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CONTENTS

STUDII

DETERMINING THE RELATIONSHIPS BETWEEN PREDICATION JUDGMENTS USING THEORY OF THE RELATIONS OF FLOREA ȚUȚUGAN

GEORGETA CUCULEANU[1]

Abstract. The paper presents the relationships between the predication judgments, starting from the unique and well-determinate relations that can exist between the two terms of a judgment. These relations are of identity, contradiction, subordination, contrariety, subcontrariety, superordination and crossing. For determining these relationships, the disjunctions of unique and well-determinate relations that represent every universal or particular judgment were established. It emerges from the study that universal judgments are represented by disjunctions of two unique relations, being double indeterminate. On the other hand, particular judgments are represented by disjunctions of five unique relations, thus being quintuple indeterminate. Relationships between judgments were established by comparing disjunctions.

Keywords: *judgments, opposition, relationships, terms, disjunction.*

I. Introduction

Relationships between predication judgments are relations between their statements and are given by relations between the two component terms of a judgment which may be positive and negative. The relations between the terms of a judgment and their graphical representation are given by Florea Țuțugan in his monumental book "*Silogistica judecăților de predicație*". In this book he proves that the formal structure of classical logic can be

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extended by introducing in the judgments both positive terms and negative terms. This allows the multiplication of syllogistic moods.

As method for determining these relations, in the paper is used the graphical representation of the relations that exist between the respective terms. This representation ensures the possibility to establish all the judgments that can be stated with two terms within each relation. Also, the method allows to establish the disjunctions of relations for every judgment and, making use of these disjunctions, the relationships between the predication judgments will be determined. Florea Țuțugan in his book gave disjunctions of relations only for fundamental predication judgment without justifying their origin. Also, as method for establishing the other judgments that can be obtained with two terms, positive and negative, he used conversion and obversion of the fundamental judgments.

In the present paper the results obtained by the method used in it, are compared with the ones given by Florea Țuțugan in his book for pointing out the equivalence of the two methods.

II. Brief presentation of Florea Țuțugan's theory

Florea Țuțugan begins his study, carried out in the spirit of classical logic, by representing the seven "unique and well-determinate" relations (*op. cit.* p. 7) discovered between two terms that are elements of the judgment "S is P", called predication judgment. These relations are, according to Florea Țuțugan, "simple and irreducible" (*Ibidem* p. 8) because they cannot be stated by means of others. In the judgment "S is P" copula, the terms or the whole judgment may be affirmative or negative. Also he states that relations between the two terms can be characterized, using subsumption and implication taking into account the extensions of the terms. The judgments of subsumption are judgments whose subject is a class of individuals or cases. The subject of implicative judgments is not class of individuals or cases (*op. cit.*, p. 14), so they have not determinative. Therefore, we can not talk about particular judgments in the case of the implicative judgments.

The shift from a subsumption judgment to an implication one is made easily using the following relations (*Ibidem*, pp. 15-19):

"All A is B" corresponds to "A includes B"
"No A is B" corresponds to "A excludes B"

For particular judgments, it is taken into account the fact that they are the negations of the universals of opposite quality. So:

"Some A is B" corresponds to "A does not exclude B"
"Some A is not B" corresponds to "A does not include B"

The seven relations were divided by Florea Țuțugan into three categories: category I, consisting of two relations (identity and contradiction) represented graphically in two equivalent ways; category II, consisting of four relations (subordination, contrariety, subcontrariety and superordination) each represented graphically in three equivalent ways; category III, consisting of one relation (crossing) represented graphically in four equivalent ways (*Ibidem* p. 9).

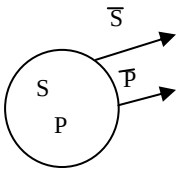
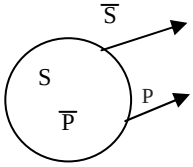
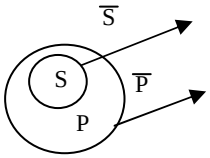
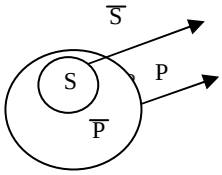
Classical logic did not take into account the relations of contradiction and subcontrariety, it is stated in the cited paper (p. 10) because classical logic was focused exclusively on positive terms. Also, by admitting the two relations between two terms of a judgment represents an extension of traditional logic, because they allow the use of negative terms. In this way, one obtains, in addition, other four judgments (A', E', I', O'), about which Florea Țuțugan states that "they are (...) perfect analogous to the classical judgments, with the only observation that they always have the negative subject" (*Ibidem* p. 12). It should be noted that the predicate of the four judgments is also negative.

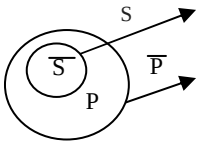
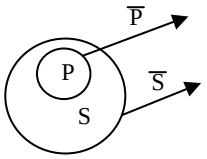
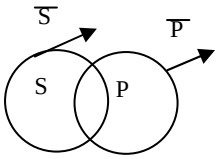
III. Predication judgments for every relation

The seven relations, taken separately, are perfectly and totally determinate, and the disjunction of all constitutes is a totally

indeterminate relation between the two terms (*Idem*). Combinations of two, three, to six irreducible relations are indeterminate (double, triple etc.). These unique and well-determinate relations that may exist between two positive and negative terms, each accompanied by the first graphical representation given by Florea Țuțugan in his book are presented in Table 1. Using the graphical representation, for each relation, all possible subsumption judgments have been established. It should be take into consideration the fact that a universal judgment involves a particular judgment of the same quality. The symbols of the relations in the table are the same as those used by Florea Țuțugan.

Table 1

The symbol and name of the relation	**Relation scheme**	**Possible judgments**
I_1 – identity (equivalence, symmetric implication)		All S is P All P is S Some S is P Some P is S All S̄ is P̄ All P̄ is S̄ Some S̄ is P̄ Some P̄ is S̄ No S is P̄ No P̄ is S Some S is not P̄ Some P̄ is not S No S̄ is P No P is S̄ Some S̄ is not P Some P is not S̄
I_2 – contradiction (exclusion, non-equivalence)		All S is P̄ All P̄ is S Some S is P̄ Some P̄ is S All S̄ is P All P is S̄ Some S̄ is P Some P is S̄ No S is P No P is S Some S is not P Some P is not S No S̄ is P̄ No P̄ is S̄ Some S̄ is not P̄ Some P̄ is not S̄
II_1 – subordination (direct implication)		All S is P All P̄ is S̄ Some S is P Some P̄ is S̄ Some S̄ is P Some P is S Some S̄ is P̄ Some P is S̄ No S is P̄ No P̄ is S Some S is not P̄ Some P̄ is not S Some S̄ is not P Some P is not S̄ Some S̄ is not P̄ Some P is not S
II_2 – contrariety (strict positive exclusion)		All S is P̄ All P is S̄ Some S is P̄ Some P is S̄ No S is P No P is S Some S is not P Some P is not S Some S̄ is P̄ Some P̄ is S Some S̄ is not P̄ Some P̄ is not S̄ Some S̄ is not P Some P̄ is S̄ Some S̄ is P Some P̄ is not S

The symbol and name of the relation	Relation scheme	Possible judgments
II_3 – subcontrariety (strict negative exclusion)		All $\overline{S}$ is P All $\overline{P}$ is S Some $\overline{S}$ is P Some $\overline{P}$ is S No $\overline{S}$ is $\overline{P}$ No $\overline{P}$ is $\overline{S}$ Some $\overline{S}$ is not $\overline{P}$ Some $\overline{P}$ is not $\overline{S}$ Some S is P Some P is S Some S is $\overline{P}$ Some P is $\overline{S}$ Some S is not P Some P is not $\overline{S}$ Some S is not $\overline{P}$ Some P is not S
II_4 – superordination (reverse implication)		All $\overline{S}$ is $\overline{P}$ All P is S Some $\overline{S}$ is $\overline{P}$ Some P is S No $\overline{S}$ is P No P is $\overline{S}$ Some $\overline{S}$ is not P Some P is not $\overline{S}$ Some S is P Some $\overline{P}$ is S Some S is $\overline{P}$ Some $\overline{P}$ is $\overline{S}$ Some S is not P Some $\overline{P}$ is not S Some S is not $\overline{P}$ Some $\overline{P}$ is not $\overline{S}$
III – crossing (implicative indifference)		Some S is P Some P is S Some S is not P Some P is not S Some S is $\overline{P}$ Some $\overline{P}$ is S Some S is not $\overline{P}$ Some $\overline{P}$ is not S Some $\overline{S}$ is P Some P is $\overline{S}$ Some $\overline{S}$ is not P Some P is not $\overline{S}$ Some $\overline{S}$ is $\overline{P}$ Some $\overline{P}$ is $\overline{S}$ Some $\overline{S}$ is not $\overline{P}$ Some $\overline{P}$ is not $\overline{S}$

From the analysis of the Table 1 result:

1. Every type of relation generates sixteen judgments, so that there are 112 judgments in total, of which 32 are universal judgments and 80 are particular judgments; some of them are obtained multiple times.
2. The sixteen judgments of each relation are divided by topic into two groups of eight judgments with the same subject, of which four with positive subject and four with negative subject. Also, the predicates are four positive and four negative. In each group there are, also, judgments with both terms of the same sign. Between the judgments of the two groups of a relation there is asymmetry regarding the function of the terms and symmetry regarding the quality of the terms and judgments;
3. Some judgments (universal or particular, affirmative or negative) characterize more relations;

4. There is no judgment that characterizes all relations.

IV. Disjunctions of relations of the judgments

By ordering the judgments in Table 1 by subject, quantity and quality, we end up with groups of four judgments with the same subject, the same quantity and quality, presented in Table 2. This table highlights the unique and well-determinate relations that characterize each of the judgments. The disjunctions of these relations are the same as those given by Florea Țuțugan, for the eight types of fundamental judgments (*Ibidem* pp. 10-12); he gave them without explanations regarding their obtaining.

Table 2

Judgment	Symbol	Disjunction of the relations	Judgment	Symbol	Disjunction of the relations
A All S is P	SaP	$I_1 \vee II_1$	All P is S	PaS	$I_1 \vee II_4$
All S is $\overline{P}$	Sa$\overline{P}$	$I_2 \vee II_2$	All P is $\overline{S}$	Pa$\overline{S}$	$I_2 \vee II_2$
All $\overline{S}$ is P	$\overline{S}$aP	$I_2 \vee II_3$	All $\overline{P}$ is S	$\overline{P}$aS	$I_2 \vee II_3$
A' All $\overline{S}$ is $\overline{P}$	$\overline{S}$a$\overline{P}$	$I_1 \vee II_4$	All $\overline{P}$ is $\overline{S}$	$\overline{P}$a$\overline{S}$	$I_1 \vee II_1$
E No S is P	SeP	$I_2 \vee II_2$	No P is S	PeS	$I_2 \vee II_2$
No S is $\overline{P}$	Se$\overline{P}$	$I_1 \vee II_1$	No P is $\overline{S}$	Pe$\overline{S}$	$I_1 \vee II_4$
No $\overline{S}$ is P	$\overline{S}$eP	$I_1 \vee II_4$	No $\overline{P}$ is S	$\overline{P}$eS	$I_1 \vee II_1$
E' No $\overline{S}$ is $\overline{P}$	$\overline{S}$e$\overline{P}$	$I_2 \vee II_3$	No $\overline{P}$ is $\overline{S}$	$\overline{P}$e$\overline{S}$	$I_2 \vee II_3$
I Some S is P	SiP	$I_1 \vee II_1 \vee II_3 \vee II_4 \vee III$	Some P is S	PiS	$I_1 \vee II_1 \vee II_3 \vee II_4 \vee III$
Some S is $\overline{P}$	Si$\overline{P}$	$I_2 \vee II_2 \vee II_3 \vee II_4 \vee III$	Some P is $\overline{S}$	Pi$\overline{S}$	$I_2 \vee II_1 \vee II_2 \vee II_3 \vee III$
Some $\overline{S}$ is P	$\overline{S}$iP	$I_2 \vee II_1 \vee II_2 \vee II_3 \vee III$	Some $\overline{P}$ is S	$\overline{P}$iS	$I_2 \vee II_2 \vee II_3 \vee II_4 \vee III$
I' Some $\overline{S}$ is $\overline{P}$	$\overline{S}$i$\overline{P}$	$I_1 \vee II_1 \vee II_2 \vee II_4 \vee III$	Some $\overline{P}$ is $\overline{S}$	$\overline{P}$i$\overline{S}$	$I_1 \vee II_1 \vee II_2 \vee II_4 \vee III$
O Some S is not P	SoP	$I_2 \vee II_2 \vee II_3 \vee II_4 \vee III$	Some P is not S	PoS	$I_2 \vee II_1 \vee II_2 \vee II_3 \vee III$
Some S is not $\overline{P}$	So$\overline{P}$	$I_1 \vee II_1 \vee II_3 \vee II_4 \vee III$	Some P is not $\overline{S}$	Po$\overline{S}$	$I_1 \vee II_1 \vee II_3 \vee II_4 \vee III$
Some $\overline{S}$ is not P	$\overline{S}$oP	$I_1 \vee II_1 \vee II_2 \vee II_4 \vee III$	Some $\overline{P}$ is not S	$\overline{P}$oS	$I_1 \vee II_1 \vee II_2 \vee II_4 \vee III$
O' Some $\overline{S}$ is not $\overline{P}$	$\overline{S}$o$\overline{P}$	$I_2 \vee II_1 \vee II_2 \vee II_3 \vee III$	Some $\overline{P}$ is not $\overline{S}$	$\overline{P}$o$\overline{S}$	$I_2 \vee II_2 \vee II_3 \vee II_4 \vee III$

The table shows the internal logical structure of judgments and confirms the author's assertion that universal judgments are double indeterminate, being the disjunction of two unique and well-determine relations, and the particular judgments are quintuple indeterminate, being disjunction of five unique and well-determinate relations (*Ibidem* p. 11). It is noted that two terms, positive and negative, lead exactly to 32 possible distinct and simple judgments, which is in line with the statements of Florea Țuțugan contained in pages 13-15 of the above-mentioned book, judgments which were written by him without emphasizing their

connection with the graphical representations of the seven unique and well-determinate relations. From the 32 judgments, sixteen are universal and sixteen are particular. As for the subject, sixteen have the subject S and sixteen have the subject P. At the same time, Florea Țuțugan states that these judgments are the only possible disjunctions of the seven irreducible relations enunciated by a simple judgment of the form "S-P" (*Ibidem* p. 12), judgments that can be expressed one by another using negation.

His assertion that "affirmative judgments necessarily comprise the relation I_1 and do not comprise the I_2 relation" (*Idem*) certainly refers only to the A, A', I and I' judgments, since Table 2 shows that affirmative judgments having a single negative term in their composition do not contain in their disjunction the relation I_1 but contain I_2. The author makes a similar observation about the negative judgments as they all include the relation I_2, and they do not include the relation I_1 (*Idem*). It is certain that Florea Țuțugan refers to judgments E, E', O and O', since the Table 2 shows that all negative judgments that contain only one negative term have in their disjunction the relation I1 and do not have the relation I_2.

It can be checked whether Table 2 comprises all the judgments from the Table 1 using the number of distinct universal and particular judgments and the number of relations that make up a disjunction. The calculation results in 112 judgments, equal to the number of judgments from the Table 1.

Analyzing the disjunctions of unique and well-determinate relations characterizing the judgments in Table 2, we can see the following:

1. All universal judgment groups, irrespective of their quality and subject matter, contain the same four different disjunctions of two unique and well-determinate relations, one of the first and one of the second categories. Each disjunction characterizes only a judgment from every group of universal judgments. This means that there is a correspondence between these judgments, correspondence that will be discussed further;
2. All groups of particular judgments, irrespective of their quality and subject matter, are characterized by the same four different

disjunctions of five unique and well-determinate relations, indicating that there is a certain correspondence between these judgments;

3. Relations I_1 (identity), II_1 (subordination) and II_4 (superordination) are components of the disjunctions of universal and particular judgments, which contain no negations or contain an even number of negations;
4. Relations I_2 (contradiction), II_2 (contrariety) and II_3 (subcontrariety) are components of disjunctions that characterize universal and particular judgments that have an odd number of negations;
5. Relation III (crossing) is part of the disjunctions that characterize all and only particular judgments;
6. The disjunctions of the judgments confirm the Aristotelian theory of the conversion of judgments (Aristotel, *An. pr*. I, 2). So:
   a) the disjunctions corresponding to affirmative universal judgments are part of the disjunctions that characterize particular affirmative judgments with the same terms, but in reverse order. As a result, an affirmative universal judgment with either positive or negative terms has as converse a particular affirmative judgment with inverted terms, although the two judgments (universal and particular) are not equivalent. In order for an affirmative universal judgment (All A is B) to have as converse an affirmative universal judgment (All B is A), it is necessary that the only relation existing between its two terms to be of identity, which requires that their extensions to be equal. This requirement is also highlighted by the disjunctions of the two judgments in which the first component is the same (I_1). However, Table 2 shows that for each affirmative universal judgment there is a judgment of the same quantity and quality, but with inverse negative terms, characterized by the same disjunction;
   b) the pairs of negative universal judgments with the same terms, but inverted to each other are characterized by the same disjunction, so they are converse one to other; the same characteristic is also given by the pairs of affirmative

particular judgments, which proves that one is the converse of the other;

c) the pairs of particular negative judgments characterized by the same disjunction have opposing and reversed terms. As a result, the Aristotelian theory of conversion is confirmed, established only for positive terms, as that negative particular judgment has no converse.

If conversion is only meant to preserve the quantity and quality of judgment and the reversal of terms, Table 2 shows that both the universal affirmative judgments and the negative one "can be converted", but by changing the sign of the terms. For example, the judgment "All S is P" is "converse" to the judgment "All $\overline{P}$ is $\overline{S}$", and the judgment "Some S is not P" is "converse" to the judgment "Some $\overline{P}$ is not $\overline{S}$", because the judgments of each pair are equivalent, being characterized by the same disjunction. These are also stated by Florea Țuțugan in his book (*Ibidem* pp. 55-56). In order to decide whether the judgments that make up each of the two pairs can be considered as "converses" one to another, the example method can be used. In the case of affirmative universal judgments, one considers the syllogism of *Cesare* mood:

No dielectric is conductive.
<u>All metals are conductive.</u>
No metal is dielectric.

Applying to it the operations: 1) replacing the minor premise with its equivalent with negative terms "All non-conductors are non-metals; 2) obversion of the major premise: "All dielectrics are non-conductive"; 3) the transposition of the new premises, one obtains the *Barbara* syllogism:

All non-conductors are non-metals.
<u>All dielectrics are non-conductive.</u>
All dielectrics are non-metals.

By obversion of the conclusion and the conversion of the obverse results the conclusion of the given syllogism. Therefore, it can be considered that an affirmative universal judgment with positive terms has as "converse" a universal affirmative judgment with negative and reversed terms.

In the case of negative particular judgments, one considers the syllogism *Bocardo*:

Some artworks are not paintings.
All artworks are artistic products.
Some artistic products are not paintings.

By replacing the premises with their equivalents with negative terms: "Some non-paintings are not non-artworks" and "All non-artistic products are non-artworks" a *Baroco* syllogism is obtained, with the conclusion "Some non-paintings are not non-artistic products" equivalent to "Some artistic products are not paintings". So it can be considered that the negative particular judgment "Some S is not P" has as "converse" the negative particular judgment "Some $\overline{P}$ is not $\overline{S}$".

From the two examples it can be concluded that the use of negative terms, together with the positive ones, leads to the expansion of the conversion.

7. The judgments of Table 2 also check the theory of immediate inferences, as can easily be seen from the comparison of the data in this table with those in Table 3, drawn up after the explanations from Didilescu (*op. cit*. pp. 48-56) for judgments A, E, I and O and completed by us with the judgments A', E', I' and O''.

Table 3

Initial judgment	Conversion	Obversion	Contraposition		Inversion	
			partial	partial	partial	total
A SaP	PiS	Se$\overline{P}$	$\overline{P}$eS	$\overline{P}$a$\overline{S}$	$\overline{S}$oP	$\overline{S}$i$\overline{P}$
E SeP	PeS	Sa$\overline{P}$	$\overline{P}$iS	$\overline{P}$o$\overline{S}$	$\overline{S}$iP	$\overline{S}$o$\overline{P}$
I SiP	PiS	So$\overline{P}$	-	-	-	-
O SoP	-	Si$\overline{P}$	$\overline{P}$iS	$\overline{P}$o$\overline{S}$	-	-
A' $\overline{S}$a$\overline{P}$	$\overline{P}$i$\overline{S}$	$\overline{S}$eP	Pe$\overline{S}$	PaS	So$\overline{P}$	SiP
E' $\overline{S}$e$\overline{P}$	$\overline{P}$e$\overline{S}$	$\overline{S}$aP	Pi$\overline{S}$	PoS	Si$\overline{P}$	SoP
I' $\overline{S}$i$\overline{P}$	$\overline{P}$i$\overline{S}$	$\overline{S}$oP	-	-	-	-
O' $\overline{S}$o$\overline{P}$	-	$\overline{S}$iP	Pi$\overline{S}$	PoS	-	-

V. Relationships between predication judgments

Relationships between judgments are similar to the unique and well-determinate relations that exist between the terms of a judgment. The definitions of these relationships given by Florea Ţuţugan in his book (p. 21) are also used in this paper. For highlighting these relationships, the judgments in Table 2 were ordered after their disjunctions, resulting the Table 4.

Table 4

Universal judgments			
Disjunction of the relations			
I_1vII_1	**I_2vII_2**	**I_1vII_4**	**I_2vII_3**
A All S is P	E No S is P	A' All $\overline{S}$ is $\overline{P}$	E' No $\overline{S}$ is $\overline{P}$
No S is $\overline{P}$	All S is $\overline{P}$	No $\overline{S}$ is P	All $\overline{S}$ is P
No $\overline{P}$ is S	No P is S	No P is $\overline{S}$	All $\overline{P}$ is S
All $\overline{P}$ is $\overline{S}$	All P is $\overline{S}$	All P is S	No $\overline{P}$ is $\overline{S}$
Particular judgments			
Disjunction of the relations			
$I_1vII_1vII_3vII_4vIII$	**$I_2vII_2vII_3vII_4vIII$**	**$I_1vII_1vII_2vII_4vIII$**	**$I_2vII_1vII_2vII_3vIII$**
I Some S is P	O Some S is not P	I' Some $\overline{S}$ is $\overline{P}$	O' Some $\overline{S}$ is not $\overline{P}$
Some S is not $\overline{P}$	Some S is $\overline{P}$	Some $\overline{S}$ is not P	Some $\overline{S}$ is P
Some P is S	Some $\overline{P}$ is S	Some $\overline{P}$ is not S	Some P is not S
Some P is not $\overline{S}$	Some $\overline{P}$ is not $\overline{S}$	Some $\overline{P}$ is $\overline{S}$	Some P is $\overline{S}$

The table contains four groups of universal judgments and four of particular judgments. In each group there are two affirmative and two negative judgments, one with the subject $\overline{S}$ or S and one

with the subject $\overline{P}$ or P. The groups of judgments correspond to the eight types of fundamental judgments, so the first judgment in each group is one of these judgments and is marked with the respective symbol.

From the analysis of the judgments of each group it is found that the second, third and fourth judgments are obtained from the first judgment through conversion and obversion.

Based on Table 4, the relationships between judgments will be determined.

a) Equivalence relationships of the judgments

Two judgments are in the equivalence relationships when they represent the disjunction of the same unique and well-determinate relations.

The definition says that the judgments contained in every groups of the Table 4 are equivalent to each other. Each judgment in a group is equivalent to each of the other three judgments of the same group, due to the symmetry of the equivalence relation. The equivalence of the judgments belonging to a group shows that the relations between the terms of each judgment, terms that vary from the judgment to the judgment within the group, are of the same form. Because of equivalence, each judgment in a group can be reduced, by conversion and obversion, to any of the other three judgments of the same group.

In order to obtain the equivalence of judgment groups, Florea Țuțugan applied conversion and obversion to the eight fundamental judgments, obtaining the same groups of judgments as those in Table 4.

b) Contradiction relationships of the judgments

Two judgments are in a contradiction relationship if they have no unique and well-determinate relation in common, and the sum of their relations is equal to all seven unique and well-determinate relations.

Applying the definition, it follows from Table 4, that each judgment of a group that contains universal judgments has as contradictory judgments, due to equivalence, all judgments of the particular group that do not contain the disjunction of the considered universals, and the sum of the disjunctions of the two groups is equal to the seven unique and well-determinate relations. Thus, for example, each universal judgment from the first group of universal judgments (A-group) is contradictory to all particular judgments from the second group of particular judgments (O-group). As the relation of contradiction is symmetrical, each particular judgment from the second group (O-group) is contradictory to all universal judgment from the first group (A-group). The results are in line with Aristotle's statements from *On Interpretation* (10, 20a, 27-29) "the sentence «Some people are non-right» follows from the sentence «Some people are not right» which is opposite to «Every man is right»". Since the phrase "follows from" has the meaning "is equivalent to", the universal judgment has as contradictory the two equivalent particular judgments. Because the relation of contradiction is symmetrical, the two individuals have as contradictory the same universal.

As Florea Țuțugan considered only the eight fundamental judgments, he gave the following contradiction relationships:

A-O; E-I; A'-O'; E'-I'

specifying that they are symmetrical.

Considering also the negation operation, the particular judgments are the denial of universal judgments of opposite quality, and vice-versa, universal judgments are the denial of particular judgments of the opposite quality. Consequently, the knowledge of one also determines the knowledge of the other. So, universal judgments are equivalent to the denial of particular judgments of opposite quality, and vice versa, particular judgments are equivalent to the denial of universal judgments of opposite quality. Due to these properties, the 32 judgments can be divided into four groups of equivalent judgments, each group

having eight judgments of which four universal and four particular, but of the opposite quality. These groups are made up of judgments corresponding to the association of the above-mentioned fundamental judgments.

c) Subordination (subalternation) of the judgments

A judgment is found in a relationship of subordination to another judgment if the first judgment includes in addition to the relations of the second judgment at least one unique and well-determinate relation.

From the analysis of the judgment disjunctions, it is found that the disjunction of each group of universal judgments is part of two disjunctions of particular judgments. As a result, two universal judgments in a group have subordinates (subalterns) in one of the two groups of particular judgments, and the other two universal judgments have their subordinates (subalterns) in the second group of particular judgments. For example, each of the first two universal judgments from the first group of universal judgment (A-group) has as subaltern, in the same order, one of the first two particular judgments from the first group of particular judgments (I-group), and the last two universal judgments of the first group of universal judgments (A-group) have as subaltern the last two judgments from the third group of particular judgments (I'-group). The disjunctions of the two groups of particular judgments have in their composition the disjunction $I_1 \vee II_1$ of the first group of universal judgments (A-group). Since the two particular judgments in a group, although of different qualities, are equivalent, each universal judgment can be considered to have two subalterns. They agree with the results of Florea Țuțugan (*op. cit*. p. 23):

A-I, I'; A'-I, I'; E-O, O'; E'-O, O'

d) Superordination (superalternation) relationships of the judgments

A judgment is in a relationship of superordination to another judgment if the second judgment includes, besides the relations of the first judgment, a unique and well-determinate relation in addition. These relationships are the inverse of subordination relationships, that is, each particular judgment has as superalterns two universal judgments.

e) Contrariety relationships of the judgments

Two judgments are in contrariety relationships if they have in common no unique and well-determinate relation, and their sum is not equal to the seven unique and well-determinate relations. The contrariety characterizes the universal judgments of the opposite quality. Investigating the disjunctions of the universal judgment groups from Table 4 it has been found that for each group there are two other groups with which it has no common relation. Consequently, two of the judgments of each group have the contraries in one of the two groups, and the other two judgments in the second group with which it has no unique and well-determinate common relation. For example, it is considered the first group of universal judgments (A-group), in which the first two judgments have as contraries the first two judgments of the second group (E-group), and the last two universals of the first group (A-group) are contraries to the last two judgments of the fourth group of universal judgments (E'-group). However, due to the equivalence of the judgments in a group, it can be considered that each judgment in a group is contrary to all the universal judgments of the other group. This property also includes symmetry. These are consistent with the results of Florea Țuțugan (*Ibidem* p. 25), with the specification that he limited himself only to the fundamental judgments (A, A', E and E').

f) Subcontrariety relationships of the judgments

Subcontrariety characterizes particular judgments. Two judgments are found in a relationship of subcontrariety if they share at least one unique and well-determinate relation and each has at least one unique and well-determinate relation in addition to the other.

Applying the above definition to the four groups of particular judgments it is deduced that the first group of particular judgments has as subcontraries the second and the fourth groups. Therefore, the first two judgments of the first group of particular judgments (I-group) have as subcontraries the first two judgments from the second group (O-group), and the two following judgments from the first group (I-group) have as subcontraries the last two judgments from the fourth group of particular judgments (O'-group).

The third group of particular judgments (I'-group) contains the subcontraries of the other judgments from the second and fourth particular judgments. The first two judgments of the third group (I'-group) are the subcontraries of the first two judgments from the fourth group (O'-group), and the next two judgments from the third group (I'-group) have as subcontraries the last two judgments of the second group (O-group).

As in the case of the contrariety relationship, due to the equivalence between the particular judgments of a group and the symmetry of subcontrariety, each particular judgment is subcontrary of the other particular judgments of the respective groups.

These coincide with Florea Țuțugan's assertion (*Ibidem* p. 25) that there are the following groups of subcontrariety:

I - O; I-O'; I'-O; I'-O'

g) Crossing (implicative indifference) relationships of the judgments

The relationship between judgments is of implicative indifference when, reciprocally, the truth or falsity of a judgment does not imply neither the truth nor the falsity of the other judgment.

Two judgments are in a crossing relationship or implicative indifference if they share at least one unique and well-determinate relation and each has at least one relation in addition to the other, but their sum does not equal to the seven unique and well-determinate relations.

From Table 4, by applying the definition, the following eight pairs of groups of judgments are identified in terms of implicative indifference:

1. Universal judgments
   – the first group (A) with the third group (A')
   – the second group (E) with the fourth group (E')
2. Universal judgments with particular judgments (written in this order)
   – the first group (A) with the fourth group (O')
   – the second group (E) with the third group (I')
   – the third group (A') with the second group (O)
   – the fourth group (E') with the first group (I)
3. Particular judgments
   – the first group (I) with the third group (I')
   – the second group (O) with the fourth group (O')

For all these relationships existing between the 32 judgments that can be obtained with two terms, both positive and negative, Florea Țuțugan gave several representations, of which it was chosen that similar to "Boethius' opposition square", with the difference that all the judgments corresponding to the fundamental ones written in the figure 1 are at the vertices of the squares.

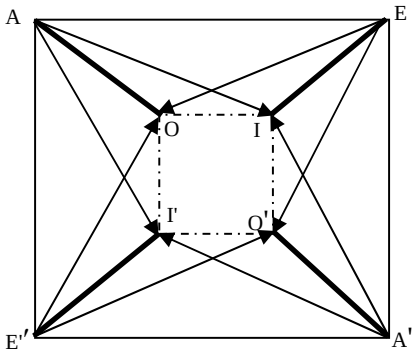


Figure 1

In Figure 1 the sides of the outer square signify contrariety relations; the sides of the inner square indicate subcontrariety relationships; the lines joining the vertices of the two squares indicate the contradictory relationships; the arrows mean the relationships of subordination (subalternation) or superordination (superalternation) respectively; the implicative indifference relationships were not shown because the figure is full.

Since the eight judgments written on the vertices of the squares are the representatives of the eight groups of equivalent judgments, it is to be understood that there are four judgments in each vertex.

VI. Conclusions

Between the extensions of two positive and negative terms, there are seven unique and well-determinate relations (identity, contradiction, subordination, superordination, contrariety, subcontrariety, and crossing) that generate 32 simple and distinct, universal and particular judgments; the number of universal judgments is equal to that of particular judgments.

Any judgment is represented by a disjunction that depends on the type of judgment: in the case of the universal judgments it consists of two unique and well-determinate relations, and in the case of particular judgments it is made up of five unique and well-determinate relations.

For each category of universal or particular judgment, four separate disjunctions are obtained, which divided every category into four groups of four judgments (Table 4); each group is represented by its own disjunction.

This division of judgments allowed: 1) to determine the relationships between judgments, which are of equivalence, contradiction, subordination (subalternation), superordination (superalternation), contrariety, subcontrariety and crossing; 2) proves the validity of the theory of Aristotelian conversion and the theory of immediate inferences.

The method used in this paper for determining the relationships between the predication judgments, by enunciating all the judgments

that characterize each unique and well-determinate relation existing between two positive and negative terms, has allowed the determination of the disjunctions of all these judgments. It has led to the same results as those of Florea Țuțugan, who used the conversion and obversion of the eight fundamental judgments and who did not explain how he established the disjunctions that characterize these judgments. Also, the method used in this paper allows to verify Aristotle's theory of the judgment conversion and leads to its extension when the two terms of a judgment are positive and negative.

The fact that the two methods have achieved the same results proves their equivalence.

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DOES THE HIDDEN INDEXICAL THEORY OF BELIEF REPORTS HAVE A LOGICAL FORM PROBLEM?

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Abstract. On the hidden indexical theory of belief reports (Crimmins and Perry 1989), believing the proposition that Mark Twain was a writer is believing it under a mode of presentation. This view faces the logical form problem (Schiffer 1992): belief is said to be a relation between three arguments (agent, proposition, mode of presentation), yet the predicate "believes" is a relation between just an agent and a proposition. I sketch two solutions to the problem, one semantic and one pragmatic (Larson and Ludlow 1993, Jaszczolt 2000). Both solutions involve quantifying not only over modes, but also over types of modes of presentation. I conclude with a methodological argument in favor of Jaszczolt's solution.

Keywords: *belief reports; logical form; hidden indexical theory; semantics-pragmatics interface.*

1. Introduction

This essay is concerned with belief reports, sentences like "John believes that the sky is blue", "Mary does not believe that John is insane" and "Tom believes that the mayor is not corrupt".[2] How belief reports should be theorized has proven to be a difficult question. One theory that has been advanced is the hidden indexical theory (Crimmins and Perry 1989, pp. 689-706; Schiffer

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[2] In what follows, I will only use examples of belief reports formulated in English.

1992, pp. 500-509). According to this theory, when John believes the proposition that Mark Twain was a writer, he believes that proposition under a mode of presentation. The mode of presentation is invoked so as to provide an explanation of the failure of substitution *salva veritate* in belief contexts.[3]

One problem that has been formulated for this theory is the logical form problem, which arises, cf. Schiffer (1992, pp. 518-521), by accepting two claims. First, according to the hidden indexical theory, belief is a relation between three arguments: an agent, a proposition, and a mode of presentation, and the mode of presentation under which an agent believes a proposition should be specified in the logical form of the belief report. Second, inspection of natural languages such as English reveals that the predicate "believes" in the public lexicon (and many of its natural language translations in, e.g., French, German etc.) is a relation between just two arguments, namely, an agent and a proposition, and this prevents introducing modes of presentation in the logical form of belief reports. My essay attempts to assess whether the hidden indexical theory can give a satisfactory answer to this logical form challenge raised by Schiffer.[4] The essay is concerned only with the logical form problem, and does not attempt to globally evaluate either the hidden indexical theory of belief reports, or other challenges that have been adduced to it.

The plan of the paper is the following. I first briefly present the failure of substitution *salva veritate* in belief contexts, the

[3] For example, modes of presentation are invoked in order to show how it can be possible for John to believe that Mark Twain was a writer, while not believing that Samuel Clemens was a writer, in spite of the identity of Mark Twain with Samuel Clemens. By invoking modes of presentation, the hidden indexical theorist claims that John can believe the former and dissent from the latter because he is not thinking of Mark Twain under the mode of presentation of being identical to Samuel Clemens, nor is John thinking of Samuel Clemens under the mode of presentation of being identical to Mark Twain. I will elaborate on this explanation in what follows.

[4] In particular, I will be concerned with some of the replies given in the exchange between Schiffer (1992, 1995, 1996, 2000) and Ludlow (1993, 1995, 1996, 2000).

problem that mainly motivates the hidden indexical theory, and I sketch how the theory attempts to solve that problem. I then provide a first analysis of the notion of modes of presentation that the hidden indexical theory uses, and argue in favor of quantifying not only over modes, but also over types of modes of presentation. I then attempt a thorough articulation of the logical form problem, and sketch two alternative solutions to the problem, a semantic solution advanced by Larson and Ludlow (1993, pp. 316-325), and a pragmatic solution advanced by Jaszczolt (2000, pp. 176-182). I conclude with a methodological argument in favor of Jaszczolt's solution, according to which (a) a pragmatic solution to the logical form problem is preferable to a semantic solution, and (b) Jaszczolt's default semantics for belief reports allows for an elegant explanation of why, how and when quantification over both modes of presentation and types of modes of presentation is introduced.

2. Failure of substitution *salva veritate* in belief contexts

One of the core phenomena that belief reports exhibit, and the phenomenon that mainly motivates an approach along the lines of the hidden indexical theory, is the phenomenon of the failure of substitution *salva veritate* in belief contexts. Consider (1)-(3).

(1) Whistler believes that Hesperus shines brightly.
(2) Whistler believes that Phosphorus shines brightly.
(3) Hesperus is identical to Phosphorus.

Suppose that the painter Whistler, when looking at the morning sky, sees Hesperus, and he believes the star he is seeing shines brightly. The star he is seeing is Venus, which is named both "Hesperus" and "Phosphorus". By disquotation, we obtain that Hesperus is identical to Phosphorus, that is, (3). Whistler, however, does not know that Phosphorus is identical to Hesperus, and when he sees Hesperus (which he knows under the name of "Hesperus"), (1) would describe or characterize (Bach 1997, §3) what he believes, but (2) would not. Substituting the proper name "Hesperus" in (1) with the proper name "Phosphorus" would

result in (2). But (1) is true and (2) is false, as characterizations of Whistler's belief state. So the substitution is not truth preserving – there is a failure of substitution *salva veritate* of two coreferential proper names, "Hesperus" and "Phosphorus".[5]

3. The hidden indexical theory of belief reports

Attempting to solve the problem of the failure of substitution *salva veritate* in belief contexts is one of the main motivations for considering the hidden indexical theory of belief reports. According to this theory, belief is a relation between three arguments: an agent, a proposition, and a mode of presentation. The propositions being believed are construed, on this account, as being mode-of-

[5] The phenomenon of substitution failure is by no means unique to coreferential proper names. If we were to replace the name "Hesperus" with the definite description "the morning star", and the name "Phosphorus" with the definite description "the evening star", we would be able to describe Whistler's resulting beliefs in complete analogy with (1)-(3). The reason why it is preferable to discuss the case of proper names is that here the discrepancy between semantic values in what Whistler believes is the greatest: it is contingent upon our physical universe that the descriptions "the morning star" and "the evening star" pick out the same object, namely, the planet Venus, given that definite descriptions are non-rigid designators (Kripke 1980). Their coreference is contingent because, in a non-actual but logically possible world, the morning star might have been different from the evening star: perhaps Venus would have shone brightly in the morning, but the Moon would have shone brightly in the evening, etc. But a proper name is a rigid designator, that is, it refers to one and the same object in all logically possible worlds at which that object exists, and it refers to nothing at the worlds at which that object does not exist (Kaplan 1978, p.329). So if "Hesperus" and "Phosphorus" refer to the same object in one world (as they do, since they both refer to the planet Venus in the actual world), then both names refer to the same object in all possible worlds at which that object exists. Switching to definite descriptions instead of proper names, for instance, or offering different accounts of how proper names or definite descriptions designate, would, I submit, change little in the terms in which the logical form problem for the hidden indexical theory of belief reports is raised.

presentation-free singular propositions (Kaplan 1978, p. 328). What Whistler believes in (1) is (4), which is represented as a singular proposition in (5). The belief report in (1) could then be made fully explicit in (6), which would then be represented as the belief of a singular proposition in (7). (2) would be made fully explicit by (8) and would be represented by (9):

(4) Hesperus shines brightly.
(5) <Hesperus, the property of shining brightly>
(6) Whistler believes that Hesperus shines brightly under the mode of presentation *m*.
(7) Believes (Whistler, <Hesperus, the property of shining brightly>, *m*)
(8) Whistler believes that Phosphorus shines brightly under the mode of presentation *m′*.
(9) Believes (Whistler, <Hesperus, the property of shining brightly>, *m′*)

Given the representations (7) of (1) and (9) of (2), the failure of substitution is explicable by the difference between the two associated modes of presentation *m* and *m′*. (7) and (9) present a singular proposition differently, so if Whistler assents (in reporting on himself in the third person) to (7) and dissents from (9), he is not contradicting himself, but merely revealing his ignorance of the truth expressed by (3).

This theory of belief reports is called "the hidden indexical theory" for two reasons. First, it is called "hidden" because no expression referring to the mode of presentation appearing in (7) is present in (1). Likewise, no expression referring to the mode of presentation appearing in (9) is present in (2). Second, the theory is called "indexical" because modes of presentation are assigned to propositions contextually. In the context of Whistler's believing the proposition identical to (5) and expressed by (4), (5) is assigned a mode of presentation as in (7). Likewise, in the context of Whistler's believing the proposition (5) but expressed by (2), (5) is assigned a mode of presentation as in (9). The difference between *m* and *m′* is meant to account for Whistler's possible assent to (1) and dissent from (2).

4. Modes of presentation under which propositions are believed

The expression "mode of presentation" has been surrounded by many philosophical debates, and there are many ways in which it can be used, some of which are surveyed in (Schiffer 1992, p. 511). I will follow Schiffer in qualifying the representations in (7) and (9) in two respects. In both qualifications, the guiding consideration is that modes of presentation (hereafter, MoPs) are private to believers in contexts of believing. But the hidden indexical theory (hereafter, HIT) is a theory of the semantics and part of the pragmatics of belief reports, not a theory of the psychology of believers (Ludlow 2000, p. 35). So we have to distinguish contexts in which (1) and (2) are assessed for truth or falsehood from contexts in which Whistler is in certain mental states. These contexts may coincide given special assumptions, but they may differ in the general case. To see this, suppose the belief report were in the past tense: "Whistler believed that Hesperus shines brightly". Here, Whistler's believing is in the past of the time of the context at which the sentence is evaluated for truth.

Given that *m* and *m′* are MoPs private to Whistler's psychology (no matter how and whether they may further be theorized or whether they are just useful theoretical fictions),[6] what is needed in representing how (1) and (2) differ is something accessible to both the speaker and the hearer in a context in which (1) and (2) are evaluated, and each of these persons may differ from Whistler. So the MoP of the speaker who reports Whistler's belief in (4) and the MoP of the hearer who understands Whistler's belief in (4) also have to be considered in the contextual evaluation as true or false of (1) and (2), respectively. One solution that has been advanced (Schiffer 1992, p.503) is to say that all three MoPs belong to the same type of modes of presentation (hereafter, a MoP-type),

[6] For Schiffer (1992, p. 503), MoPs are functional, in that any entity whatsoever can be used to distinguish the truth of (1) from the falsehood of (2). For Crimmins and Perry (1989, p.688), in contrast, MoPs are particular cognitive structures. In this paper, I will adopt Schiffer's view. However, once again, little hangs on this theoretical choice.

and that this MoP-type is a bundle of contextually-salient properties which determine a set of MoPs, to which *m*, *m′*, and whatever MoPs the speaker and hearer may have must belong in order for the proposition expressed by (4) to be interpretable by either Whistler, the speaker or the hearer.

Moreover, given the many possible MoPs involved in the evaluation of (1) and (2), either across agents (e.g., Whistler, speaker, hearer) or across times (e.g., present, past), "*m*" and "*m′* ", as proper names for MoPs, can no longer serve their explanatory purposes because, given the privacy of MoPs, there is no way of telling whether any two time-agent pairs agree in their MoPs or not. So proper names of MoPs have to give way to an existential generalization over MoPs. Given these two qualifications, (1) and (2) are both partly represented as (10), and so as (11).

(10) There is a MoP *m* such that it belongs to a MoP-type Φ determined by a bundle of contextually-salient features, and Whistler believes that Hesperus shines brightly under the mode of presentation *m*.

(11) (∃*m*)(Φ*m* & Believes (Whistler,<Hesperus, the property of shining brightly>, *m*)

There are at least two reasons why (10) is theoretically useful. First, it provides a partial representation of (1) and (2) that contains one and the same MoP-free singular proposition, thereby capturing the Russellian intuition of there being a single proposition to which Whistler stands in a relation of believing or not. The difference between (1) and (2) will show in the substitution instances of the existentially quantified formula. Returning to (7) and (9) with the additional assumption that both *m* and *m′* belong to the contextually-determined MoP-type Φ, we will be able to say that (1) is true because (7) is true, and (11) is an existential generalization of it, while (9) is false, thereby accounting for the falsehood of (2). To elaborate on (2): it is false that Whistler believes that Phosphorus shines brightly (2) because the triple <Whistler,<Hesperus, the property of shining brightly>, *m′*> does not belong to the extension of the relation "believe" when *m′* depicts Venus as named by "Phosphorus". (1) and (2) will

semantically express the same kind of proposition, that depicted in (11) and stated in (10), but (1) will be represented by a true instance of (11) and (2) will be represented by a false instance of (11). (11) itself, as an existential generalization, will be true.

5. A proposal: quantifying over types of modes of presentation

Notice that, given the MoP-type Φ in (11) is not quantified over, all of (7), (9) and (11) are propositions expressed in one and the same context, namely, that which antecedently determined Φ. Both Schiffer (1992, p. 503 passim), as well as more recent expositions of HIT (Bach 1997, §1) seem to overlook the fact that a fully general account would have to quantify over Φ, thereby giving a result such as:

(12) $(\exists\Phi)(\exists m)(\Phi m$ & Believes (Whistler, <Hesperus, the property of shining brightly>, $m)$

This would be needed because it would be unsatisfactory to relegate Φ to the context but explicitly quantify over Φ's members, the MoPs under which (4) is believed by Whistler, or such a belief is attributed to him. The same reasoning has to apply to both Φ and *m*, and if *m* is introduced in the representation (11), so should Φ.

Once Φ is quantified over, (12) is evaluable not only relative to one context, but it introduces reference to a context in the index, and allows for representing how the speaker and hearer reporting on Whistler's beliefs differ from Whistler himself. In reporting on Whistler's belief, the reporter Mary, in speaking to the hearer John, will have modes of presentation *m* (for Mary) and *m′* (for John) that will share the contextually-salient type of MoP Φ, but if Whistler himself were to report (in the third person, as it were) his own belief attitude, he would do so by means of a MoP, *m′′*, belonging to a different MoP-type, Φ′′. This will not change the logical form of the sentence-type (1), since MoPs and types thereof are contextually inserted. Mary the speaker and John the hearer will have different MoPs, *m* and *m′*, but will share their Φ; Whistler reporting on himself and any of them will have not only

different MoPs (*m''* for Whistler), but also a different type of MoP, (Φ'' for Whistler) since the contexts differ.

Two things are worth noting here. First, the differences between Mary, John and Whistler affect (11), since Whistler is reporting himself to be believing in a context that determines Φ'', as opposed to Φ. But (12) is not affected by the difference, since (12) existentially generalizes over Φ and Φ'', and over all other contextually-salient MoP-types.

The second thing to notice is that if the distinction between semantics and pragmatics is to be kept clear, there has to be a way of omitting reference to Φs and MoPs altogether, so that we could then ask how a possibly MoP-free interpretation of (4) and a MoP-relative interpretation of (1) are related to each another. I will come back to this issue, with which Jaszczolt's solution to the logical form problem makes headway.

6. The logical form problem for the hidden indexical theory

Schiffer objects to the HIT analysis of (1) and (2) along the lines of (11) by insisting that "believe" is a two-place predicate specified in the public lexicon of English, while the "believe" relation that HIT invokes is a three-place relation, with MoP-types appearing as third arguments. Unfortunately, neither Schiffer (1992, 1996) nor Ludlow (1995, 1996) clearly distinguish between the following four distinct issues.

A first challenge that is subsumed under the name "the logical form problem" is that, on the one hand, the English predicate "believe" is a two-place predicate, while the analysis HIT provides for (1) in terms of (6) – and then (10) under Schiffer's own reformulation – "believe" is a three-place predicate. This challenge concerns the adicity of "believe" (Ludlow 1996) and it is a problem about a specific lexical item of English, namely, the predicate "believe".

A second challenge is that "believe" is known, and used by English speakers, with the assumption (be it correct or not), that

those speakers share a common, public language, English, in which the word "believe" is a two-place predicate. How are their intuitions to be explained away if "believe" is, as HIT maintains, actually a three-place predicate? This challenge concerns the public knowledge of the English lexicon.

A third challenge concerns the English syntax of belief reports. There is a clear difference between (1) and (6), given by the phrase "under the mode of presentation *m*". What is the status of this phrase? In particular, is it an argument of the predicate "believe" or is it an adjunct? Here is a dilemma prompted by the question. If "under the mode of presentation *m*" is an argument, why is it missing in (1)? Are we to interpret all belief reports like (1) as elliptical sentences? On the other hand, if the phrase is an adjunct, an undesirable consequence is apparent. According to HIT, (6) is needed to allow for a plausible truth-evaluation of (1), as a result of the truth evaluation of (6). But (1) is a perfectly grammatical English sentence even in the absence of (6). So syntax and semantics come apart, given that, syntactically, the phrase "under the mode of presentation *m*" is optional, turning (1) into (6). Yet semantically, according to HIT, it is mandatory if the truth evaluation of (1) is to respect our pre-theoretical intuitions concerning ordinary cases of belief attribution.

A fourth challenge is that MoPs and their types are obscure entities, belonging to a metaphysics associated to either cognition proper, or pragmatics; how does appeal to them affect the semantic interpretation of a belief attribution? Are they necessary, from an explanatory point of view? If they are, as the difference between (1) and (2) and the substitution failure seem to suggest, is the pessimistic conclusion we should draw that semantics essentially depends on pragmatics? If so, is there any way of displaying the logical form of the *sentence* (1) such that the logical form in question stay the same across contexts of utterance? Such an LF seems required by grammatical theory (Chomsky 1995, pp. 1-13), and failure to provide one would divorce syntax from semantics-*cum*-pragmatics. And, if an LF for (1) were to be provided, what would the relation be between that and (7), (11), or (12)?

7. The adicity of "believe" and public knowledge of English

To a certain extent, determining whether "believe" is a two-place or three-place predicate depends on how the other three challenges are answered. But one can already clearly distinguish two positions. One is Schiffer (1992), for whom, if the word "believe" is two-place, that constrains our interpretation of any utterance of (1) to contain a two-place relation interpreting that predicate.[7] *The step here is from a premise in semantics about word-types to a conclusion in pragmatics about word-tokens*. Bezuidenhout (2000, pp. 145-153) adopts the opposing view: interpreting belief reports is something extremely context-sensitive, and many pragmatic processes intervene before we can evaluate (1) for truth. In particular, it is not *a priori* excluded that "believe" contextually receive an extra-argument, as in (6).[8]

If the third argument were to appear at the level of pragmatics, it would explain why the representations of (4) and (1) differ: (5) does not contain a MoP, while (7) does. (7), in its turn, would have that MoP and its type Φ because those would be required by interpreting the belief report in context, and consequently Φ and its member MoPs would be only contextually selected. Given that the third argument of "believe" in (7), the MoP, is inserted only contextually and relative to the agent undergoing[9] (or ascribing) the belief in (1), the English verb

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[7] It is interesting to note that the adjective "pragmatic" does not even occur in the text body of Schiffer (1992).

[8] Bezuidenhout represents an extreme contextualist view, while Schiffer takes the anti-contextualist line. An intermediate view is that of Jaszczolt (2000, pp. 179-180), for whom what is contextually enriched, loosened, transferred, etc. is not the literal meaning of (1), but its *default* interpretation, which may differ from (1). I will return to Jaszczolt's view below.

[9] A similar move has been made at the semantics-cognition interface. Schiffer's pure semantics view can be contrasted with Salmon (1986), who distinguishes how the English predicate "believe" should be interpreted from how an agent's being in a belief state should be characterized. Salmon distinguishes between the semantic "belief" relation, which is two-place, and the "metaphysical" three-place relation holding between

"believe" can still be specified as two-place in the public lexicon, thereby also satisfying Schiffer's worries (1995) concerning the publicity of lexical knowledge.[10]

8. "Under mode of presentation *m*": argument or adjunct?

The third challenge Schiffer raised concerns whether "under the mode of presentation *m*" in (6) should be interpreted as an adjunct or as an argument of the "believe" relation. The challenge crucially depends on the assumption that MoPs are linguistically present or represented. Some theorists (Ludlow 1996, p. 101) accept this assumption, others deny it.[11] In what follows, I will focus on two

an agent, a singular MoP-less proposition, and a "guise", his term for a MoP, with the qualification that MoPs here are not to be understood in a Fregean manner, but, as *per* Schiffer, functionally – they can be anything that adequately distinguishes (7) from (9).

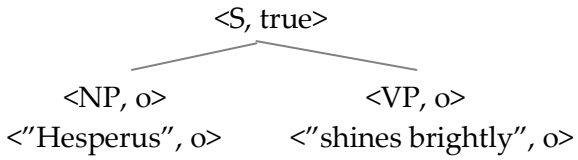
[10] This solution seems superior to that advanced by Ludlow (2000, p. 38), according to which Schiffer is mistaken in taking an external perspective on grammar and the lexicon, when the better perspective (by Chomskyan standards) is an internalist one. In this paper, I do not adopt Ludlow's suggestion for two reasons. First, as a research tactic, it is not advisable that an intricate topic like how belief reports are to be theorized should come to depend on opposing methodological and metaphysical assumptions such as internalism vs. externalism if that can be avoided. And, secondly, it seems that the internalist stance can be avoided: Jeffrey King (1994) is both an externalist and a Chomskyan. Moreover, the pragmatic line developed by Bezuidenhout and Jaszczolt seems to provide a more efficient reply to Schiffer's adicity challenge, despite the fact that Jaszczolt is an externalist about the objects of *de re* beliefs, while Bezuidenhout has an avowedly Fregean approach.

[11] According to Ludlow (1996, p.101), the adjunct of the "believe" relation can be represented by a rule of the form VP → V S A. For example, in keeping with the way Larson and Ludlow (1993, pp.305-315) represent MoPs, the VP "believe that Hesperus shines brightly" would be analyzed as "believe" (V) "Hesperus shines brightly" (S) "under the mode of presentation 'Hesperus shines brightly' " (A). I will not pursue Ludlow's analysis in this respect, because the rule VP → V S A does not agree with the Government & Binding (GB) constraint that a rule for a phrase have only one argument per projection. Perhaps the rule could be amended as

versions of the option according to which MoP insertion requires neither the introduction of a third argument at the level of logical form or at that of the phrase-marker, nor the introduction of an adjunct.[12]

According to Larson and Ludlow (1993, pp. 305-324), "Hesperus shines brightly" ought to be represented as (13), while "Phosphorus shines brightly" ought to be represented as (14):[13] these are interpreted logical forms (hereafter, ILFs).[14]

(13)



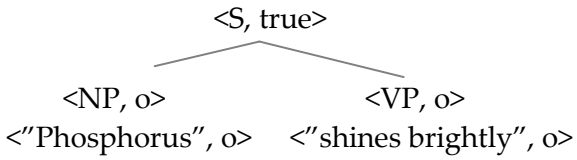
follows: VP → V′ A; V′ → V^0 S. Of course, matters are more complicated in the GB framework, because introduction of an inflection phrase is necessary, e.g., for specifying tense. According to the strategy I sketch in the text, one put forward by Larson and Ludlow (1993, pp. 305-315), MoPs need not be specified separately from what they are MoPs of, i.e., what they present in the proposition. Given this, it seems that the mere possibility of introducing MoPs as adjuncts, as in (6), is neither a hindrance nor a help to theorizing about belief reports, so a rule of the form VP → V S A would not be theoretically or explanatorily economical.

12 Ludlow (1995, p.107) also makes the important point that both adjuncts and arguments can be quantified into, so (11) is not worse off, as a problem case for representing the proposition expressed by (4) in reporting Whistler's belief in it, than (6), which is HIT's initial representation.

13 The representations (13) and (14) are not, strictly speaking, ILFs: "shines brightly" ought to be analyzed further into a V and an AdvP, whose first projection is Adv and then "brightly". Moreover, an inflection phrase IP specifying the tense, aspect and mood should be introduced, and, if a generative morphology is assumed, "brightly" would be analyzed in terms of the adjective "bright" and "-ly". But (13) and (14) serve the purpose of identifying the MoPs used in an ILF with the words themselves.

14 Larson and Ludlow are committed, by the analysis of (13) and (14), to saying that MoPs figure in the logical form of (1) and (2), since ILFs are identical to logical forms. Jaszczolt's solution below inserts MoPs (in certain circumstances) to propositions expressed by (1) and (2) in context, not to the sentence-type itself, and this seems to be a point in favor of its theoretical economy.

(14)



In (13) and (14), propositions wear their MoP on their sleeve: the words themselves are MoPs of the objects they designate, and the sentence is a MoP of truth or falsehood (as the case may be). Larson and Ludlow develop a fully recursive semantics for ILFs, starting with base clauses indicating how words are assigned designations. On their account, (1) will be able to be true when (2) is false because Whistler will be thinking of Venus under the MoP "Hesperus" in assenting to (1) while he will be thinking of Venus under the MoP "Phosphorus" in assenting to (2). Their account still keeps one of the insights of singular propositions: lacking an object, the ILF will only display words, and it will not be true of anything (in particular, it will not be true of MoPs, the words themselves).

One sees how Larson and Ludlow answer the problem of adjunct *versus* argument. For them, there is no separate adjunct to "believe" and its arguments; rather, the (linguistic) MoPs, the words themselves, are included in the ILF, and the ILF is the second argument of "believe". Since (13) and (14) display different ILFs, Whistler's belief attitude towards (13) and his non-belief attitude towards (14) will be mirrored by the difference in truth value between the respective belief reports, namely, (1) and (2).

9. Preferring a pragmatic solution to the logical form problem to a semantic solution

A feature of the Larson-Ludlow approach to the "adjunct or argument" challenge is that they modify the semantics of the proposition being believed so as to account for the difference between (1) and (2). How they answer the logical form problem results from the particular details of their view developed in agreement with this principle. But one may wonder whether it

may not be more economical, from an explanatory point of view, to leave the semantics of the propositions taken as arguments by the "believe" relation unchanged, and merely alter the pragmatics.

On Bezuidenhout's view, strong pragmatic effects occur in interpreting a belief report, and these effects do not change the semantic input to the contextual interpretation of the reports. Given that Bezuidenhout's (2000, p. 139) view claims to be both Fregean and strongly contextualist, I propose to look at a less extreme theoretical possibility which also emphasizes the role of pragmatic interpretation: Jaszczolt's (2000, p. 176) view.

Unlike Bezuidenhout, Jaszczolt differentiates between the default interpretation of (1) and its literal meaning. For Jaszczolt, only the default interpretation of (1) can be pragmatically enriched, and it can only be enriched once there are contextual cues that the intended interpretation of the report is not its default interpretation. In particular, on Jaszczolt's view, the default reading of a belief report is the *de re* reading:

(15) Whistler believes of Hesperus that it shines brightly.

On Jaszczolt's view, (15) is the default interpretation and contextual cues would depart from the default to provide a *de dicto* reading, corresponding to (1), which may be either pure (*de dicto* proper) or mixed (*de dicto*$_1$), according to whether the reporter of (1) manages to herself have an appropriate *de re* attitude concerning the object of Whistler's belief, or whether her attitude suffers from referential failure or is *de dicto* proper itself. For example, if the reporter is Mary, (1) can be reported sincerely in either of the following:[15]

[15] The examples are my own. Jaszczolt (2000, p. 172) only gives the example "Ralph believes that Smith is a spy, although he mistakenly calls him Ortcutt". This example is problematic on at least two accounts. First, it is not clear whether "he mistakenly calls him Ortcutt" is part of the sentence asserted in context, so it would come to enter evaluation in any context, or whether it is a specification of the context of evaluation. Second, there is no need to assume that it is Ralph who is referentially mistaken, rather than the speaker who reports on Ralph's beliefs: the essential point, present in both contexts, is that there is failure in coreference between the reporter and Ralph. Third, proper names are treated as predicates in

(16) Mary believes of Hesperus that Whistler believes it shines brightly. [*de re*]
(17) Mary believes of the Moon that Whistler believes it shines brightly. [*de dicto*$_1$, reference failure, Mary assumes the Moon is, under a MoP-type similar to hers, the object of Whistler's belief]
(18) Mary believes that Whistler believes that the object that happens to be believed by Whistler to be Hesperus shines brightly. [*de dicto* proper]

10. The *de re* default and the meta-types of modes of presentation

Here, (16)-(18) need not be verbalized in ordinary communication, and their status is made explicit here only as theoretical illustrations. According to Jaszczolt, when, for various contextual reasons, the interpretation of the belief report turns out to be (17) or (18), and not (16), then contextual enrichment will occur.

Jaszczolt uses this to account for Schiffer and HIT's uses of MoPs and MoP-types. For Jaszczolt, the *de re*, *de dicto*$_1$ and the *de dicto* proper are three meta-types of MoPs. In the default *de re* case (16), no enrichment is necessary; the speaker Mary will have successfully managed to report Whistler's belief. In this case, Russellian singular propositions are kept not only in the semantics of belief reports, but also in their pragmatics, and there is no logical form problem.

By way of contrast, in the *de dicto*$_1$ case, which results from failure of coreference, Mary will have mistaken the object of Whistler's belief, so, in Jaszczolt's (2000, p.181) terms, she will need "enough" similarity between her MoP-type Φ and Whistler's MoP-type Φ'' so that the hearer could, by means of contextual cues

Kamp (1981) and in Jaszczolt's (2000) diagram on p. 173, thus being able to vary their referents from one DRS to another, and this aspect of Jaszczolt's use of DRT seems to not do justice to the direct-referential arguments provided in Kripke (1980), which are elaborated for belief contexts in Salmon (1986) and which are directly relevant for the interpretation of (1) and (2).

(which would prompt him to share Mary's Φ) come to similarly be able to report on Whistler in as competent a manner as Mary. This is one way of expressing, at a very general level, the intricate process of negotiation which governs communication of belief reports, according to Ludlow (2000, p. 39).

In the *de dicto* proper case, Mary has no access to the object of Whistler's belief, and she can only report (1) *de dicto*, thereby relying entirely on Whistler's own MoP and the Φ'' type thereof. In this case, reference to Φ'' and, moreover, to Whistler's particular *m''* are essential. This is to be contrasted to the *de dicto*$_1$ case, where all that matters is the degree of overall similarity between the Φ of Mary and John and the Φ'' of Whistler. These differences are theorized by Jaszczolt under the heading of "degrees of intensions", though her reference to Quine (1956) makes it unclear how that notion may be represented.[16]

So it seems Jaszczolt's analysis enriches the LF of (1) to obtain the proposition expressed in context by making reference only to the degree of similarity between Φ and Φ'' in (17), by making reference only to Φ'' and *m''* in (18), and no enrichment whatsoever is needed in the default case (16).

This approach crucially depends on the possibility of a distinction between the proposition and the LF of the sentence-type, and Jaszczolt (2000, p. 176) seems to be committed to this in saying that "the logical form problem of attitude reports […] is founded on the *un*founded assumption that the adicity […] of the

[16] Jaszczolt (2000, p. 174) interprets Quine (1956, p. 357) as speaking of degrees of intensions, but provides no metric for the "degrees" in question. For example, take (a) "Ralph believes x(x is a spy) of Ortcutt"; (b) "Ralph believes xy (x is the brother of y & y is a spy) of Ortcutt and Jones"; (c) "Ralph believes xP (x is a P) of Ortcutt and the property of being a spy". (a) is clearly of lower intensional degree than both (b) and (c). But what counts as increasing the degree of intension, on this reading? If it is the number of arguments that a predicate has, then (b) and (c) have the same degree of intension, or perhaps (b) is greater; if it is the type or order of the predicate or of the sentential formula embedding it, then (c) has a higher degree of intension than (b). On any reading, the adicity of the predicate and its order are different dimensions, and it is hard to see how to commensurate them.

belief predicate has to be preserved" – preserved, that is, in passing from the LF of the sentence-type (1) in a minimal context to the proposition expressed by an utterance of (1) with extra parameters set by the context.[17]

Once this distinction is granted, we can then further differentiate between the sentence-type (1) and its logical form, a token of that type produced in context – the belief report – and the belief being reported on. Clearly, each of the first two may express propositions when used, and those propositions may differ amongst themselves, as well as differ from the proposition believed. The approach also distinguishes semantics (and related questions concerning how we may interpret the logical form of the sentence-type (1)) from pragmatics (and related questions about when interpretations are default, and what meta-types modes of presentation belong to).

In turn, this leaves open all routes to answering the logical form problem for (indexical theories of) belief reports. It may well be that "believe" is a two-place predicate in the public lexicon. Yet, contextually, belief reports whose interpretations are not default require a three-place believing relation in order to specify the propositions expressed by such belief reports. This solution is made possible by Jaszczolt's treatment, but not mandatory. For semantics and pragmatics may coincide when the interpretation of the belief report is the default *de re* one, and no pragmatic enrichment would then be needed. Jaszczolt's approach then builds in added flexibility in how to interpret (1) in context.

11. Conclusion

In this paper, I have suggested that the logical form problem for the hidden indexical theory of belief reports can receive at least

[17] Jaszczolt wishes to present her view as a continuer of Discourse Representation Theory (Kamp 1981), so it may be plausible to cast her approach to the logical form problem for HIT in terms of DRT.

two pertinent solutions, one which appeals to semantics (Larson and Ludlow 1993) and one which appeals to pragmatics (Jaszczolt 2000). I have also argued in favor of Jaszczolt's solution on the grounds that (1) it keeps a clear distinction between semantics and pragmatics and offers a more economical theoretical explanation of the phenomenon of the substitutivity failure in belief reports, and (2) it allows for an explanation of *how* types of modes of presentation are introduced, as well as an explanation of *why* they are introduced and limitations on the conditions of *when* they are introduced, thereby going farther in answering what motivates Schiffer's logical form problem with singular propositions believed under modes of presentation. In passing, I have also pointed out that two of Ludlow's contributions to the resolution of the logical form problem can be seen as independent: (a) ILFs; (b) conceptualizing the speaker-hearer negotiation and the prerequisite of an adequate theory of belief reports. I have suggested that (b) can be appropriated by Jaszczolt's pragmatic account as well.

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REALISM AND MENTAL REPRESENTATIONS IN COGNITIV PSYCHOLOGY

MARTA PETROVA[1]

Abstract. The article presents the problematic consequences of the application of one possible and very intuitive definition of realism to mental representations postulated by cognitive psychology. A brief explanation of what sort of entities mental representations are taken to be in the framework of cognitive psychology is provided. The definition of realism taken into consideration consists in two parts – claim of existence and independence of beliefs, linguistic practices and conceptual schemes.

Keywords: *cognitive psychology, mental representation, realism.*

Cognitive psychology is the leading paradigm in the field of psychology today. One of its central assumptions is that mind and mental representations exist and that they can be studied as other entities, processes, etc., postulated by other sciences (Uttal 2004; Pitt 2018). But are mental representations real? What is their ontological status – do they exist, and if so, what kinds of things they are? The text examines the consequences of application of a well-accepted, very intuitive definition of what realism consists in to mental representations.

We should start with a clarification of what we mean when we use the notion of "mental representation" in the framework of cognitive psychology. One can define representations in general as "any notation or sign or set of symbols that "re-presents" something to us" (Eysenck and Keane 2000: 267). "That is, it stands

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for something in the absence of that thing; typically, that thing is an aspect of the external world or an object of our imagination (i.e., our own internal world)" (Ibid.). Cognitive psychology takes this idea and assumes that the "mind" can be described in terms of representations and relationships, computations, etc. between them. Mental representations, however, are "theoretical constructs" (Pitt 2018) which can be studied only by analogies with representations in general, because "the mind" is considered private – the others do not have direct access to a cognitive agent's mental life. According to cognitive psychology, mental representations are of two types – propositional and analogical (Eysenck and Keane 2000: 269). The differences between them are derived by analogy with the representations in general. Propositional representations are discrete, explicit, combined according to rules, and abstract (Ibid.); in short, they are language-like. Analogical representations are described as non-discrete, representing things implicitly, having loose rules of combination and concrete (Ibid.: 270); they resemble images, maps, etc. The distinction abstract-concrete entails that propositional representations are amodal (they can be extracted from all modalities – visual, auditory, etc.) while analogical representations are modal (they are extracted from a particular modality) (Ibid.). Mental representations can be interpreted as mental objects with semantic properties (Pitt 2018) – propositional mental representations may have content, reference, truth conditions, truth value, etc. and non-propositional may have content and reference.

What can be deduced from this description? At first glance the nature of *mental* representations, seems obvious (indicated by the name). If this is the case, we can conclude that cognitive psychology presupposes some kind of ontological dualism – we have on the one hand the physical reality (which is not called into question) and on the other hand another thing – "the mental" which *re-presents* the first (or some of its aspects). It is not surprising that cognitive psychology presupposes the existence of a reality independent of the mind (a "physical" or "external" one). The ontological idealist position that "there is no world external to

and thus independent of the mind" (Chakravartty 2017), is not popular even in philosophy and when it comes to science – the question of the existence of a "physical" (or "external") world is rarely posited. Of course, there are some epistemological versions of idealism which do not exclude the existence of something mind-independent, but only argue that everything we can "*know* about this mind-independent "reality" is held to be so permeated by the creative, formative, or constructive activities of the mind (of some kind or other) that all claims to knowledge must be considered, in some sense, to be a form of self-knowledge" (Guyer 2018). So, if cognitive psychologists desire to have a scientific status (which could be questioned (Uttal 2004; Elchinov 2016)), they cannot deny the existence of an external world (they cannot be committed to ontological idealism). One can make the following remark here: in general, the distinction "external-internal" is not always interchangeable with "physical-mental" (for example we can speak of the brain as internal and inside the body, even if it is physical). In any case, the presupposition of the existence of mental representations seems much more confusing from a scientific point of view than the assumption that there is an external or physical environment (supposedly represented by mental representations).

We can pose the question of the ontological status of the mental representations. Are they real? First of all, it is necessary to explain what realism consists in – what conditions must be satisfied for someone to say that something is real. Here, we take that to say that x is real is the same as to be realist about x. By taking realism for the everyday world of macroscopic objects and their properties, we can say that there are two aspects of realism: the claim of existence and the independence of beliefs, linguistic practices, conceptual schemes, and so on (Miller 2016). If we apply these two criteria to mental representations, it turns out that to be realist in regard of mental representations postulated by cognitive psychology, we must accept that they exist independently of (a) our beliefs, (b) our language and (c) our conceptual schemes. We are not going to examine in detail what "existence" consists in

(since this is not the aim of the text), here the word "exist" is used in a trivial sense – to say that "*x* exists" is to say that "there is an *x*" or, alternatively, that "x is".

A widely shared view of scientific realism is similar to realism in general: "scientific theories give true or approximately true descriptions of observable and unobservable aspects of a mind-independent world" (Chakravartty 2017). The representational theory of mind (RTM) is where we encounter mental representations, so we will examine it. The theory presupposes the existence of intentional mental states (which are *about* or which *refer to* something) as relations to mental representations (Pitt 2018). If we have for example the mental representation "the cat is on the chair", we can have propositional attitudes (desires, beliefs, regrets, fears, etc.) related to that representation. We can *be afraid that* the cat is on the chair, or *want* it to be there, etc. This theory assumes that mental representations and propositional attitudes (including beliefs) exist. If we make a connection with the definition of realism that we examined earlier in the text and especially with the condition that to be realist about something is to state that the thing exists independently of (a) our beliefs, we can build the following argument:

1. Realism about something consists in accepting the existence of this thing independently of our beliefs.
2. The representational theory of mind is a realistic theory with respect to beliefs.

Therefore:

3. According to the representational theory of mind, beliefs exist independently of beliefs.

Obviously, something is not quite right. Moreover, the problem remains the same each time when one tries to define the reality of something (for example "the external world" ("the physical world", "the non-mental world")) with respect to the mind:

1. Realism about something consists in accepting the existence of this thing independently of the mind (including mental representations).

2. The representational theory of mind is a realistic theory with respect to the mind (including mental representations).

Therefore:

3. According to the representational theory the mind, the mind (including mental representations) exist independently of the mind (including mental representations).

The conclusion might be that the definition of realism we considered earlier is not accurate and we must reconsider it. How can we do that? We can exclude the condition "independently of our beliefs" (or "independently of the mind"). So, the argument would be as follows:

1. Realism about something consists in the accepting of the existence of this thing.
2. The representational theory of the mind is a realistic theory with respect to beliefs and mental representations.

Therefore:

3. According to the representational theory of mind, beliefs and mental representations exist.

That way, one can overcome the absurd and tautological consequence. But is it a satisfactory outcome? We obtain the following definition of realism: "for every *x: x* is real if *x* exists". So, the external (the physical) is real if it exists and the internal (the mental) is as real if it exists. But are they dependent or independent? We have seen that in the framework of cognitive psychology the mind depends on the physical (since mental representations represent the physical world). And does the physical world depend on the mind? If the answer is "yes", we enter in the field of ontological idealism, which would be very problematic if cognitive psychology is to be considered a scientific discipline. If the answer is "no", we return to the argument we examined above.

Let's examine the other part of the definition of realism – "*x* is real if *x* exists (b) independently of our language". Is it possible that mental representations exist independently of language? It's not quite problematic regarding analogical representations, but as we have seen in the context of cognitive psychology, propositional representations are also proposed. Propositional representations

(as indicated by their name) resemble propositions in general. It is also often assumed that mental representations constitute a fundamental language called "mentalese" (Eysenck and Keane 2000: 270). Thus, propositional mental representations are very dependent on language (it is unlikely that they can exist without language). So, we can compose the following argument:

1. Realism about x consists in accepting the existence of x independently of language.
2. Propositional mental representations are not independent of language.

Therefore:

3. Realism about propositional mental representations is contradictory / incoherent.

We will examine the last part of the definition of realism "x is real if it exists (c) independently of our conceptual schemes". The notion of "conceptual scheme" requires a brief explanation (because it is a bit vague). They can be understood as "ways of organizing experience; they are systems of categories that give form to the data of sensation; they are points of view from which individuals, cultures, or periods survey the passing scene" (Davidson 1973: 5). Thus, conceptual schemes are a kind of framework, a way of classification. Obviously *conceptual* schemes cannot be constructed without concepts (otherwise they would be only schemes or non-conceptual schemes). So, we can conclude that for conceptual schemes to be constructed, there are two conditions – one needs concepts and the scheme of these concepts. According to cognitive psychology, concepts are mental representations or they are constituents of mental representations (Margolis and Laurence 2014). For example, one can have a mental representation (or a concept) of a "dog", or one can have a mental representation "a dog under a table", which consists of the concepts "dog" and "table". One can also have complex concepts, such as "diamond ring" which is a concept, composed by two other concepts and which has emergent properties (that the concepts "diamond" and "ring" lack separately). In any case, in the context of cognitive psychology, concepts are mental representations

and without concepts, we could not have representations. Thus, mental representations are not independent of concepts.

1. Realism about *x* consists in accepting the existence of *x* independently of our conceptual schemas (of our concepts and the schemes of these concepts).
2. The mental representations postulated within the field of cognitive psychology are not independent of concepts.

Therefore:

3. Realism about mental representations is contradictory / incoherent.

We can ask the question "Can mental representations exist independently of *others* beliefs?". It seems, at first glance, that mental representations of others can exist independently of the beliefs of given subject (*S*) and vice versa – the mental representations of *S* can be independent of the beliefs of others. So, the beliefs and the mental representations of others are independent of the beliefs and the mental representations of *S* in the same sense that the external/physical world is independent of *S*'s beliefs and mental representations. At the same time *S*'s mental representations are not independent of *S*'s beliefs (in the framework of the RTM) – if we take the mental representation "the cat is on the mat", *S* can believe that this is the case, but this mental representation depends on other beliefs of *S* – for example "cats exist", "cats can be on mats" etc. But the RTM doesn't make a difference between *S*'s beliefs and mental representations and others beliefs and mental representations – at least, it shouldn't, if the theory is supposed to be coherent – the theory cannot be realistic (to accepts the independent existence of) *some* mental representations and at the same time to be non-realistic towards other mental representations (to accept that they are dependent of some beliefs). It seems odd if the RTM (a realistic theory towards mental representations – i.e. a theory that accepts that mental representations exist independently of our beliefs) accepts that there are two types of mental representations – some dependent of beliefs and some independent of beliefs (i.e. if the theory is realistic towards *certain* amount of mental representations), because that

means that according to the theory there are *some* mental representations that are real and *some* that aren't real. Additionally, this makes the theory incomplete, because it ignores certain mental states (the mental representations and the beliefs of *S*, which are dependent of *S*'s beliefs).

We have seen that when the reality of the external/physical world is defined in relation to its existence independently of our beliefs, language and conceptual schemes (a definition implicitly used in science), we receive criteria of reality that pose problems when they are applied to mental representations. Perhaps the definition of realism is poorly constructed, or the problem is not the definition, but the assumption that mental representations must meet the same criteria of "reality" as the entities, processes etc., postulated by other sciences. The last will be a big obstacle if cognitive psychologists insist that cognitive psychology is a scientific enterprise. Perhaps realism is not the best attitude towards mental representations and maybe within science in general. If one examines the mental representations from the point of view of instrumentalism ("the view that theories are merely instruments for predicting observable phenomena or systematizing observation reports" (Chakravartty 2017)), we only have to conclude that if cognitive psychology has a good theory postulating mental representations with which one can predict observable phenomena, the question of reality will not be essential. Does cognitive psychology offer us such a theory (which includes mental representations)? Not yet (and it's an open question if psychology will propose it to us in the future). First, if there is an observable phenomenon that should be predicted, it is human (and perhaps some animal's) behavior, but cognitive psychology does not have a complete theory of behavior. Moreover, in the field of psychology itself, there are serious disagreements – whether there are really two types of representations or only one (Eysenck & Keane 2000: 270), whether the phenomenal character of a mental state is reducible to a kind of intentional or non-intentional content (Pitt 2018), whether the representations are symbolic structures with semantically

evaluable constituents (classical view) or they are realized by patterns of activation in a network of simple processors ("nodes") (connectionist view) (Ibid.) etc.

There is another kind of anti-realism that suggests that mental representations postulated by cognitive psychology (those that resemble images or language) do not exist. Eliminative materialism is the position that folk psychology is a radically erroneous theory, and the entities postulated in this theory will be replaced by terms of complete neuroscience (Churchland 1981). One of the reasons to suspect that popular psychology proposes a good theory is the impossibility of making appropriate and accurate predictions of behavior and the lack of explanation for many observable phenomena. Mental illnesses, creative imagination, differences in intelligence between individuals, sleep, perceptual illusions, learning (Ibid.: 73) – all of this remains unexplainable within the framework of folk psychology.

In any case, if we set aside the antirealist positions, the status of mental representations remains problematic, if we apply the same criteria of "being real" to them, as we do for other things of the physical/external world and entities postulated by science. If the options are either the acceptance of scientific realism or ontological idealism (which seems to be a consequence of realist positions towards mental representations), the first alternative is preferable or at least not as problematic as the second. The corollary of this dilemma is the elimination of the notion of "mental representation" from the scientific vocabulary.

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METAPHYSICAL VIEWS ON QUANTIFIED MODAL LOGIC

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Abstract. This paper provides an overview of the metaphysical views treating the problem of merely possible objects. This overview maps different aspects of Quantified Modal Logic and the problem of merely possible objects. There are three elements discussed in the formal part of the paper: objectual quantification, rigid terms and the evaluation clauses for quantifiers. The philosophical part regards the following metaphysical views: actualism, possibilism, contingentism and necessitism. The provided mapping connects the formal aspects with the metaphysical views.

Keywords: *Quantified Modal Logic, merely possible objects, actualism, possibilism, contingentism, necessitism.*

Introduction

When engaging in modal talk, we often refer to various possible objects, such as a possible stick, a possible situation, the possible child of Wittgenstein. If the possible objects we refer to are not actual, then they are merely possible objects or possibilia. How are we to account for such objects? Are there any mere possible objects? In this paper, I discuss this metaphysical issue in relation to Quantified Modal Logic (QML), which was developed for the treatment of modality. I study the interaction between QML and the metaphysical issues one can raise with respect to such a tool.

This paper is structured as follows. In section 1, I briefly discuss the relation between metaphysics and QML, following Williamson's (2013) considerations regarding this relation.

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In section 2, I briefly present two semantic approaches to first-order modal logic[2], i.e the constant-domain approach and the varying domain approach, as exposed by Fitting and Mendelsohn (1998). A varying domain semantics is obtained by some formal constraints imposed on the model defined for a constant-domain approach.

In section 3, I focus, following Garson (2001), on three aspects that set the ground for asking whether QML is committed to mere possibilia: the objectual interpretation, the rigid terms assumption and the evaluation clauses for quantifiers[3]. Each of these aspects are discussed in relation to a metaphysical claim. For instance, Cresswell (1991, 274) states that the objectual interpretation together with possible-worlds already embed a commitment to mere possibilia. The rigidity of terms is important in the rejection of the controversial Barcan Formula (BF) and of the converse Barcan Formula (converse BF)[4]. Finally, the evaluation clauses for the quantifiers correspond to constant domain semantics or varying domain semantic approach to QML. I focus on the metaphysical problems of a varying-domain semantics and constant-domain semantics. The latter is approached by two formal constructions: constant-domain first-order modal models and locally constant-domain first-order modal models. The varying-domain approach was developed to meet the intuition that what objects exist at different possible worlds is a contingent matter: some objects from the actual world could have failed to exist and other objects could have come into existence. This

[2] The problem of possibilia can be discussed in relation with QML in general. However, for matters of simplicity I will reduce the discussion to a first-order modal logic and its semantics (FOML).

[3] Garson (2001) presents the developments of QML beginning with objectual quantification and the assumption that terms are rigid. On this common ground he proceeds to present different approaches concerning the way a quantified modal model is defined. Quantification can be understood in other ways as well. For instance, it can be understood substitutionally or conceptually. However, in this paper I am concerned with the consequences of interpreting quantification objectually.

[4] An instance of the BF '$(\exists x)\Diamond Px \rightarrow \Diamond(\exists x)Px$', and an instance of the converse BF is '$\Diamond(\exists x)Px \rightarrow (\exists x)\Diamond Px$'.

constraint can also be seen as device to avoid quantification over mere possibilia. However, it is often argued that it does embed a kind of commitment to mere possibilia[5]. The constant-domain approach, depending on how it is constructed, can have two metaphysical consequences: it can either admit quantification over mere possibilia, or, as Cresswell (1991) suggests, it can go against the intuition of the contingency of existence.

In the last section, I present Barcan's critique on Kripke's semantics. This critique is meant to show that varying-domain semantics, as proposed by Kripke (1971), is not immune to a commitment to mere possibilia. The critique makes the mappings between QML and the different metaphysical views more complicated since some actualist approaches are designed to meet this critique.

Before presenting the relevant aspects of the semantics for the first-order quantified modal logic, I would like to make explicit the relation between the formal developments and the metaphysical developments as presented in section 3. The formal aspects concern the two semantic proposals: the constant-domain and the varying-domain approach. The competing metaphysical views relating to the formal aspects will be the following: actualism, possibilism, necessitism and contingentism. Actualism should be seen as paired with possibilism within a debate, and necessitism should be seen as paired with contingentism within another debate (Williamson 2013). Thus, in this paper I discuss both the internal assumptions that lead to the metaphysical debates and the debates themselves. I also focus on how they should be paired with the formal results. I do not treat the formal aspects of QML as discerning between the metaphysical views, but as giving rise to the metaphysical debates.

[5] This critique can be found for instance in Barcan (1993), Zalta and Linsky (1994), Williamson (1998) or Stalnaker (2012).

1. Semantics and metaphysics

Williamson (2013, 146-147) discusses the relation between metaphysics and logic in general and argues that logic should not be regarded to be neutral with respect to metaphysical problems. In this paper I work with Williamson's claims that quantified modal logic is not neutral and that metaphysics interferes in formal constructions such as the semantics for QML.

How do metaphysics and formal constructions interfere? Accepting additional types of entities such as mere possibilia into one's theory should be done only if necessary. The semantics of a formal construction treating modal notions may determine an expansion of ontology. In this way, the semantical approach imports a metaphysical problem. A semantical approach to modality in terms of possible worlds is often seen to allow for possibilia. To see when possibilia are admitted, I examine several developments of QML considered to appeal to mere possibilia and the various metaphysical views trying to explain these developments. I regard metaphysical views as metaphysical models which provide the resources to interpret the consequences of a formal construction, consequences which exceed the explaining resources the formal tool has. Metaphysical tools will guide the interpretation of metaphysical consequences of QML within such a model. I will search for the mappings between the metaphysical models and the formal approaches with respect to the semantics of QML.

2. A Presentation of the semantics of a first-order modal logic

Following Fitting and Mendelsohn (1998), I will present a constant domain and a varying domain semantics for first-order modal logic. However, I will make some changes in the language, specifically, in the list of symbols used[6].

[6] For instance, the symbols used for possible worlds in Fitting and Mendelsohn's presentation are capital letters from the Greek alphabet: Γ,

First, I will present a constant domain semantics and then specify the changes needed for a varying-domain semantics, *i.e* changes of the evaluation clauses for quantifiers.

A frame[7] for a first-order modal logic is F=<W,R,D>, a triple consisting of: W, the set of possible worlds; R, the accessibility relation between worlds; D, a set of objects. A constant domain first-order modal model based on a frame F is a quadruple M=<W,R,D,Ï>, where Ï is a function mapping a set of n-tuples from D to the extension of a predicate P at a world w, Ï(w,P). To provide the evaluation clauses for the formulas, an assignment function υ is needed in order to map each free variable x to a set of n-tuples from D, υ(x). If υ(x) is part of the extension of a predicate P at w, then υ(x) ∈Ï(P,w)[8]. Given Fitting and Mendelsohn's (1998, p. 98) presentation of the constant-domain modal model, the evaluation clauses for quantified sentences are the following:

> (E ∀) M,w ⊩υ (∀x)φ *iff for every x-alternative ω of υ such that M,w ⊮υ ϕ, where an x-alternative ω of υ agrees on the assignment of free variables in ϕ, except (possibly) x.*
> (E ∃) M,w ⊩υ (∃x)φ *iff there is at least one x-alternative ω of υ such that M,w ⊮υ ϕ.*

A varying domain semantics is obtained by some adjustments on the definition of a frame and model. A varying domain frame F=<W,R,D> has it's elements defined in the same manner as a constant domain frame. However, the domain of the frame D(F) is defined as U{D(w)| w∈W}, that is the union of all

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Δ, Ω etc. I will instead use letters as 'w', 'u', 'v' etc. for possible worlds, following Forbes (1994).

7 Fitting and Mendelsohn (1998) use the terminology of *constant domain augmented frame*, since the frame is an extension of a frame for propositional modal logic. F is constructed on the modal propositional frame F=<W,R> by the addition of D, the domain over which quantifiers range. A model M is a *constant domain first order model,* given the way an interpretation Ï is defined.

8 The evaluation clauses relevant for the discussion are the clauses for quantified sentence.

sets of objects existing at the different members of W. Thus, each w has an associated D(w), the domain of objects existing at w. A model M is a varying domain first-order modal model M=<W,R,D,Ï> where Ï maps elements from D(F) to the extension of a predicate P at a w. Thus, elements from the extension of a predicate at a world w need not be elements of D(w). However, some changes are made concerning the valuation of quantified sentences. The evaluation clauses for truth in a varying domain first order modal model M=<W,R,D,Ï> remain the same as in a constant domain first order model, except for the evaluation clauses for quantified sentences, given Fitting and Mendelsohn (1998, p. 104):

> (E ∀*) M,w ⊩$_\upsilon$ (∀x)φ *iff for every x-alternative ω of υ at w, such that M,w* ⊮$_\upsilon$ *φ, where an x-alternative ω of υ is one that agrees on the assignment of free variables in ϕ, except (possibly) x.*
> (E ∃*) M,w ⊩$_\upsilon$ (∃x)φ *iff there is at least one x-alternative ω of υ at w, such that M,w* ⊮$_\upsilon$ *φ.*

In a varying-domain semantics the assignment function for quantified formulas is restricted to D(w). Thus, formulas with free variables are evaluated relative to D(F) and quantified formulas, relative to D(w). Even though the feature of an unrestricted evaluation of formulas with free variables is kept in a varying-domain semantics, the introduction of a domain of the frame D(F) is needed in order to differentiate between D and D(F). In a constant domain model, D is regarded as a set of objects, whereas in a varying-domain semantics, as a function relativizing the set of existing objects to each possible world. Thus, in a varying-domain semantics D(F) does the job D does in a constant-domain semantics.

Depending on how we choose to evaluate quantified sentences, one can provide different metaphysical views. In the next section, I especially focus on the relation between the evaluation clauses for quantifiers, domains and the metaphysical approaches associated.

3. Quantifiers, rigid terms and domains

I will focus on the metaphysical discussion in relation to the semantics of QML. This relation concerns the problem of possibilia. Stalnaker (2012) addresses the problem of the interaction between metaphysics and semantics both as a general issue, and as an applied question regarding the problem of mere possibilia and quantifiers. The question is how to evaluate quantified formulas in a possible-worlds semantics with objectual interpretation of quantifiers, in order to overcome the problem of possibilia. After surveying the accounts developed in order to eliminate possibilia, Stalnaker presents his own account in which quantification should be restricted to what there really is, without appealing to problematic entities. I will address the same issue regarding the ontological commitment that emerges from the interpretation of quantifiers, but I will focus on both the metaphysical consequences of a constant-domain semantics and the metaphysical constraints imposed on a varying-domain semantics.

In Cresswell (1991) the interpretation of quantifiers is discussed in relation to the BF and the question is why should they be interpreted as restricted rather than unrestricted. Cresswell considers the best solution to be established on semantic grounds and not by metaphysical criteria. The reason is the following: if we use a semantics with possible worlds and domains as sets of objects, then we have already made a commitment to non-existents or mere possibilia. Since the commitment is already made, there is no need to choose our evaluation clauses for quantifiers by metaphysical criteria and we should rather make the decision on pragmatic grounds such as the simplicity and fruitfulness of the semantics. For instance, he considers the systems in which the BF is valid, to be basic for the systems without the BF. This is because one way to show the BF is valid rests on the unrestricted evaluation of quantifiers[9]. However, I would raise the following

[9] The other way to show the BF to be valid is to impose the condition that no possible world contains objects not in the actual world.

two questions: (i) are there other metaphysical aspects, except from committing to non-existents or possibilia, that should count in evaluating the two semantic approaches? (ii) are restricted evaluation clauses for quantifiers committing to non-existents in the same way as unrestricted evaluation clauses?

To answer these questions, I will present the problematic features of QML, focusing on the interpretation of quantifiers. Thus, the approach will proceed from semantics towards metaphysics. We start with the objectual interpretation of quantifiers and continue with rigid terms and the evaluation clauses for quantifiers. Since the discussion regarding constant-domain or varying-domain semantics takes the first two as common ground, I will start with the objectual interpretation and the rigid terms assumption. In this discussion, I will follow Stalnaker (2012) in following Carnap (1950) in making the distinction between external or substantive questions regarding metaphysical subjects and internal questions, those regarding the semantic aspects of the framework. I will concentrate on the substantive aspects and questions regarding the two semantic approaches.

3.1. Objectual interpretation

In the semantics presented, a frame F is a triple with the following elements, F=<W,R,D>, where D is the set of objects over which quantifiers range and we have no prior discrimination between actual and possible objects. However, a constant-domain first order modal model based on F, M=<W,R,D,Ï>, validates the BF and this formula can be shown to imply quantification over mere possibilia. In a varying-domain first order modal model M=<W,R,D,Ï>, D is taken to include both actual and merely possible objects. If we restrict the discussion to what D consists of, the objectual quantification seems problematic for both directions we choose: constant-domain or varying-domain semantics. In this sense, Cresswell (1991) considers the metaphysical commitment to merely possible objects to be unavoidable.

3.2. Rigid terms

The thesis of rigid terms is problematic for a constant domain semantics since counterexamples against the converse BF are based on this assumption. Consider the following instance of the converse BF: $(\exists x)\Diamond Px \rightarrow \Diamond(\exists x)Px$. In a varying-domain semantics with the assumption that terms are rigid, this formula is shown to fail. The antecedent '$(\exists x)\Diamond Px$' is shown to be true since there is an x such that Px is true at a possible world u, where wRu. 'Px' is true since the value assigned to x is in the extension of predicate P, but the object assigned to x need not belong to D(u). If object a, existing at w, is in the extension of P at u, then for 'Px' to be true, x must be assigned the same value in the two worlds of the model. Kripke (1971) explains the admission of truth values for sentences containing free variables relying on the thesis of rigid terms. Considering the sentence "x is bald" containing the free variable 'x', he argues that we can assign a truth value, even though x replaces an object which does not exist at the actual world. For instance, he argues that "Sherlock Holmes is bald" may still have a truth value, even though Sherlock Holmes does not exist at the actual world[10]. The same holds for "Socrates is a philosopher". The sentence has a truth value at a possible world where Socrates does not exist, since objects may belong to extensions of predicates at worlds at which they do not exist and we rigidly refer to "Socrates". If we go back to the converse BF, the antecedent is made true by Socrates who could have been a sophist, but the consequent is made false since there may be another possible world in which Socrates enters the extension of the predicate "sophist", but does not exist at that world.

[10] In his later papers, Kripke reevaluates the thesis that Sherlock Holmes or Pegasus are merely possible objects and instead argues for the thesis that fictional objects are abstract objects tied to the fiction from which they originate. See Kripke (2011) 'Sherlock Holmes' is a rigid term, referring to Sherlock Holmes in every possible world, but this status of fictional object, prevents it from being actualized in other possible worlds.

3.3. Evaluation clauses for quantifiers.

Many first-order modal logics work with the assumptions that quantifiers are interpreted to range over a domain D of objects, either restrictedly or unrestrictedly, and that terms are rigid. What is considered problematic is the evaluation clauses we apply to quantifiers since this determines whether we work with a constant-domain semantics or a varying-domain semantics. The evaluation clauses making the quantifiers range unrestricted or restricted correspond to (E$\forall$) and (E$\exists$), for unrestricted range, and (E$\forall$*) and (E$\exists$*), for the restricted interpretation. Given the evaluation clauses, we can ask what ontological commitment each pair generates and whether there are any other metaphysical aspects we should consider when interpreting quantifiers.

3.3.1. The constant-domain approach

Beginning with a constant-domain approach to first-order modal logic, the pair (E$\forall$) and (E$\exists$) is based on the assignment function taking values from D. The truth of quantified sentences in a model M at a world w depends on the values taken from the whole domain D and worlds are thought of as having the same domain in the model. This semantic direction comes as a natural extension of the semantics for first-order logic, in which the evaluation of a formula is based on a single domain of objects, that the assignment function picks values from. Moreover, as Cresswell and other defenders of an unrestricted treatment of quantification state[11], in a constant domain approach to the semantics for first order modal logic, the classical rules for quantifiers, such as universal instantiation (UI) are preserved: $(\forall x)\varphi \supset \varphi[x/y]$, where every free occurrence of 'x' in ϕ is replaced by 'y'. What the rule states is that if something holds about every individual in a domain, then it also holds about a certain individual. Thus, if a universally quantified

[11] See Zalta and Linsky (1994), and Williamson (1998).

formula is true, then each of its instances are true as well. Preserving the classical rules for the quantifiers is one of the motivations for the constant-domain approach. However, the metaphysical consequences seem to impose restrictions leading to the varying-domain approach. In order to better approach the metaphysical consequences of a constant-domain approach, the following distinction should be considered, namely, the distinction between a constant domain first order modal model and a locally constant-domain modal model. Each direction determines different metaphysical interpretations.

Following Fitting and Mendelsohn's (1998) presentation of the semantics for first-order modal logic, if we impose certain conditions on the accessibility relation R in a model M, we get either the BF valid, or the converse BF. For the validity of the BF, the condition is that if wRv, then $D(v) \subseteq D(w)$. Thus, if v is accessible from w, then the domain of v does not exceed that of w. This feature of the semantics is called anti-monotonicity. The other condition, which could be imposed on the accessibility relation R in a model, is that of monotonicity. A model M is monotonic if given any pair of worlds $w \in W$ and $u \in W$, if wRv, then $D(w) \subseteq D(u)$. In a monotonic model, the converse BF is valid, even though the BF is not. A first-order modal model which is both monotonic and anti-monotonic, is defined to be a locally constant-domain first-order modal model. In such a model, both the BF and converse BF are valid. In a locally constant-domain first-order model, if wRv, then D(w)=D(v). In such a model, the BF and the converse BF are valid because all worlds contain the same elements in their associated domains, and not because we have the $(E\forall)$ and $(E\exists)$. Locally constant-domain first order modal models follow from the conditions of monotonicity and anti-monotonicity, which are conditions imposed on worlds with respect to their domains. Because a locally constant-domain model follows from combining the two conditions, the specifics of this semantics consists in the conditions imposed on the world domains, while a constant-domain semantics is defined by the evaluation clauses for the quantifiers. What

substantive differences follow from the semantic differences between the two constant-domain approaches?

From a formal point of view, the common ground would be that the BF is valid on both approaches. This aspect is problematic for an actualist who would like to preserve the intuition that domains associated with worlds should vary. The difficulty comes from problematic objects the truth of the BF seems to be committed to, such as a possible talking donkey. However, Cresswell (1991) sees a very important substantive difference that follows from the two approaches, namely, that objects in a locally constant-domain first-order modal model are necessary existents. A formula such as '$\Box(\forall x)\Box(\exists y)(x=y)$' is valid because for every $w \in W$ and $u \in W$, if wRu, then D(w)=D(u) and thus, every object exists in every possible world. In a constant-domain first-order modal model, the substantive aspect that follows is weaker. In such a model, quantifiers are permitted to range over non-existents and a commitment to such objects is permitted. The BF is accepted as well and quantification over possible talking donkeys is legitimate. This interpretation rests on rejecting the actualist claim that there are only actual objects. Thus, there are two substantive views that follow from the kind of approach made with respect to our constant-domain first-order modal model: we either accept that everything is necessarily something, or even Williamson's (2013, 2) stronger claim that "necessarily, everything is necessarily something" or we quantify over non-existents. Here, "x is something" should be understood in a stronger sense, namely, to exclude "x is non-existent". One can go in either direction, namely, in the direction of quantifying over non-existents, or taking everything to be necessary.

If one wants to avoid quantification over non-existents, in the sense of making a distinction between what there is and what there could be, one can adopt Zalta, Linksy and Williamson's proposal that "necessarily, everything necessarily is something"[12]. In this way, the metaphysical consequence of a locally constant-domain approach is taken as a metaphysical interpretation of a constant-

[12] See Zalta and Linsky (1994) and Williamson (1998) or Williamson (2013).

domain approach. The domain D in a model M is interpreted as consisting of only existing objects. 'Existence' is reserved not only to what the actualist usually takes to exist[13]. Whether the quantifiers are permitted to take values from D and world domains are unspecified, or whether world domains are taken to be the same, we can have the same metaphysical interpretation over the locally constant-domain and the constant-domain approaches. Thus, the thesis that there are no non-existing objects, seen as a consequence of a locally constant-domain approach, can be taken as a metaphysical interpretation for the constant-domain approach.

The other metaphysical approach is quantification over non-existents. Besides the ordinary unproblematic objects, the quantifiers range over mere possibilia as well. If the constant-domain approach is used, one is not compelled in taking objects to be necessary existents. To be a necessary existent would mean to exist at all possible worlds. Since world domains are not relevant for evaluating quantified sentences, no such condition of necessary existence is imposed[14]. Can this constitute a metaphysical interpretation with respect to the locally constant-domain approach? Cresswell sees the locally constant-domain approach to be forcing a stronger metaphysical view than the constant-domain approach, which only needs quantification over non-existents. However, we can force a metaphysical interpretation over locally constant-domain model and consider world domains to contain non-existent objects as well. They contain such objects in the sense that quantifiers range over them. In this way, we maintain a symmetry with constant-domain models in the sense that being a value of a bound variable does not imply existence.

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[13] However, there are disputes related to what it means for an objects to be actual. For instance, Zalta and Linsky (1994) take everything to be actual, even the mere possibilia. What I have in mind here is rather a definition coming from a Russellian tradition, as Barcan claims her view to be. In Barcan (1993) the controversial possibilia and the uncontroversial objects are distinguished by the criteria that the latter can be objects of reference, while possibilia cannot be.

[14] See Cresswell (1991).

The other semantic approach, namely, the varying-domain approach manages to avoid both quantification over non-existent objects or mere possibilia, at least in the object language, and the assumption that "necessarily, everything is necessarily something". These consequences are avoided by the restrictions imposed on the definition of a first-order modal model.

3.3.2. The varying-domain approach

The varying-domain approach was proposed by Kripke (1971) in order to create a correspondence between the semantics and the intuition that world domains should vary. His motivation was that what objects exist at different possible worlds is a contingent matter. We can imagine all sorts of objects which do not exist at the real world[15], but which are nevertheless possible, thus being possible existents. This revision of the semantic approach allows us to model the intuition that even though a talking donkey is possible, it does not mean there is something at the real world which is possibly a talking donkey. Thus, we have a substantive issue which determines a decision in the evaluation of modalized sentences. The request to make a distinction between the set of elements each world has, determines a substantive distinction between the elements the set D has, namely actual and possible objects. This distinction is made explicit by Kripke (1971), by individualizing a single element from W as the actual world. However, the varying-domain semantic approach presented in this paper does not single out a special element from W as the actual world. If no actual world is singled out, the truth of a formula in a model M is evaluated at an arbitrary world and the possible objects are defined relative to the world of evaluation. However, both approaches (the one which singles out the actual

[15] Using 'real world' instead of 'actual world', as Kripke(1993) does, is useful in making a distinction between what we intuitively call the real world and what we call the actual world of a modal model.

world and the one treating the worlds indiscriminately) can work with actualist assumptions. Even though in the semantics presented, following Fitting and Mendelsohn (1998), we do not have a world singled out as the actual world, the authors define the quantifiers in a varying domain first-order modal model to be actualist. The quantifiers are actualist since, given a formula '$(\exists x)\phi$', it is true in a model M at a world w, $M,w \Vdash_\upsilon (\exists x)\phi$, if the assignment function picks out values from D(w). Thus, a quantified formula, not in the range of a modal operator, is evaluated with respect to the objects existing at the world of evaluation. The elements of the set D(w) are defined by the authors as objects actually existing at w.

It seems that a varying-domain semantics works under two restrictions emerging from metaphysical considerations. The first one is that world domains should vary, since it is contingent what objects exist at a possible world. The second is that quantifiers should range only over existing objects from the world domain of a possible world. Thus, in a varying-domain semantics the substantive aspects impose conditions on the semantics.

Even though this semantic approach should meet some actualist conditions, as Cresswell states, its innocence with respect to possibilia is not complete. Varying-domain semantics is still considered to be committed to possibilia. This critique has been formulated by Barcan Marcus (1993) as well, and it has been restated in the recent literature[16]. Barcan's critique is that allowing domains to vary implies a commitment to possibilia. Thus, the fault does not lie in the evaluation clauses for the quantifiers, but in the condition that other worlds may contain objects different from those at the actual world. To admit that world domains vary is to allow the model to work with mere possibilia as objects of reference and to make them relevant in evaluating modalized sentences. Her second critique comes from the objectual

[16] Zalta and Linsky (1994), Williamson (1998), Bennett (2005) and more recently Stalnaker (2012). Unlike Zalta, Linsky and Williamson, Stalnaker defends a varying-domain semantics.

quantification direction. Cresswell sees this as committing to quantification over non-existents and authors like Williamson (1998) and Zalta and Linsky (1994) develop the critique that quantification over non-existents or possibilia is unavoidable in the metalanguage.

4. Barcan against Kripke's semantics

Modal logic with an objectual interpretation of quantifiers and a possible worlds semantics faces the problem of possibilia. It is not clear whether Barcan takes only a variable domains interpretation of quantifiers to be committed to possibilia. What is clear is that she sees Kripke's admission of possibilia to be a consequence of such a variable domains interpretation. If we allow other possible worlds to contain objects which are not members of the actual world's domain, then possibilia have been admitted. Relying on Williamson (1998), I would interpret her claim in the following manner: accepting that other possible worlds have different domains of objects is to accept there is an object x such that x is a member of the domain of a possible world different from the actual one. Thus, if we take the domain of the actual world to be a proper subset of D, then the construction has some sort of commitment to possibilia. 'Admission of possibilia' is not a clear charge against the variable-domains interpretation. If we go back to Williamson, we can say that Kripke's proposal is committed to possibilia at the level of the metalanguage of the QML with variable domains. Another interpretation would be that admission of possibilia means employing such objects to explain different the use of modal idioms. Since it is not clear where this commitment to possibilia is produced, the interpretation is informal. If we look at what Barcan considers to be problematic about possibilia, we can better understand what 'admitting possibilia' means.

Barcan stands against Quine's (1961) critique with respect to modal logic. Modal logic implies a commitment to objects such as the possible fat man in the doorway, and Quine considers this

issue as problematic. How do we distinguish between such possible objects? How do we distinguish between a possible fat man in the doorway and the possible bald man in the doorway? We have no criteria of identification for such a possible object. To distinguish between two objects is to provide criteria of identification. However, Barcan argues that such criteria can be provided. We can establish there is a set of properties such that only one object could satisfy it. However, Barcan (1993, p. 197) considers that by "a mere concatenation of properties" no object is obtained. One should see the problem the other way around. While Quine's critique is that we have no possible objects since we have no identity conditions, Barcan argues that there cannot be an identity relation where there is no object. Thus, possibilia cannot enter an identity relation or self-identity relation, because they do not exist. This would be Barcan's (1993, p. 200) sense of "no identity without entity". This argument is meant to show a deeper problem in employing possibilia. Admitting possibilia means taking such objects to be objects of reference. Barcan appeals to a description of actual objects in order to show that possibilia cannot be objects of reference. Her claim is that we can refer to actual objects because we have a naming device and they are components of truths about identity statements. Both aspects rely on ostension. This requires that objects which are named and stay in a self-identity relation are objects of acquaintance at one point. Thus, the distinction between actual objects and possibilia is that the former have been objects of acquaintance at one point. Thus, the main critique is that possibilia cannot be admitted since they cannot be objects of reference.

However, how are we to accommodate the intuition the varying domain semantics manages to capture, namely, that there could have been more things than there actually are? A constant-domain semantics with a quantification domain restricted to the objects of the actual world would not be able to capture this idea. If the domain of quantification is not restricted to the one from the actual world, then possibilia have been admitted as well. Here the sense of "admitting possibilia" can be extended from "taking

possibilia as objects of reference" to "quantifying over possibilia". The constant domain approach seems to either be committed to possibilia, or to go against the contingency of existence. It seems that to account for the contingency of existence, we need possibilia. However, is there any innocent admission of possibilia and how are to define such an innocent commitment? Quantification over possibilia seems to be a stronger commitment, thus, the constant domain approach is less innocent than one in which such quantification is not required. The answer seems to lead us to a varying domain approach and see how damaging its admission of the problematic objects is.

How is reference to possibilia produced? In the semantics for quantified modal logic developed by Kripke (1971), a quantified sentence is evaluated relative to the actual world. An existentially quantified sentence, in which a property is predicated about an individual, is true if there is an individual at the actual world such that it belongs to the extension of the given predicate. The problems seem to appear when the quantifier is in the scope of the modal operator. Consider an existentially quantified sentence in the scope of a modal operator, in which a property is predicated about an object, which does not belong to the domain of the actual world. The sentence is true if there is a world such that the existentially quantified sentence is true. Since the sentence is existentially quantified, then at the given world there must be an individual such that it belongs to the extension of the predicate. "Possibly there could have been talking donkeys" is evaluated as true if there is a world in which the sentence "There are talking donkeys" is true. This is in turn true if there is at least one object at that world such that it is a donkey and it talks. Thus, this can be the first case in which admission of possibilia is produced. The second one is produced in the case of atomic sentences. The language of QML used by Kripke (1971) does not admit individual constants and variables are used instead. So in the case of atomic sentences such as 'Px', the formula is true if the individual x enters the extension of the predicate P, even though the object named by x does not exist at the world of evaluation. This is the sense of the

"Sherlock Holmes is bald"[17] example. We can take a sentence such as "x is bald" in which x can stay for any entity not in the domain of the actual world. Since such statement is given a truth value, then we have taken a mere possible object as an object of reference.

It seems that the critique of Zalta and Linsky (1994) and Williamson (1998) concerning the commitment to possibilia at the level of the metalanguage of QML is determined by the admission of mere possibilia as objects of reference. Admission of possible objects as objects of reference does not refer only to a commitment by means of quantifying over such objects, but it also refers to an appeal to such objects in order to offer the evaluation and truth conditions of sentences in modal contexts.

The critique Barcan provides against Kripke's semantics and the metaphysical consequences of this semantics are important for the development of different actualist approaches to QML that try to remove mere possibilia. These actualist approaches differ with respect to how quantification is understood and how the objects of quantification are treated. This leads to some varieties of actualism that make the mappings between the metaphysical views and the formal developments even more difficult.

5. Conclusion

I presented two semantic directions for first-order modal logic and the metaphysical problems associated with them. Both semantics work with the objectual quantification and the assumption that terms are rigid. The departure of varying-domain semantics from the constant-domain semantics is made with respect to the evaluation clauses for the quantifiers. Depending on the formal direction we choose, different metaphysical interpretations come into play.

[17] Recall that Kripke (2011) would exclude fictional entities from the spectrum of mere possibilia, since he argues there that fictional entities are abstract objects.

The discussion concerning the semantics for QML is shaped by metaphysical aspects. A central point concerning the metaphysics in QML is the problem of mere possibilia or quantification over non-existents. One direction is to accept quantification over non-existents and consider it a compromise that should be made since it seems unavoidable. The other direction is to impose conditions that would avoid quantification over such objects, at least with respect to how quantifiers are defined to work, namely as ranging only over existing objects at the world of evaluation. The former corresponds to a possibilist interpretation of quantifiers, while the latter corresponds to an actualist interpretation. However, there are other possible directions. For instance, rejecting any kind of commitment to mere possibilia or non-existents, as proposed by Williamson's (2013, 2) solution that "necessarily, everything is necessarily something". In this way, one can adopt a constant-domain semantics without quantification over non-existent. Another direction is to embed in the semantics the idea that world domains are different since it is contingent what individuals exist at different possible worlds.

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