxiliary concept, it leads to some illuminating comments. I assume that S is a competent user of \mathbf{L} . This allows us to

dispense with the mysteries of reference connected with accidental linguistic errors as well as questions seriously considered by some authors, for example problems of reference by acts of sharks, dogs or newborns. Protoreference (and, *a fortiori*, reference) is related to a language, together with its translations into languages sufficiently known to S . If languages \mathbf{L}_1 and \mathbf{L}_2 are not translatable for S with respect to a certain individual expression a , then S uses two different languages. The expression ' a is P ' is used here so widely that it also covers the expression ' a is not P ', unless it is explicitly indicated that its positive form (i.e. without negation before P) is considered. Further, the predicate ' $is P$ ' can be tensed. I prefer to regard temporal qualification as indexes attributed to P . Thus, ' a will be P ' is to be transformed into ' a is P at t ', where t indicates a future moment of time (analogically for the past tenses). For simplicity, the expression ' $is P$ ' is always used as a monadic predicate. Thus, the phrase ' $is a student of Plato$ ' has its canonical notation in the phrase ' $is a Plato-student$ '. The content of the sentence ' a is P ' (the propositional content of this sentence) has its representation in the ordered pair $\langle c(a), c(P) \rangle$, where the symbol c stands for 'content'; the second element (the letter P abbreviates here the phrase ' $is P$ ') of the pair expresses a mode of presentation of a^* . The addition "is ready to utter it assertively" covers the situation in which S refers only "in thought", uses more complex linguistic structures than ' a is P ' or some indirect referential utterances. The second point concerns for example conditionals, like 'if Hitler had won the war, Poland would not be an independent country today'. It is clear that a person uttering this conditional is ready to say something about Hitler and Poland *via* using the form ' a is P '. Sometimes referential acts consist in answering questions, of the type 'Is $a P$?'. The answer 'Yes' replaces the sentence ' a is P ', the answer 'No' its negative form. Clearly, S is ready in such situations to use these sentences. Speaking on reference only in "thought", I do not extend the domain of reference to extralinguistic cases. As a matter of fact, I regard every referential act, verbalized or not, as inevitably connected with having a content expressible by a sentence. Usually, I will omit the clause "or at least is ready to utter it assertively".

Proper names are of course the paradigm of individual expressions. Indexicals, demonstratives and combinations like 'this man' or 'that horse' also belong to this category. What about definite descriptions? It seems that they individuate referents to various degrees. Consider the sentence 'the man in the corner of this room is tall' uttered by a definite person in a definite ('this') room. The phrase 'the man in the corner of this room' (possibly, accompanied by a gesture) is a perfect individual expression which uniquely

selects its referent. On the other hand, the expression ‘the highest mountain in the world’ in the sentence ‘The highest mountain in the world is in Asia’ individuates its referent only to a certain degree. Although we can infer from this sentence that there is only one highest world mountain and that it is in Asia, we are not able to point out which one exactly it is. However, a competent user of English, who additionally has some general knowledge, is able to make the description ‘the highest mountain in the world’ more complete by giving the proper geographic coordinates or using the name ‘Mt Everest’. It is important that such completion is theoretically always possible. This remark also concerns words like ‘someone’, for instance in the sentence ‘someone is waiting for me in my office’. Regardless of the fact, that we can transform the last sentence into ‘there is a person x , such that x is waiting for me in my office’ (it means that ‘someone’ is a hidden quantifier), ‘someone’ ordinarily functions as an individual expression. I would like to stress that the possibility of completion of definite descriptions does not mean that there is no difference between them and proper names. My remarks only indicate that individualizing expressions can require an additional precization. This concerns even proper names. If someone has difficulties with selecting the precise referent of the name ‘Aristotle’ occurring in the sentence ‘Aristotle was a student of Plato’, he or she can always ask for further explanations. Such completion is made either by saying something new about Aristotle (generally about a^*) or Plato (more generally, by changing the old mode of presentation) has no significance at the moment.

The definition (1) has an important general consequence. If reference is always connected with a pair $\langle c(a), c(P) \rangle$, so called pure reference, that is reference not mediated by any propositional content is rather impossible. Of course, this is a consequence of adopting (1), not an unconditional demonstration. However, (1) does not entail that proper names have the Fregean sense. The proposed account only means that propositional content is always involved in using individual expressions. We avoid in this way a popular objection against Frege’s semantic theory. The objection is as follows. Since we can associate different propositional contents with a given proper name a , it becomes unclear which content(s) constitutes *its* sense. Russell tried to solve this problem by accepting the view that (ordinary) proper names are condensed descriptions. Consequently, the sense of a proper name is given by all descriptions condensed by the name in question. However, this view is clearly inadequate with respect to the actual linguistic practice, because if the sense of an expression is something which makes its understanding possible, we can appeal to some descriptions only. On the other hand, if we

weaken Russell's requirement and accept that a limited bundle of definite descriptions constitutes the sense of proper names, the latter become ambiguous — this last view is also not intuitive. Thus, the problem of the sense of proper names is really difficult. Yet the weakened Russell's view has some merit, because actually definite descriptions determine the use of proper names in most cases. In most, but not in all. If someone says 'Kraków is an old city', it gives a mode of presentation of Kraków, although no definite description. If this observation is right, an arbitrary propositional content can contribute to the use of a given proper name. Doubtless, (1) remains within the descriptive theory of proper names, but weakened, because it does not postulate that we necessarily need definite descriptions in order to equip proper names with a certain sense. Finally, I note that (1) does not imply that if a is an individual expression, its referent must exist.

Designation is the second key concept in my analysis. The definition of designation is this:

- (2) An object o is a designatum of a predicate 'is P ' if and only if an open formula ' x is P ' is satisfied by o .

I understand objects in the Leśniewskian sense, that is an object is something existing and unique: o is an object if and only if o exists and o is unique. Thus, if o is a (the) designatum of P , then o exists.

The definition (2) is not incompatible with the standard semantics in which sets and relations are denotations of predicates. In fact, the definition only supplements this picture. Namely, we now say that designata are elements (objects in the case of sets, n -tuples in the case of relations) of denotations. Having designata is an objective property of predicates, regardless of acts of referring. Even predicates introduced by stipulative definitions have or do not have designata. The distinction between reference and designation does not mean that individual expressions do not designate, because they always can be introduced as parts of predicates, for example 'Pegasus' into 'is Pegasus' or 'the man standing behind you and drinking vodka' into 'is the man standing behind you and drinking vodka'. This is an important fact which provides a criterion for checking whether a given individual expression designates something or not.

There is an obvious connection between (proto)reference and designation, because we can and even should ask whether given a (if it occurs in the predicative position) and P are codesignative or not. This motivates a modification of (1) given by

- (3) A person S protorefers in a language \mathbf{L} through the content represented by $\langle c(a), c(P) \rangle$ to a referent a^* as a (the) designatum of a predicate P if and only if (a) the sentence ' a is P ' belongs to \mathbf{L} , (b) the expression a belongs to the class of linguistic devices which S uses for the individuation of a^* (individual expressions), and (c) S assertively utters the sentence ' a is P '.

There are different relations between reference and designation. They are displayed by the following definitions (each explicitly combines protoreference and designation):

- (4) S perfectly-correctly refers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as to a (the) designatum of P if and only if (a) S protorefers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as a (the) designatum of P , and (b) a^* is a (the) designatum of P .
- (5) S semi-correctly (that is, with an error concerning a) refers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as to a (the) designatum of P if and only if (a) S protorefers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as a (the) designatum of P , (b) a does not individuate a^* , and (c) a^* is a (the) designatum of P .
- (6) S simply-incorrectly refers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as to a (the) designatum of P if and only if (a) S protorefers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as a (the) designatum of P , (b) a^* is an object, (c) a individuates a^* , and (d) a^* is not a (the) designatum of P .
- (7) S double-incorrectly (that is, with an error concerning a) refers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as to a (the) designatum of P if and only if (a) S protorefers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as a (the) designatum of P , (b) a^* is an object, (c) a does not individuate a^* , and (d) a^* is not a the designatum of P .
- (8) S vacuously-incorrectly refers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as to a (the) designatum of P if and only if (a) S protorefers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as a (the) designatum of P , and (b) a^* is not an object.
- (9) S refers in \mathbf{L} through $\langle c(a), c(P) \rangle$ to a^* as to a (the) designatum of P if and only if (4) or (5) or (6) or (7) or (8) holds. Moreover, S can refer partly correctly and partly incorrectly to the same referent a^* (an example will be given below).

How are the conditions (4b), (5c), (6d), (7d) and (8b) related to truth or falsity of sentences of the form ' a is P ' in its positive form? (4b) is equivalent

to the clause that '*a* is *P*' is true. The conditions (6d), (7d) and (8b) are equivalent to falsity of '*a* is *P*'. Yet the reasons for this are different in the cases (6d) and (7d) than in (8b). If *S* vacuously refers to *a** the sentence '*a* is *P*' is false, because *a** does not exist. Note also that in all cases of incorrect reference a misuse of a predicate is involved. The situation is more complicated in (5c), because the sentence '*a* is *P*' is false, although *a** is a (the) designatum of *P*. Thus, the interplay of reference and designation does not fall under a uniform scheme. In particular, reference and designation do not need to be equal, except in the case of perfectly correct reference (see (4)). However, if we distinguish (4) and (5), that is two cases of correct reference, the truth of '*a* is *P*' is not a necessary condition for the correctness of referential acts.

Now I will check how the ideas expressed by (1)–(9) and the comments to them work. At first I consider two distinctions regarded as very important in the theory of reference. The first is the distinction between a referential and an attributive use of definite description. Assume that *S* says 'The murderer of John was insane' having in his mind that the assassination of John was exceptionally cruel. This use of a definite description (in our case, the phrase 'the murderer of John') is called 'attributive', because *S* intends to count the referent of the description 'the murderer of John' among insane persons. On the other hand, *S* may be thinking about a concrete person who assassinated John and is insane. It is said that *S* uses the definite description 'the murderer of John' in the referential way. In my view, we have here special cases of the completion of individual expressions by different modes of presentation. The problem concerns in fact various instances of the scheme '*x* is *P*' which are satisfied (or not) by referents of expressions substituted for *x*. In the case of definite descriptions, the referential use is connected with the form '*x* is the *P*' ('*x* is the murderer of John'), but the attributive use is regulated by the form '*x* is a *P*' (*x* is an insane-person). Both cases essentially involves designation. In a sense, the considered distinction employs various combinations of reference and designation. This confirms the view that the distinction between referential and attributive use of definite descriptions is a relative one.

Our second distinction is that of the speaker's reference and semantic reference (or the terms speaker's reference and linguistic reference). Reference is speaker's reference by definition, and designation is a semantic matter also by definition. Thus, we should not use the terms 'semantic reference' and 'speaker's designation' (in fact, the latter is not employed). Besides, the distinction between speaker's reference and semantic reference is entirely

covered by the concepts of reference and designation. Speaking about incorrect reference is not in collision with the thesis that reference is always carried out through propositional content, because I did not assume that a given content is semantically correct, that is expressed by a true sentence. It can also be expressed by a false sentence.

Now, I will show that this distinction introduces allows us to solve many puzzles concerning reference, raised in the earlier discussions.

The old problem of identity sentences has a similar solution as in Frege. The problem is this. We can admit that the sentence

(10) Venus = Venus,

is asserted by everybody on purely logical grounds. On the other hand, (10) has a different content than

(11) Venus = the Evening Star.

Frege explained this difference *via* the distinction between *Sinn* and *Bedeutung*, where the term '*Bedeutung*' denotes (modulo a given *Sinn*) an object. We can say that although we have that $\langle \text{Venus}, \text{Venus} \rangle = \langle \text{Venus}, \text{Evening Star} \rangle$, this does not entail (and even should not entail) that $\langle c(\text{'Venus'}), c(\text{'Venus'}) \rangle = \langle c(\text{'Venus'}), c(\text{Evening Star}) \rangle$. Thus, the identity of referents does not entail the identity of contents used in acts of referring. This explains why the contents of (10) and (11) are different.

Assume that *S*, thinking about London, utters the sentence

(12) Dublin is the capital of Great Britain.

However, what does *S* refer to? It would not be intuitive to think that the term 'Dublin' was not used by *S* referentially in this case. It could happen that *S* forgot that 'London' individuated the capital of Great Britain. However, *S* is still thinking about London as the capital of Great Britain. It seems that more or less accidental linguistic errors do not devastate the correct reference to referents. On the other hand, the act of reference in this case is certainly not fully correct, although London is the designatum of the predicate 'the capital of England'. This is why I am speaking here about a (semi)correct reference but with a mistake concerning an individual expression (see (5) above).

Assume now that *S*, thinking about Belfast, says

(13) Belfast is the capital of Ireland.

This case falls under (6), because *S* refers the term 'Belfast' to Belfast, but Belfast is not the designatum of 'the capital of Ireland'. Finally, consider

(14) Belfast is the capital of Great Britain,

uttered by *S* who was thinking about Dublin. This situation exemplifies (7), because ‘Belfast’ does not individuate Dublin (*S* made a mistake concerning the individual expression) and Dublin is not the designatum of ‘the capital of Great Britain’.

The examples presented by (12)-(14) are relatively simple. I discuss them in order to show cases in which (5)-(7) are applicable. Now I will pass to more puzzling examples. The Meinong puzzle concerning sentences having empty terms in the subject position, like

(15) Pegasus does not exist;

(16) Pegasus is a winged horse.

The problem is that the term ‘Pegasus’ seems to refer in (15) and (16) to something which does not exist. Fortunately, we can show that the subjects uttering sentences like (15) and (16) do not refer to Pegasus at all.

The sentence (15) is not an instance of the form ‘*a* is *P*’ which is the basic form connected with referential acts. Of course, we can extend this form by rewriting (15) as

(17) Pegasus is not existing,

but I do not want to use ‘existence’ as a predicate. Another way is to use Leśniewski’s ontology in which we have a definition

(18) for any *x*, *x* exists $\stackrel{\text{df}}{=}$ for some *y*, *y* is *x*.

The contraposition of (18) gives

(19) for any *x*, *x* does not exist if and only if for no *y*, *y* is *x*.

The intuitive meaning of (19) is this: *x* does not exist if and only if nothing is *x*, that is no object is *x*. Since being an object means in Leśniewski’s ontology being something, we obtain: nothing is *x* if and only if *x* is nothing. Thus, Leśniewski’s ontology leads to a quite intuitive result: *S* vacuously refers to a referent if and only if *S* refers to nothing.

How to explain (15) assuming the standard predicate logic? Metalogically speaking, (15) expresses the following thought:

(20) for any *x*, *x* is not a designatum of the predicate ‘Pegasus’.

However, (20) has obviously a different content than (15). Thus, it would be difficult to say that if one uses (15), one refers to anything through (20). We must find a way to associate (15) with the form ‘*a* is *P*’.

Assume that S_1 says to S_2 that Pegasus does not exist. The reaction of S_2 will depend on his or her views about Pegasus. If both S_1 and S_2 share the same views, S_2 will agree with S_1 , but if not, S_2 will probably ask: well, what is Pegasus? In this situation, S_1 is obliged to answer ‘Pegasus is so and so’, that is to use an instance of the form ‘ a is P ’. This strategy is motivated by a rule of the standard predicate logic which allows us to infer the sentence ‘there is x such that x is P ’ from the premise ‘ a is P ’, provided that a is not empty. The contraposition of the rule gives

(21) if for no x , x is P , then a is not P .

Now, the sentence which denies existence of x being P , that is the sentence ‘there is no x such that x is P ’ implies both: the antecedent of (21) and the negation of ‘ a is P ’; both are equivalent, if the sentence ‘there is no x such that x is P ’ is true. This fact suggests a solution. If (15) is true, no true sentence of the form ‘ a is P ’ in which a stands for Pegasus can be found. In particular, this concerns (16). Thus, if someone refers to Pegasus, for example, saying that it is a winged horse, one does not refer to anything. Combining this conclusion with (20), we can say that (15) is, with respect to the question of reference, about the predicate ‘Pegasus’ and its designata, not about Pegasus.

The sentence (16) taken separately from (15) leads to additional problems, because its content is devoid of any suggestion that Pegasus does not exist or that the predicate ‘a winged horse’ is empty. Nevertheless, since Pegasus does not exist, (16) cannot be about Pegasus for exactly the same reason for which (15) is not. In this case, the emptiness of the predicate ‘a winged horse’ is of the utmost importance, because ‘Pegasus’ is defined or rather *quasi*-defined as a winged horse. There is no general rule which regulates the role of empty predicates in relation to the question of reference, except for the statement that a sentence of the form ‘ a is P ’ is false, if P has no designata. This means that reference *via* the empty predicative content can be either incorrect (if a is not empty, but combined with an empty predicate) or vacuous (if a is empty). Assume that S did not know that Pegasus did not exist, but he or she was later informed about it. S is certainly entitled (after being informed that Pegasus does not exist) to say that, uttering (16), S did not refer to anything. This legitimizes the following stipulation

(22) S refers vacuously (omit the further qualifications occurring in (8)) if and only if S refers to nothing.

The word ‘nothing’ denotes here the so called relative nothing that is, relativized to a stock of assumed entities, however, in this case this stock is equal to all existing objects.

This proposal assumes that the ontology of reference is given by the domain of designata, not of referents. If someone decides to define an ontology determined by the domain of referents of individual expressions, then introducing special objects, for instance, incomplete objects in Meinong’s sense seems unavoidable. The proposed analysis of (16) does not entail that all sentences with empty predicates have the same content. So the sentence

(23) Pegasus is a unicorn,

has a different content than (16). Although (d abbreviates ‘the denotation of’), $d(\text{‘winged horse’}) = d(\text{‘unicorn’}) = \emptyset$, but $c(\text{‘winged horse’}) \neq c(\text{‘unicorn’})$.

I have myself some reservations about including vacuous reference into genuine referential cases. There is a sharp discrepancy between reference and designation. Intentionally, S refers to a referent, even if the reference is vacuous, but designation does not occur in this case. For this reason, one could argue that ‘vacuous’ in ‘vacuous reference’ is rather a modifier than determinator. Since the matter is conventional to a great extent, I decided to recognize vacuous reference as a special case of reference.

Keith Donnellan formulated a puzzle connected to this which can be represented by

(24) the man behind you is drinking vodka and he is happy.

The puzzle appears in the situation in which the referent of ‘the man behind you’ is drinking wine, although he is happy. We can solve this puzzle by pointing out that reference can be incorrect, or partially correct and partially incorrect. Thus, for example, (24) incorrectly asserts about the man in question that he is drinking vodka, but correctly that he is happy. Therefore, if a person utters (24) in the situation described, the reference involved is partially correct and partially incorrect; in general, the anaphoric reference frequently has such a double character.

A special problem is connected with substitutivity for identical in intensional contexts. Consider the sentence

(25) S knows that Venus is the Evening Star.

Now, although we have

(26) the Evening Star = the Morning Star,

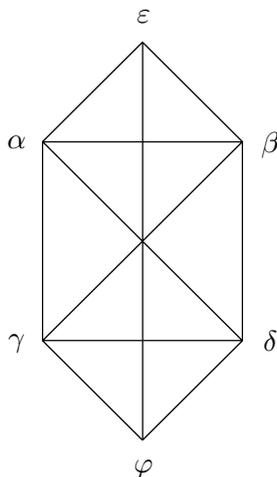
it is perfectly possible that S does not know that Venus is the Morning Star. Thus, it is possible that (26) is true, but the sentence

(27) S knows that Venus is the Morning Star

is false. This means that the rule of substitutivity for identicals is not truth-preserving in opaque (intensional) contexts. The operator ‘ S knows that’ is among them. ‘ S believes that’, ‘ S thinks that’, ‘ S asserts that’, ‘ S expects that’ or ‘ S is afraid that’ are other examples. In fact, the family of operators leading to opacity is quite large.

This situation can motivate various reactions. One consists in improving the rule in order to secure its soundness. It is a way toward an intensional logic. Another, which seems to me better, will try to explain the failure in question without special attempts to build a new logic, at least one which has the rule of substitutivity.

Reference has still one peculiarity which was not noted above. It is a modal concept in the sense that it satisfies typical logical relations valid for modalities, for example alethic or deontic ones (necessity, possibility, obligation, permission, etc.) Let the expression $A(a, P)$ represent the sentence ‘ a is P ’ in its positive form. Further, let the notation $R^S(a^*, A(a, P))$ abbreviate the sentence ‘ S refers through the content of the sentence $A(a, P)$ to a^* ’. We have the following basic cases: (a) $R^S(a^*, A(a, P))$ as α , (b) $R^S(a^*, \neg A(a, P))$ as β , (c) $\neg R^S(a^*, \neg A(a, P))$ as γ , and (d) $\neg R^S(a^*, A(a, P))$ as δ . Define ε as $\alpha \vee \beta$ and φ as $\gamma \wedge \delta$. Now the following diagram (D) represents the logical relations among the set $\{\alpha, \beta, \gamma, \delta, \varepsilon, \varphi\}$



In particular, α is subordinated to γ (the former logically implies the latter), β is subordinated to δ , α and β exclude each other, etc. For our case, the most important fact is that γ and δ are compatible. It is represented by the sentence κ and means that, given a , S can neither refer to a^* through $A(a)$ nor through $\neg A(a)$.

Now let us return to our puzzle in its general form. We can formulate it even without any epistemic verbs, like ‘knows’, ‘believes’, etc. Assume

$$(28) \quad (a) R^S(a^*, A(a, P_1)) \\ (b) P_1(a) \Leftrightarrow P_2(a).$$

However, we have no reason to conclude on purely logical grounds

$$(29) \quad R^S(a^*, A(a, P_2)).$$

This sentence can be false either because S asserts $\neg A(a, P_2)$ or

$$(30) \quad \neg R^S(a^*, A(a, P_2)) \wedge \neg R^S(a^*, \neg A(a, P_2)).$$

is the case. In the first situation, S makes a simply-incorrect referential act, but in the second case no reference (on prescribed conditions) takes place. Anyway, in both circumstances, S neither utters the sentence ‘ a is P ’ in its positive form nor is ready to do so. In order to obtain a concrete example, we can substitute ‘Venus’ for a , ‘the Evening Star’ for P_1 and ‘the Morning Star’ for P_2 .

The above reasoning shows that reference is intensional in itself. On the other hand, designation is purely extensional. Ignoring fuzzy predicates which lead to special problems we have (the double role of negation does not lead to any confusion)

$$(31) \quad \neg d(P) \Leftrightarrow d(\neg P).$$

Now we see that both assumptions listed in (28) belong to different orders: (28a) to the order of reference, but (28b) to the order of designation. Since the logic of reference is modal and the logic of designation fully extensional, the failure of substitutivity is a result of their co-existence. However, reference and designation coincide in the case of perfectly-correct referential acts. In fact, (30) is true just if S 's reference to a^* through $A(a, P_2)$ is perfectly-correct. In other words, the logic of reference and the logic of designation are the same, if reference is perfectly-correct. Thus, the perfection of reference plays a similar role as the perfection of knowledge in epistemic logic. A simple way to eliminate the puzzle expressed by (29)–(30) is to add the premise

(32) S knows that $P_1(a) \Leftrightarrow P_2(a)$.

Since it is a factual statement, it is not surprising that logicians have reservations about taking it as a basis for epistemic logic.

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