LATIN AS A FORMAL LANGUAGE

Outlines of a Buridanian Semantics

INTRODUCTION

Originally, in this paper I wished to present a complete formal semantic system constructed for a fragment of Latin in line with the logico-semantic tenets of Jean Buridan. By the presentation of this semantic system I hoped to show that Buridan's semantic ideas, if given the appropriate technical formulations, can provide us with a genuine alternative way of construing the relationships between language, thought and reality, worthy of our serious consideration when thinking of matters of semantics. (Which explains the intentionally provocative title.[1]) Though I still believe that the task is after all not impossible, work on the technical details of this project convinced me that it cannot be properly completed within the confines of a single research paper. The intuitively quite simple and transparent ideas of Buridan's semantic theory, when one tries to convert them into strict syntactic and model theoretical formulations, turn out to "branch" into several, rather complicated formal clauses, resulting in an extremely complex, unperspicuous system.

This fact, however, in itself gives rise to a number of interesting questions. Are these complications inevitable? Are they rooted in the difference between Buridan's mediaeval and our modern standards of what a complete semantic theory should look like? Or do they represent rather the inherent complexity of natural, as opposed to formal languages? Or do they, perhaps, have something to do with Buridan's particularistic approach to logic in general, and his explicit admission of an infinity of first principles?[2]

These and similar questions will crop up inevitably even after the subsequent "rudimentary" presentation, reflection on which, I hope, may promote our understanding not only of Buridan's semantic ideas, but perhaps also of the nature of the semantic enterprise in general.

I begin the discussion by presenting the syntactic construction of a rather restricted, but philosophically interesting fragment of Latin. In contrast with Montague's approach, the semantic theory will be defined for this fragment, without the use of a formal language mediating between natural language sentences and their interpretation. Syntactic ambiguities will be taken care of by analyses supplied

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by the syntactic construction. The semantic theory, however, will not be built directly on the syntactic construction, because of Buridan's peculiar theory of meaning in terms of a mental language. It is notably at this point that the unwieldy complexity of formulations will raise its ugly head, so, by way of a compromise, I will supply only an incomplete characterization of Buridan's "Mentalese" in a model theoretical framework. On this incomplete basis I will be able only to indicate how further treatment of the most important properties of terms: signification, connotation, supposition, appellation and ampliation, and the definition of truth and consequence would look in a complete system. I shall close my discussion with some illustrations of the workings of the system, reflecting on its philosophical and methodological implications.

SYNTAX

Since the primary purpose of a logical semantic theory is to define logical consequence in terms of the truth values of propositions in different interpretations, the corresponding syntactic theory is primarily concerned with the formation rules of propositions, determining the ways propositions are built up from their components.

In modern logical systems a distinction is usually drawn between atomic and molecular formulae (i.e., strings of signs representing natural language sentences expressing propositions). Atomic formulae are formulae that are not made up from other formulae, while molecular formulae are those which are made up from other formulae by means of logical connectives that take formulae in their arguments to produce further formulae.

In Buridan's syntactic theory a somewhat similar distinction can be found between categorical and hypothetical propositions. Categorical propositions do not contain other propositions as their components, while hypothetical propositions are those formed from other propositions by means of logical connectives.[3]

However, despite this analogy, Buridan's categoricals are by no means syntactically as simple as the atomic formulae of the modern theories. Categorical propositions consist of a copula, a subject and a predicate term, possibly determined by *signa quantitatis*, that is, determiners. Obvious counterexamples to this "canonical form", containing verbs as their predicates, are explained away in Buridan's theory by resolving the verb into copula and participle.[4] Accordingly, atomic formulae of

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standard quantification theory containing a relational predicate parameter correspond to categoricals with a complex term having one or more parts in an oblique case. For example, the sentence: "Plato debet Socrati Brunellum" in its canonical form would look like: "Plato est debens Socrati Brunellum", where the subject, 'Plato', is joined by the copula, 'est', to the complex term "debens Socrati Brunellum".

As this example also shows, the potential complexity of a categorical proposition is due to the potential complexity of its terms, which, linguistically, can be just any noun-phrases that may occur in subject or predicate positions: singular or common nouns (with or without determiners), pronouns, adjectives, participles,[5] common nouns determined by adjectives, by possessives (i.e., possessive pronouns or terms in the genitive case), by participles (along with their oblique complements) or by relative clauses, infinitives, accusative with infinitive constructions and complex terms obtained from the above by Boolean operations, i.e., negation, conjunction and disjunction.

In view of this enormous potential complexity, one can easily see how ill-conceived it is to think of the theory of categoricals as an insignificant, minor fragment of logical theory. Indeed, in order to obtain a tractable theory, in this paper I shall consider only a fragment of Buridan's theory of categorical propositions.

Accordingly, I will not deal with Buridan's propositional logic (which, as far as I can judge, would only present the historically-minded reader with just another *nil-novi-sub-sole*-experience anyway).[6]

Again, I will not deal with pronouns, the analysis of which is partly related to the logic of hypotheticals, and which form a separate issue in Buridan's semantics under the heading: *de suppositione relativorum*.[7] I will, however, consider some uses of relative pronouns in forming relative clauses to explain a peculiar property of terms in what modern philosophers would call intensional contexts, namely *ampliation*.

To fully consider intensional phenomena in Buridan's semantics we would need

tenses. However, to simplify matters, for illustrative purposes in this fragment I will deal only with the present, perfect and future forms of the copula in the third person singular, namely 'est', 'fuit' and 'erit' - the tenses mostly occurring in Buridan's examples as well.

On the part of the noun phrases in this framework I am also going to leave several possible constructions aside. However, I am going to deal in more detail with complex terms containing one or more oblique terms as their parts. So in the fragment to be constructed here we shall need cases.

On the other hand, due to the special difficulties they present, I am also going to disregard plurals. Consequently, since according to Buridan "subjectum copulatum aequivalet subjecto pluralis numeri in reddendo suppositum verbo", I shall have to omit conjunctive terms as well.[8]

As we are soon to see, even with so many omissions, a relatively rich, and philosophically interesting fragment of Latin can be constructed. However, since the main purpose of this construction is not to give a description of a significant part of the Latin language, but to illustrate the theoretical power of Buridan's semantic ideas, we can afford to base this construction on a very limited vocabulary. As a matter of fact, this squares well both with Montague's method, and with Buridan's practice in selecting his examples and *sophismata*.

VOCABULARY (VOC)

In the subsequent clauses:

$g \in \{mas, fem, ne\} = GENDER$ and $c \in \{nom, acc, gen, dat, abl\} = CASE$, indicating the appropriate gender and case of the lexical item indexed by them.

PN (proper nouns): $= \{Socrates_{mas}, Plato_{mas}, Brunellus_{mas}, Favellus_{mas}\}$
CN (common nouns): $= \{homo_{mas}, equus_{mas}, animal_{ne}, canis_{mas}, visus_{mas}, albedo_{fec}\}$
Adj (adjectives): $= \{caecus_{g}, albus_{g}\}$
Prtc (participles): $= \{mortuus_{g}, videns_{g,acc}, debens_{g,dat,acc}, habens_{g,acc}, ens_{g}\}$
Sig (signa quantitatis, determiners): $= \{quidam_{g}, omnis_{g}\}$
Conj (conjunctiones): $= \{vel, non\}$
RP (relative pronoun): $= \{quod_{g}\}$
Cop (copula): $= \{est, fuit, erit\}$

The whole vocabulary of our fragment, then, is the union of the above-defined sets:

$VOC := PN \cup CN \cup Adj \cup Prtc \cup Sig \cup Conj \cup RP \cup Cop$

In an obvious manner, an indexed term stands for just the same term in the appropriate case and gender, e.g., "$omnis_{nenom}$ $animal_{nenom}$ $quidam_{masgen}$ $homo_{masgen}$ $videns_{nenom}$ $quidam_{femacc}$ $albedo_{femacc}$" = "omne animal cuiusdam hominis videns quamdam albedinem". The case indices of participles after the commas indicate the required cases of their complements, i.e., terms with which they can be construed.

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praedicati; ideo ad explicandum subjectum, praedicatum et copulam, tale verbum debet resolvi in hoc verbum 'est' tertium adjacens, si propositio sit de inesse et de praesenti, et in participium illius verbi, ut 'homo currit' id est 'homo est currens', similiter 'homo est' id est 'homo est ens'. SL, Tractatus primus: De Propositionibus, c.3, 2.
[5] Adjectives and participles can be subjects only when they are "substantivated in the neutral gender". Cf. e.g.: " ... quare omne subjicibile est praedicabile et non e converso. Ad quod potest responderi notando primo quod in hac tota parte nihil intendimus de subjectione vel praedicatione vocum materialiter sumptarum, sed significative. Et tunc dico primo de illis adjectivis non substantivatis in neutro genere quod secundum grammaticum non possunt reddere suppositum verbo, ideo etiam non possunt esse subjecta propositionis, propter defectum congruitatis; sed verbo jam habente suppositum, adjectiva possunt apponi ad designandum quid adjaceat subjecto vel ei pro quo subjectum supponit. Tamen verum est quod adjectivum substantivatum in neutro genere potest esse subjectum, quia resolvitur in substantivum et adjectivum, ut 'album' id est 'res alba'." SL, Tractatus Quartus: De Suppositionibus, c.2. 2.
[6] For excellent presentations and evaluations of Buridan's propositional logic from a modern point of view see e.g.: Hubien, H.: 'Logiciens médiévaux et logique d'aujourd'hui', *Revue Philosophique de Louvain*, 75, pp. 219-232, 1977 and E.A. Moody: *Truth and Consequence in Medieval Logic*, Amsterdam, 1957.
[7] For some formal treatment of the topic see, however, my "General Terms in Their Referring Function", in G. Klima: *Ars Artium: Essays in Philosophical Semantics, Mediaeval and Modern*, Budapest, 1988.

[8] "Quia subjectum copulatum aequivalet subjecto pluralis numeri in reddendo suppositum verbo; ideo oportet verbum esse pluralis numeri." SL Tarctatus Quartus: De Suppositionibus, c.2, 6. For a systematic account of the semantics of conjunctive terms and their relationships with supposition theory, however, see my "Approaching Natural Language via Mediaeval Logic", in: J. Bernard-J. Kelemen: *Zeichen, Denken, Praxis*, Institut für Sozio-Semiotische Studien, Vienna, 1990.

Indexed names of sets of expressions will serve to indicate their subsets containing just the appropriate indexed items. For example: $Adj_{nenom} = \{caecus_{nenom}, albus_{nenom}\} = \{caecum, album\}$. (Correspondingly, indexed metavariables in the subsequent clauses range over terms in the appropriate genders and cases: if n ranges over common nouns, then $n_{massacc}$, e.g., ranges over only common nouns of masculine gender in the accusative case.) Brackets in the following clauses indicate that the parts of speech they enclose are optional, i.e., they may or may not be present in forming the appropriate expression. For example, in the clause: if $s_{gc} \in Sig$ and $t_{gc} \in CN$, then $"[s_{gc}] t_{gc}" \in TRM_{gc}$, the brackets indicate that the *signum* s may, but need not be concatenated with a common noun to form a term, and so, e.g. both 'homo' and "quidam homo" are terms. (The gender and case indices indicate that e.g. "quemdam hominem" and "quamdam albedinem" would also be terms by this clause. Double quotation marks are used as quasi-quotes, indicating the operation of concatenation. Simple expressions of our fragment are mentioned by enclosing them in single quotation marks.) Bracketed indices of metavariables ranging over participles indicate that these metavariables range both over participles that do and those that do not require complements in specified cases: $p_{massgen[,c1][,c2]}$, e.g., has as its range of values: {mortui, videntis$_{acc}$, debentis$_{dat,acc}$, habentis$_{acc}$, entis}. The optional occurrence of the appropriate complements in a phrase is, of course, conditioned by the presence of the participle requiring them: such complements occur in a phrase only if the participle requiring them occurs. Generally, bracketed occurrences of a phrase enclosed in the same pair of outer brackets with another expression below are conditioned by the occurrence of the expression with which they are bracketed together. The pairs of sub-strings enclosed by < > < > may be replaced by one another (i.e. they may occur also in the reverse order).

TERMS (TRM)

(0) If $n_{gc} \in PN \cup CN$, then $n_{gc} \in ITRM_{gc} \subset TRM_{gc}$

(1) If $a_{nec} \in Adj$, then
$a_{nec} \in ITRM_{nec} \subset TRM_{nec}$

(2) If $p_{necl[,c2][,c3]} \in Prtc$, $t2_{c2}, t3_{c3} \in TRM$ and $s_{necl} \in Sig$, then
$"<p_{necl[,c2][,c3]}> <[t2_{c2}] [t3_{c3}]>" \in ITRM_{necl} \subset TRM_{necl}$ and
$"<s_{necl} p_{necl[,c2][,c3]}> <[t2_{c2}] [t3_{c3}]>" \in DTRM_{necl} \subset TRM_{necl}$

(3) If $n_{gc} \in PN \cup CN$, $s_{gc} \in Sig$ and $a_{gc} \in Adj$, then
$"[non] n_{gc} [non] a_{gc}" \in NA_{gc} \subset ITRM_{gc} \subset TRM_{gc}$ and
$"s_{gc} [non] n_{gc} [non] a_{gc}" \in NA_{gc} \subset DTRM_{gc} \subset TRM_{gc}$

(4) If $n_{gc} \in PN \cup CN \cup NA \subset ITRM$, $t_{gen} \in TRM_{gen}$ and $s_{gc} \in Sig$, then
$"<n_{gc}> <t_{gen}>" \in NAG_{gc} \subset ITRM_{gc}$
$"<s_{gc} n_{gc}> <t_{gen}>" \in DTRM_{gc}$

(5) If $n_{gcl} \in PN \cup CN \cup NA \cup NAG \subset ITRM$, $p_{gcl[,c2][,c3]} \in Prtc$, $s_{gcl} \in Sig$, and $t2_{c2}, t3_{c3} \in TRM$, then
$"<n_{gcl} [non] p_{gcl[,c2][,c3]}> <[t2_{c2}] [t3_{c3}]>" \in ITRM_{gcl} \subset TRM_{gcl}$
$"<s_{gcl} n_{gcl} [non] p_{gcl[,c2][,c3]}> <[t2_{c2}] [t3_{c3}]>" \in DTRM_{gcl} \subset TRM_{gcl}$

(6) If $t \in TRM$, then

"non t" $\in TRM$, where if $t \in ITRM$, then also "non t" $\in ITRM$

(7) If $t_{gc} \in ITRM$ and $s_{gc} \in Sig$, then
$"s_{gc} t_{gc}" \in TRM_{gc}$

(8) If $t1_{gnom} \in TRM$, $t2_{nom} \in TRM$, $cop \in Cop$ and $q_{gnom} \in RP$, then
$"t1_{gnom} q_{gnom} cop t2_{nom}" \in TRM_{gnom}$

(9) If $q_{nenom} \in RP$, $cop \in Cop$ and $t_{nom} \in TRM$, then
$"q_{nenom} cop t_{nom}" \in ITRM_{nenom}$

(10) If $t1_{gc}, t2_{gc} \in ITRM$, then
$"t1_{gc} vel t2_{gc}" \in ITRM_{gc}$

For semantic purposes we shall have to distinguish between categorematic (CAT) and syncategorematic terms (SYNC):
$SYNC := Sig \cup Cop \cup Conj$; $CAT := TRM \cup RP \cup Adj \cup Prtc$

Again, we shall have to distinguish abstract (ABTR), from concrete (CONCR) terms:
$ABTR := \{visus_{masc}, albedo_{fec}\}$; $CONCR := CAT - ABTR$

PROPOSITIONS (PROP)

(11) If $t1, t2 \in TRM_{nom}$ and $cop \in Cop$, then
$"t1 [non] cop t2" \in PROP$

(12) If $p \in PROP$, then "non p" $\in PROP$

EXAMPLES AND DISCUSSION

Since the clauses above are rather complicated, I think it is worth providing some examples to illustrate how they are supposed to work. Through these examples we can also assess the adequacy of these rules and the extent of the fragment of Latin they cover.

Clauses (1) and (2) take care of simple as well as complex terms formed with adjectives and participles substantivated in the neutral gender, i.e., in their capacity of forming standalone terms without attaching to nouns as their adjuncts (*sicut determinatio ad determinabile*). So, e.g., 'album' in itself is a term, indeed, an indefinite term (ITRM), i.e., a term not determined to some definite quantity by some *signum*, by clause (1). Similarly, "videns hominem", "habentis omnem equum", or "debentem cuidam homini quemdam equum" are all indefinite terms by clause (2), while they would become definite terms by prefixing them with a *signum* of the appropriate case and gender as is prescribed by clause (7).

Note here that, for *semantic* reasons, Buridan himself does not regard *signa quantitatis* as parts of terms (in particular, of subject terms) of propositions.[9] It is

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[9] Cf.: "Sed de signis affirmativis, ut 'omnis', 'quilibet', quare non possunt ita bene esse partes subjectorum sicut praedicatorum? Potest dici quod signum distributivum positum a parte praedicati nihil operatur super copulam vel super subjectum, ideo totaliter dicitur pertinere ad praedicatum. Sed positum a parte subjecti operatur super copulam et super praedicatum, confundendo ipsum, licet non distributive, ideo nec ponitur esse pars subjecti nec pars praedicati, sed ponitur tamquam condicio totalis propositionis. Sed tunc videtur difficilius de signo particulari: quia nihil operatur super copulam vel super praedicatum si ponatur a parte subjecti, propter quod videtur quod ita bene deberet poni pars

quite harmless, however, to treat them in this way in the *syntactic* theory, and renders much easier the formulation of recursive clauses.

Another feature of these clauses worth noticing is their making complex terms inherit the case and gender of their core-terms. This is important again from the point of view of the recursive applicability of these clauses. This feature of these rules makes their application possible also to the result of their previous applications. For example, by clauses (1) and (7) "omne album" is a term not only in the nominative, but also in the accusative case. So this term can occur as the complement in the accusative case required by 'videns', whence, by clause (2) , "videns omne album" will also be a term.

Indeed, "videns omne album" may itself also be in the accusative case (provided 'videns' is in the accusative), whence it may be the complement of 'videns' again, and so "videns videns omne album" will also be a term. The same kind of construction can be repeated an unlimited number of times.[10]

On the other hand, since the case of a complex term depends on the case of its core, if this core is, say, in the dative, as in "videnti videns album", then this cannot be the complement of 'videns' again. It can, however, be the complement of 'debens', as in "debens videnti videns album omne videns album" (possibly referring to something that owes everything that sees a white thing to something that sees something that sees a white thing, which may be complicated but after all not impossible).

Clause (2) also allows for different word order, which has semantic significance in Buridan's theory. As we shall see, for example, "debens Socrati equum" and "equum Socrati debens" need not have the same semantic value.

Note here that by clause (7) we would not be able to obtain e.g. "quemdam

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subjecti, sicut esset pars praedicati si poneretur a parte praedicati. Ad hoc possunt dari multae responsiones. Prima est quod signum particulare omnino frustra ponitur in propositione, sive a parte subjecti sive a parte praedicati, prout ista regula concederetur, scilicet quod indefinita et particularis aequipollent gratia formae, quia sic omnino nihil mutatur de summa propter additionem vel subtractionem signi; ideo nec debet reputari pars subjecti nec pars praedicati, nec aliqua condicio propositionis nisi frustratorie apposita. Et ego ostendo quod illud signum particulare, etiam positum a parte praedicati, non sit pars praedicati. Quia istae duae gratia formae aequipollent 'B est A' et 'B est aliquod A'; ideo quaecumque contradicit uni contradicit alteri; modo constat quod ista 'nullum B est A' contradicit primae; ergo similiter contradicit secundae, et tamen non contradiceret ei si iste terminus 'aliquod' esset pars praedicati, quia jam non essent de eodem subjecto et eodem praedicato, quod tamen requiritur ad contradictionem formalem. Ideo videtur mihi quod talis dictio posita sive in subjecto sive in praedicato non debet dici pars subjecti nec pars praedicati; vel si ponatur esse pars praedicati, ita debet poni pars subjecti, sed tamen pars frustratorie apposita, quia ea ablata nihil mutaretur de summa. Sed alio modo signum particulare ponitur aliquando in propositione, vel etiam signum universale, ad determinandum indefinitam, scilicet signum universale ad designandum quod praedicatum verificatur de subjecto pro omni ejus supposito et particulare ad designandum quod veritas sit pro aliquo et non pro omni, vel saltem quod veritas sit nota pro aliquo et non sit nota pro omni; et propositio indefinita se habet ad hoc indifferenter. Unde sic proprie sumendo signum particulare leges bene ponunt differentiam inter propositionem particularem et indefinitam, et saepius per indefinitam intelligunt universalem, et non particularem. Et isto modo signum universale et particulare non deserviunt ad subjiciendum, sed ad designandum quantitatem propositionis quando ponuntur a parte subjecti." SL, Tractatus Quartus: De Suppositionibus, c.2, 2.

[10] To be sure, in real Latin, as in any human language, there should probably be some limit on the repeatability of this construction. But this may concern the limited short-term memory capacity of human language users, which may have to do rather with pragmatics than syntax. Anyway, in this paper I shall not consider the theoretical implications of this potential of the syntactic theory presented here.

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equum omne videns" from "quemdam equum videns" obtained by clause (2). So it is the second half of clause (2) that takes care of this possibility, stating that the participle itself may also be determined by a *signum* even when occurring after its adjunct(s), in which case, however, the resulting term will be determinate (**DTRM**) to which clause (7) is not applicable.

The subsequent clauses provide for the construction of complex terms with a noun as their core along with several types of possible adjuncts.

In virtue of clause (3) "homo albus", "equus non caecus", and the like constructions are indefinite terms, obtained by the concatenation of a noun and an adjective (**NA**) with the optional interposition of a negation.

Note that in clause (4) the term that, concatenated with the genitive of another term yields a new indefinite term can also be obtained by clause (3). So "equus non caecus cuiusdam hominis" is also a possible result of the application of clause (4).

Again, the clause takes care of semantically relevant variations of word order. As we shall see, "equus omnis hominis" and "omnis hominis equus" may have different semantic values. (The former can refer to a horse only if it is possessed by all men, while in the latter, on one of its possible readings, for every given person some or other of his horses is being referred to, without implying that any horse would belong to all persons.)

Note also that the second part of the clause makes it possible that the core of such a complex term be determinate (**DTRM**), which is especially relevant when the genitive precedes it, as in: "cuiusdam hominis omnis equus", which is again semantically different from "omnis equus cuiusdam hominis". (The former concerns all of some man's horses, while in the latter reference is made to all horses possessed by someone or other.)

By clause (5) we can build further the term obtained above to get, e.g., "equus non caecus cuiusdam hominis videns omnem hominem". In view of the possibility changing word order, by this clause also "omnem hominem cuiusdam hominis equus non caecus videns" is a term.

In virtue of clause (6) any of the above-mentioned indefinite terms prefixed with a negation are also indefinite terms, while a definite term prefixed with a negation is a definite term.

By clause (7) any indefinite term prefixed with a *signum* (which itself may also be prefixed with a negation) is a definite term.[11]

Clauses (8) and (9) take care of complex terms formed with relative clauses. Clause (8) treats relative clauses as adjuncts to other terms, as in "omnis equus Socratis qui est album", while clause (9) treats them as independent terms in their own right, as in "quod est equus Socratis". Of course, these clauses are also applicable recursively, as in the case of "quod est quod est equus Socratis", which may be redundant, but is otherwise acceptable.

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[11] Note here that proper nouns are also included here as possible core-terms, and so the rule allows them to be determined not only by adjuncts, but also by *signa*, that is, determiners. This would probably not be endorsed by Buridan. Nevertheless, from a semantic point of view their inclusion here is rather harmless (they just provide cases of "vacuous quantification"), and in any case simplifies the formulation of these clauses.

Note here that these clauses do not provide for constructions like "homo qui est albus", but do allow constructions like "homo qui est album". This apparent oddity is introduced only to simplify these clauses, and is after all in good accord with Buridan's theory of predication, in which a predicate term is supposed to be a referring expression in the same way as a subject term in order to be convertible with it.[12]

As can be seen, these clauses do not generate relative clauses in oblique cases, like the one in: "homo quem equus est videns". But since the incorporation of such clauses would be just further complication without much theoretical import, we can disregard them in this fragment. (On the basis of the existing clauses, I think it is quite easy to imagine how they could be handled anyway.)

Clause (10) generates disjunctive terms in all cases and genders, the only restriction in this respect being that the disjuncts be of the same case and gender. Its recursive applicability also allows these terms to contain an unlimited number of disjuncts.

Clause (11) takes care of both affirmative and negative propositions including constructions like "homo est album", or "homo est omne album", where concerning gender agreement the same considerations apply as in the case of relative clauses above.

Finally clause (12) allows negation to appear also as a prefix to a proposition as a whole, as in "Non non omnis homo est albus".

A notable general feature of these clauses is that they allow the construction of syntactically ambiguous complex expressions, i.e., expressions that can be obtained from the vocabulary by applying different sets of these rules in different order. Of course, in the semantic theory we shall have to be able to distinguish between these different possible constructions, which shall correspond to different "readings" or senses of these expressions. To distinguish these different constructions, we can assign the syntactic clauses given above *characteristic functions*, i.e., functions that correspond to the applications of these clauses, taking the input expressions of the clauses as their arguments, and yielding the output expressions as their values:

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[12] Cf.: "Et tunc distinguitur triplex passio, una substantiva, alia adjectiva adjective sumpta et tertia adjectiva in neutro genere substantivata. De primo modo dicimus 'tempus' esse passionem 'motus' et 'simitatem' 'cavitatis': nam ultra significationem 'cavitatis' 'simitas' appellat nasum; est ergo praedicatio passionis de subjecto 'motus est tempus' vel 'cavitas est simitas'. De secundo autem modo, 'simum' est passio 'nasi' et 'album' 'hominis', vel 'lapidis', vel 'entis'; et est praedicatio passionis de subjecto dicere 'nasus est simus', 'homo est albus', vel 'res est alba', et cetera. De tertio modo, est praedicatio passionis de subjecto dicere 'nasus est simum', 'homo est album'. In primo autem modo et in tertio convertitur praedicatio passionis de subjecto in praedicationem subjecti de passione, ut 'cavitas est simitas; ergo simitas est cavitas', similiter 'homo est album; ergo album est homo'. Sed in secundo modo non sic fit conversio; dicimus enim 'nasus est simus', sed non dicimus 'simus est nasus', quia oratio esset incongrua, vel imperfecta, sicut dictum est prius, sed convertendo oportet adjectivum substantivare ut 'homo est albus; ergo album est homo'. Et ex his statim manifestum est quod passiones de secundo dictorum modorum non sunt per se acceptae diffinibiles diffinitione praedicabili de diffinito significative sumpto, quia non possunt per se subjici in propositione categorica, ut dictum est." SL, Tractatus Octavus: De Divisionibus, c. 2, 4. In view of this it is probable that Buridan would also have accepted the construction: 'homo qui est album', that is, 'homo qui est quoddam album'.

(F1) $\quad F_1(p_{nec1,c2,c3})(t2_{c2})[(t3_{c3})] = "p_{nec1,c2,c3}\ t2_{c2}\ [t3_{c3}]"$

(F2) $\quad F_2(p_{nec1,c2,c3})(t2_{c2})(t3_{c3}) = "t2_{c2}\ [t3_{c3}]\ p_{nec1,c2,c3}"$

(F3) $\quad F_3([non]\ a_{gc})([s_{gc}]\ [non]\ n_{gc}) = "[s_{gc}]\ [non]\ n_{gc}\ [non]\ a_{gc}"$

(F4) $\quad F_4(t_{gen})([s_{gc}]\ n_{gc}) = "[s_{gc}]\ n_{gc}\ t_{gen}"$

(F5) $\quad F_5(t_{gen})([s_{gc}]\ n_{gc}) = "t_{gen}\ [s_{gc}]\ n_{gc}"$

(F6) $\quad F_6([non]\ p_{gc1,c2,c3})([s_{gc1}]\ n_{gc1})(t2_{c2})[(t3_{c3})] = "[s_{gc1}]\ n_{gc1}\ [non]\ p_{gc1,c2,c3}\ t2_{c2}\ [t3_{c3}]"$

(F7) $\quad F_7([non]\ p_{gc1,c2,c3})([s_{gc1}]\ n_{gc1})(t2_{c2})[(t3_{c3})] = "t2_{c2}\ [t3_{c3}]\ [s_{gc1}]\ n_{gc1}\ [non]\ p_{gc1,c2,c3}"$

(F8) $\quad F_8(non)(t) = "non\ t"$

(F9) $\quad F_9(s_{gc})(t_{gc}) = "s_{gc}\ t_{gc}"$

(F10) $\quad F_{10}(q_{gnom})(t1_{gnom})(cop)(t2_{nom}) = "t1_{gnom}\ q_{gnom}\ cop\ t2_{nom}"$

(F11) $\quad F_{11}(q_{nenom})(cop)(t2_{nom}) = "q_{nenom}\ cop\ t2_{nom}"$

(F12) $\quad F_{12}(vel)(t1_{gc})(t2_{gc}) = "t1_{gc}\ vel\ t2_{gc}"$

(F13) $\quad F_{13}([non]\ cop)(t1)(t2_{nom}) = "t1\ [non]\ cop\ t2"$

(F14) $\quad F_{14}(non)(p) = "non\ p"$

Where the metavariables in (F1)-(F2), (F3), (F4)-(F5), (F6)-(F7), (F8)-(F14) are the same as in (2), (3), (4), (5), (6)-(12), respectively.

With the help of these characteristic functions we can supply disambiguated analyses of ambiguous complex expressions of our fragment, in such a manner that these analyses can serve in the semantic theory to distinguish between the different senses of these expressions. Just by way of illustration consider the following two simple examples: "omnis hominis equus", "non homo vel equus est albus".

The first of these can be analysed in two different ways: it may be regarded either as a complex term which is formed from a noun and a genitive, determined by a *signum*, or as a complex term formed from a noun as its core, and a genitive determined by a *signum* in the genitive case.

/A/ $\quad F_9(omnis)(hominis\ equus)$

/B/ $\quad F_5(omnis\ hominis)(equus)$

Of course both of these can be analysed further as follows:

/A'/ $\quad F_9(omnis)(F_5(hominis)(equus)))$

/B'/ $\quad F_5(F_9(omnis)(hominis))(equus))$

For the second example I give here only the fully expanded analyses, showing how they generate the same ambiguous sentence:

/1/ $\quad F_{14}(non)(F_{13}(est)(F_{12}(vel)(homo)(equus))(albus)) = "non\ homo\ vel\ equus\ est\ albus"$

/2/ $\quad F_{13}(est)(F_{12}(vel)(F_8(non)(homo))(equus)))(albus) = "non\ homo\ vel\ equus\ est\ albus"$

/3/ $\quad F_{13}(est)(F_8(non)(F_{12}(vel)(homo)(equus)))(albus) = "non\ homo\ vel\ equus\ est\ albus"$

SEMANTICS

PRELIMINARY REMARKS

A Buridanian semantics cannot be one that construes meaning as a relation between words and extramental things alone. To be sure, for Buridan many words of our languages are imposed to signify extramental things. However, several expressions of our languages, namely some syncategorematic expressions, signify nothing at all in external reality, but only concepts of the mind (which, though, are real entities, ontologically on a par with other qualities); and even those that signify extramental things do so only by signifying concepts of the mind immediately, and signify extramental things only by the mediation of these, namely signifying the things that are conceived by the concepts signified by them immediately. This mediation also means that an expression signifying something *ad extra* owes its external signification exclusively to the concept that it signifies *apud mentem*, i.e. to which it is subordinated: should the same expression be subordinated to another concept, it would thereby signify those things which are conceived by this other concept, that is, it would have a different meaning.

This two-tier structure of meaning, which, to be sure, was not a peculiarity of Buridan's semantics in the Middle Ages, was developed to its utmost consequences by Buridan. Most importantly, he went as far as supposing the existence of a fully articulated mental language immediately signified by, and thereby conferring meaning on (vocal and written forms of) any kind of human idioms (including even sign-languages).

This "mentalese", however, is by no means an in principle inaccessible "private language" of individual language users. It is precisely its systematic bit-by-bit relationship with spoken and written languages that makes it accessible in ordinary communication, whereby individual language users are able to think the same thoughts, despite the fact that this is realized through their having numerically distinct, individual mental acts. For example, even if the concept immediately signified by the term 'homo' in my mind is a numerically distinct entity from the concept signified immediately by the same term in your mind, provided we conceive the same things by these concepts, namely human beings, we assign the same meaning to the same term and we are able to form the same thoughts with these concepts. Indeed, the same concept in my mind (as well as in yours) can be immediately signified also by the English word 'man', which explains why we are able to think of the same things by using either of these words, i.e., why we understand both the Latin and the English word as meaning the same.

To be sure, since subordinating words to concepts by imposing them to mean something is conventional and is entirely in our power, it may happen that the same word is assigned different meanings by different persons on different occasions. So the immediate signification of a term is always dependent on its actual imposition. But given this imposition the term is subordinated to some particular concept of a human mind, and provided users of the same term agree on imposing the same word

to signify one of their concepts by which they conceive the same things in the same way, they mean the same by the same term.

The restriction: "conceive the same things *in the same way*" is significant here. For our concepts representing extramental things may relate to the things they represent in different ways according to Buridan. Our *absolute concepts* signify directly and in the same way all the things they represent. Our *connotative concepts*, however, signify some of the things they represent directly, but some of them obliquely, as adjacent or non-adjacent to what they signify directly, which means that whatever they signify directly they signify only in relation to what they connote either positively or negatively.

For example, the English terms 'sighted' and 'blind' and, correspondingly (and indeed primarily), the concepts associated to them, according to this analysis both signify directly animals. Indeed, both of these terms signify animals connoting their sight. But while 'sighted' connotes the sight of a particular animal positively, as adjacent to that animal, 'blind', on the contrary, connotes its sight negatively, as non-adjacent to it. Consequently, the term 'sighted' will refer to this animal in a present tense affirmative proposition only if it actually does have sight, while 'blind' would do the same only if the animal does not have sight. In fact, both of these terms have reference not only to what they stand for in a proposition but also an oblique reference to what they connote even outside a proposition. Buridan calls this oblique reference *appellation*. As can be seen, positive or negative *appellation* of their connotata is of primary importance in determining the reference of connotative or, as Buridan more frequently calls them, *appellative* terms.

Since according to Buridan the import of the affirmative copula is the identity of the *supposita* of the terms flanking it, reference, or using the mediaeval technical term, *supposition* of a categorematic term in a proposition is crucial in determining the truth conditions of categorical propositions. But supposition (and appellation) of terms in the context of a proposition is dependent on their signification (and connotation in the case of connotative terms) even outside a proposition, which in turn is dependent on the signification of the concepts to which they are subordinated.

Accordingly, in constructing the semantics for the fragment defined above, first we have to establish the relation of subordination, or immediate signification between items of our fragment and concepts of human minds. As a second step, we have to define their ultimate signification in terms of their immediate signification. Finally we have to define the supposition of terms in several propositional contexts, by which we shall be able to provide a definition of truth and consequence for this fragment.

The definition of these semantic relations in a model theoretical framework can be given in basically the standard way, namely defining them as mappings from syntactic items to a domain containing their possible semantic values, a so-called universe of discourse, usually an arbitrary set. However, to provide a construction true to the spirit of Buridan's ideas several further qualifications are in order.

First of all, as the above-sketched analysis of the semantics of the term 'blind'

should already suggest, we have to distinguish between actual and non-actual elements of our universe of discourse. But of course, since actuality is time-bound - what is actual now was not necessarily so in the past and need not be so in the future -, we have to think of actual entities as forming some subset of the universe of discourse relative to some given time t. So if the universe of discourse is some set W, then the set of actual things at time t, A(t), is to be a subset of W. (A(t) ⊂ W)

In this way we can easily account for the fact that in some contexts we can successfully refer to something that actually does not exist. For example, if it is winter and there are actually no roses in my garden, I can successfully refer to the roses we saw last summer in my garden with the true sentence "I had beautiful roses here last summer". On the other hand, the sentence "I have beautiful roses in my garden", uttered at the same time is false, precisely because there are actually no roses in my garden at the time of its utterance.[13]

The difference, as Buridan explains, is that in the first sentence the past tense of the verb makes the range of reference of the term 'rose' extend beyond the domain of actual entities, permitting it to refer to what was a rose, even if now it is perished, and so does not exist. But in the present-tense sentence the same term cannot refer to anything, there being nothing to which it would actually apply. In the model theory we can represent this situation by assigning a zero-entity, say 0, which falls outside the universe of discourse (0 ∉ W), as its value to the function assigning terms their *supposita* at some given present time t. (Say, SUP('rose')(t) = 0) On the other hand, in the past tense context, in which its range is extended, or *ampliated*, to use Buridan's term, to past roses, a *suppositum* of this term is an element of a domain of entities which *were* actual at some earlier time: SUP$_P$('rose')(t) ∈ A(t') ∪ A(t), where t' < t.

[13] "... hoc significatur per nomen quod per ipsum positum in oratione intelligitur, cum significare est intellectum rei constituere. Sed per hoc nomen 'rosa' intelligitur rosa, et per hoc nomen 'rose' intelliguntur rose. Verbi gratia tu et ego simul anno preterito vidimus multas rosas rubras. Si ergo ego peto a te: "nonne rose quas vidimus erant rubre?", tu dicis quod "ymmo". Quod scis esse verum. Quod tamen tu non scires si non intelligeres istas rosas. Tu ergo per illud nomen 'rosas' cum dico "vidimus rosas" intelligis ea que vidimus. Sed vidimus rosas rubras. Igitur intelligis rosas. Quarta conclusio est quod hoc nomen 'rosa' supponit pro rosas et hoc nomen 'rose' supponit pro rosis, licet nulla sit rosa, quia secundum casu predictum, scilicet quod anno preterito vidimus multas rosas rubras, tu concedis illam 'multe rose rubre fuerunt anno preterito'; et eam scis esse veram. Et cum sit affirmativa, non esset vera nisi subiectum, quod est hoc nomen 'rose', pro aliquo supponeret, vel pro aliquibus. Sed tamen non supponit pro alio vel pro aliis quam pro rosis. ... notandum est quod possumus intelligere res sine differentia temporis et intelligere preteritas vel futuras sicud presentes. Propter hoc etiam possumus inponere vocem ad significandum sine differentia temporis. Sic enim nomina significant. Unde specifico conceptu 'hominis' ego indifferenter omnes homines concipio presentes preteritos et futuros. Et per hoc nomen 'homo' omnes indifferenter significantur presentes, preteriti et futuri. Ideo vere dicimus quod omnis homo qui fuit, fuit animal, et omnis homo qui erit, erit animal. Et propter hoc consequitur quod ista 'intelligere', 'scire', 'significare', et huiusmodi, et participia inde descendentia ampliant terminos cum quibus construuntur, ad supponendum indifferenter pro presentibus, preteritis et futuris et possibilibus que forte nec sunt nec erunt nec unquam fuerunt. Quamvis igitur nulla sit rosa, ego intelligo rosam non que est sed que fuit vel erit vel que potest esse. Et tunc quando dicitur: hoc nomen 'rosa' significat aliquid, concedo. Et cum dicis: illud non est, concedo. Sed fuit. Si tunc concludis: igitur aliquid est nichil, nego consequentiam, quia in maiore iste terminus 'aliquid' erat ampliatus ad preterita et futura, et in conclusione est restrictus ad presentia. Et dictum fuit quod quod a termino ampliori et non distributo ad seipsum minus amplum non valet consequentia." Johannes Buridanus: Questiones Longe super Librum Perihermeneias, ed. Ria van der Lecq, Utrecht, 1983, pp.12-14.

The second point to be considered here is the representation of the signification of connotative, or appellative terms. As we have seen, such terms signify whatever they signify only in relation to other things, for example, the term 'album' signifies white things (including past, future and possible ones, since 'signify' *ampliates* also to these domains) only by connoting their whitenesses, whether these whitenesses are actual or not. Of course, it will, nevertheless, *supposit* only for things which are *actually* white in a sentence like 'Animal est album'. But to supposit for them this term first has to signify them, and it signifies them only in relation to their whitenesses. Similarly, it will supposit for *past* white things in a sentence like "Animal fuit album", but it can supposit for them also in this sentence only because it signifies them connoting their past whitenesses, which need not be actual at the time of the utterance of this sentence.

On the other hand, the term 'albedo' signifies individual whitenesses of individual substances absolutely, without connoting anything, in the same way as the term 'homo' signifies individual men, or the term 'rosa' signifies individual roses. So if we denote a significate of the term 'albedo' like this: SGT('albedo'), we can say that it is just an element of a subset of the universe of discourse, namely an element of the signification of 'albedo', the set of things naturally and directly represented by the concept to which the term 'albedo' is subordinated. (SGT('albedo') ∈ SG('albedo'), where SG('albedo') ⊂ W.) A *suppositum* of the same term in a present tense proposition uttered at some time t is identical with one of its *significata* that are actual at that time, provided there are any, otherwise it supposits for nothing, that is to say, it takes 0 as its value:

SUP('albedo')(t) = SGT('albedo'), if SGT('albedo') ∈ A(t), otherwise
SUP('albedo')(t) = 0.

In a very interesting passage Buridan analyses the semantics of adjectives in comparison with the way possessives determine the supposition of their head-nouns.[14] According to this analysis 'album' in "animal album" bears a similar relationship to 'albedo' as 'hominis' in "animal hominis" to 'homo'.

Now 'hominis' is certainly a phrase that does not signify *ad extra* anything different from what the term 'homo' signifies, namely individual men. However, it signifies them differently, namely as adjacent to what the term with which 'hominis' is constructed signifies. But in view of the above considerations this should mean

[14] Sed cum dico 'homo albus currit', ego credo quod 'albus' nullam substantiam significat, sed albedinem tantum. Et ita nihil plus vel aliud, nisi quantum ad modos significandi grammaticales, significat iste terminus 'albus' quam iste terminus 'albedo', sed idem diversimode significant, scilicet albedinem; nam 'albedo' significat ipsam per modum subsistentis et 'albus' per modum alteri adjacentis. Et sic puto debere intelligi quod bene dicit Aristotiles in Praedicamentis, scilicet quod 'album' nihil aliud significat quam qualitatem, quod credo esse verum accipiendo 'album' adjective, ut dicendo 'lignum album'. Puto ergo quod 'album' in neutro genere substantivatum et supponit et appellat; 'albus' autem non supponit, sed solum appellat, et illud appellat quod significat. Ita etiam ego credo quod nomen substantivum obliquum non supponit, sed solum, et appellat illud quod significat, et appellando bene determinat suppositionem substantivi cui adjungitur. Et idem, et non aliud, significat rectus et ejus obliquus, sed diversis modis quantum ad diversos modos significandi grammaticales; quia rectus significat secundum modum subsistentis et obliquus per modum adjacentis, seu habentis se aliquo modo ad rem quem rectus cum quo construitur significat vel pro qua supponit. SL, Tractatus Octavus: De Divisionibus, c. 2, 4.

that the complex term "animal hominis" is a connotative term, signifying animals in relation to men. So 'hominis' in itself is a connotative term as well, connoting men, and the things to which these men are signified as adjacent.

Consequently, we should treat the genitive case as an "unsaturator", indicating that the genitive form of a noun signifies *apud mentem* a connotative concept connoting what is signified directly by the absolute concept to which the nominative form is subordinated and what is signified by the head-noun with which the genitive form is constructed. And this, by the way, explains why such a genitive cannot be a subject or a predicate of a proposition in itself. For in itself it is incomplete, to be completed by a nominative supplying one of its connotata. So along these lines we can construct a significate of "animal hominis" as follows:

$SGT(\text{"animal hominis"}) = SGT(\text{'hominis'})(SGT(\text{'animal'}))(SGT(\text{'homo'}))$, where $SGT(\text{'hominis'})(u)(SGT(\text{'homo'})) = u \in W$.

But then, in a similar manner, a significate of 'animal album' should be constructed as follows:

$SGT(\text{"animal album"}) = SGT(\text{'album'})(SGT(\text{'animal'}))(SGT(\text{'albedo'}))$, where $SGT(\text{'album'})(u)(SGT(\text{'albedo'})) = u \in W$.

Technically, SGT here is a function which for the term 'album' as its argument yields another function as its value, which can take another thing as its argument, namely the thing having whiteness (whether actually or not), yielding another function as its value that can take a further thing as its argument, a significate of the term 'albedo', that is, an individual whiteness connoted by 'album' as adjacent to this thing, yielding this thing as its value. Of course, a *suppositum* of this term in the context of a present tense proposition uttered at some time t can be only a thing that actually has whiteness at t, that is to say, if the term 'albedo' can successfully refer to (supposit for) this whiteness at that time as an *appellatum* of the term 'album':[15]

$SUP(\text{"animal album"})(t) = SGT(\text{'album'})(SUP(\text{'animal'})(t))(SUP(\text{'albedo'})(t))$ if $SUP(\text{'animal'})(t) \in A(t)$ and $SUP(\text{'albedo'})(t) \in A(t)$, otherwise $SUP(\text{"animal album"})(t) = 0$.

The main advantage of this treatment of connotative terms is that the arity of the term which it interprets does not determine the arity of SGT, still we do not have to take, e.g., ordered n-tuples as its arguments. For otherwise we could take SGT to be, e.g., a two-place function having a term in its first, and the term's connotatum in its second argument place, but then the same function could not interpret terms of different arities. Alternatively, we could define it as a two-place function taking a term in its first, and ordered n-tuples in its second argument place. But in this case, still, the same function could not interpret absolute terms (unless we would introduce some artificial null-tuple) and we would have to regard a connotative term's connotata to be entities which do not occur in Buridan's nominalist ontology.

Furthermore, the treatment proposed above renders technically easy and quite natural the representation of a peculiar feature of the Buridanian semantics of

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connotative terms, namely that their semantic arity is not determined by the number of their syntactic complements. What matters in this regard is only that at the end of the iterated application of functional composition we get a saturated entity, an element of the universe of discourse, but the number of intermediary functions is dependent solely on whether at any given step a given function for a given argument will yield a further function again or a saturated entity, thereby ending the process.

Indeed, this kind of construction makes it possible that the same expression has different arities, as it should be the case e.g. with adjectives or participles occurring either as standalone terms substantivated in the neutral gender, or as adjuncts to nouns.

A further point worth preliminary consideration is Buridan's theory of *appellatio rationis* used by him to explain the peculiarities of reference in intentional contexts.

Although several recent commentators think differently, I think we can treat this theory as a consistent part of Buridan's general theory of appellation.[16] The only difference between appellation of an appellative term in general and a case of *appellatio rationis* is that in the latter case oblique reference is made not to the *connotata* of an appellative term, but to the *ratio* signified by any term, whether appellative or not, in the context of an intentional verb or, rather, the participle derived from it.

For example, according to Buridan, the participle 'debens' makes the accusative constructed with it appellate its own *ratio*, which explains why it cannot be replaced by a term in a proposition like "Plato est debens Socrati equum", unless this term is strictly synonymous with it. For in this sentence a significate of the term "debens Socrati equum", in accordance with our previous considerations, is to be constructed as follows:

$SGT(\text{'debens'})(SGT(\text{'Socrates'}))(RAT(\text{'equus'}))(SGT(\text{'equus'}))(t)$, where $RAT(\text{'equus'})$ is the *ratio* of the term 'equus'.

Accordingly, a *suppositum* of the same term in the above proposition is:

$SUP(\text{'debens tibi equum'})(t) =$
$= SGT(\text{'debens'})(SUP(\text{'Socrates'})(t))(RAT(\text{'equus'}))(SUP(\text{'equus'})(t'))(t)$, if this is an element of $A(t)$, otherwise $SUP(\text{"debens tibi equum"})(t) = 0$. (Where t' is equal to or greater than t, because of the ampliative force of 'debens'.)

But so, since the sentence is true iff the *supposita* of its terms are the same, and whether this or that individual is supposited for by its predicate term depends on the *ratio* of its accusative, clearly, replacing the accusative may change the truth value of this sentence, even if the replacing term would refer to the same thing(s).[17]

For this idea to work in general, however, we clearly should be able to identify *rationes* of terms. But to this end first we have to be clear about what *rationes* are.

In many places, Buridan uses the term 'ratio' interchangeably with the term 'conceptus', or 'intentio'. But, as we have seen, concepts are individual mental acts of

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15 Cf.: "Et primo dico quod terminus substantivus obliquus appellat illud pro quo rectus suus supponeret per modum adjacentis ei pro quo rectus regens ipsum supponit." SL, Tractatus Quartus: De Suppositionibus, c.5, 4.

16 For references see my "'Debeo tibi equum': A Reconstruction of the Theoretical Framework of Buridan's Treatment of the Sophisma", in: S.L. Read (ed.): *Sophisms in Mediaeval Logic and Grammar: Acts of the Ninth European Symposium of Mediaeval Logic and Semantics*, to appear.
17 For more detailed discussion see again my paper referred to in the previous note.

individual human minds, which, when by an act of imposition get associated with vocal or written expressions, are responsible for the meaning of these expressions.

This understanding of concepts (as individual mental acts) and their relation to the meaning of linguistic items, renders meaning doubly relative. On the one hand, you and I may associate different concepts with the same expression, and hence attribute to it different meanings, while on different occasions even I may use the same expression in a different sense, associating it with some different concept, and thereby imposing it to mean something different, on the other. Whether on these different occasions you will be able to understand what *I mean* depends on whether you will be able to associate with the expression in question the same (type of) concept, i.e. a mental act by which you conceive the same things and in the same way as I do. If so, and this usage catches on, i.e., also other users of our language are able and willing to use this expression in the same way in the future (at least, perhaps, in virtue of some temporary agreement, for a limited period of time, as in obligational disputes frequently referred to by Buridan in this context), then my act of imposition will constitute a new meaning for the expression, observed by everybody who understands this expression in this sense. Otherwise my usage of the expression is an idiosyncrasy, having to do perhaps with my linguistic incompetence, my joking mood, momentary insanity, or grave conceptual differences (which may be but a euphemism for permanent insanity), etc. We can say, however, that if there is a valid convention of its usage, the *ratio* of an expression is but a concept associated with this expression by an act of imposition, no matter whose concept, mine or yours, insofar as we use this expression subordinated to the same *type* of concept. But, as I have said above, our individual concepts can be said to be of the same type, if we conceive by them the same things in the same way, i.e., if they have the same meaning.

With this, however, we seem to have entered a vicious circle: our expressions mean the same, if they are subordinated to the same concepts, while these concepts are said to be the same, if they signify the same; that is to say, concept identity is just synonymy and vice versa, but neither of these is clearer than the other, and Quineans may rejoice.

Despite appearances, however, this is no more vicious than it is a circle. For the signification of a *concept* is a natural relation, determined by the nature of the concept alone, not dependent on any further semantic medium. So we can say that simple absolute concepts are identical if and only if they signify the same, i.e., the set of their *significata* is the same, and simple connotative concepts are the same if and only if they signify the same, i.e., the sets of their significata and connotata are the same. But in a model theory sets are well-behaved entities with respect to identity. So in such a theory the identification of simple concepts should present no extra difficulty, provided we assign them in a model their *significata* (and *connotata*) in a systematic manner, which renders the identification of these sets possible.

Now in view of these considerations we can say that our model theory will have to contain a function assigning concepts of individual minds (m) to linguistic expressions (X) relative to individual acts of imposition (i), like this:

$CON(m)(i)(X) \in W$.

These individual concepts, provided they are simple, will be identified on the basis of their significations:

$CON(m)(i)(X) = CON(m)(i)(X')$ iff $SG(CON(m)(i)(X)) = SG(CON(m)(i)(X'))$

The *rationes* of these expressions, on the other hand, will be identified with these concepts, provided these concepts are of the same type, i.e., if they signify the same:

$RAT(i)(X) = CON(m)(i)(X)$ /that is to say, $RAT = CON(m)$/ if

$SG(CON(m)(i)(X)) = SG(CON(m')(i)(X))$, for any m', otherwise $RAT(i)(X) = 0$.

To be sure, *rationes* in this way will be just the same individual mental acts as concepts, nevertheless, these concepts will be identified as *rationes* only if their individual differences, depending on to *which* individual mind they belong, are irrelevant from the point of view of their significative function. (Otherwise, as the second half of the clause above states, we cannot assign a definite *ratio* to a given expression, but we can, of course, assign it several idiosyncratic concepts of individual users of it, which, however, may be interesting more from a pragmatic, than from a semantic point of view.[18]) This significative function, however, *is* affected by different impositions: if a term, like e.g. 'seal' in English, is correlated with two different *types* of concepts by different acts of imposition, then also the *rationes* corresponding to this term are different depending on according to which imposition we interpret it. On the other hand, if the expression in question is unequivocal, this means that the meaning of this expression is not a function of different impositions. (Which is equivalent to saying that it is never imposed to mean something different: it signifies the same for any imposition i, that is, it is a constant function of these different impositions.) So to simplify matters, in the case of such an expression we can omit reference to different impositions and give its *ratio* directly, like this:

$RAT(X) = CON(m)(i)(X)$ if $SG(CON(m)(i)(X)) = SG(CON(m')(i')(X))$ for any m' and any i', otherwise $RAT(X) = 0$.

In the case of complex concepts, on the other hand, the guide for their identification should be their structure, i.e., the way they are built up from their already well-identifiable components. The reason for this is that complex concepts may signify exactly the same thing or things, but be distinct from one another due to their different structure. Buridan's most frequently used example is the pair of mental propositions expressed by the sentences 'Deus est Deus' and 'Deus non est Deus'.[19] The vocal or written sentences both signify one and the same thing *ad extra*,

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[18] For a discussion of these topics, though in a different formal framework, see my "Understanding Matters from a Logical Angle: Logical Aspects of Understanding" in: G. Klima: Ars Artium: *Ars Artium: Essays in Philosophical Semantics, Mediaeval and Modern*, Budapest, 1988.

[19] Cf.: "Sed statim tu quaeres "si in re significata vel in rebus significatis non sit aliqua complexio, quid ergo significat oratio mentalis qua intellectus dicit deum esse deum vel deum non esse deum?". Respondeo quod nihil plus vel aliud significat ad extra una dictarum orationum quam alia. Neutra enim significat ad extra nisi deum; sed alio modo significat affirmativa et alio modo negativa, et illi modi sunt in anima illi conceptus complexivi quos secunda operatio intellectus addit supra simplices conceptus, qui designantur per istas copulas vocales 'est' et 'non est'." SL, Tractatus Primus: De Propositione, c.3, 1.
"... istae propositiones 'deus est deus' et 'deus non est deus' nihil omnino aliud, plus aut minus significant ad extra quam iste terminus 'deus', dum tamen haec dictio 'est' sumatur praecise ut copula,

namely God. The two sentences, nevertheless, are not synonymous, because they signify different mental propositions *apud mentem*. For the negative sentence beyond the concepts signified by the affirmative one also signifies the concept of negation, which makes it signify the same thing in a different manner, namely negatively, which renders these two sentences contradictory, i.e., the one true if and only if the other is false. But sentences are true or false only in virtue of the truth or falsity of the mental propositions they express; but no mental proposition can be true and false at the same time. Therefore, the mental propositions corresponding to these sentences are different, having different internal structures.

But what is it that accounts for these different structures? For it is certainly not the temporal or spatial order of their parts as is the case with the spoken or written counterparts of these mental sentences. The answer lies in the operation of the "glue" of these mental propositions, the syncategorematic, or as Buridan also most aptly calls them, *complexive* concepts. The role of these concepts is to form complex concepts out of other concepts, thereby modifying the ways these other concepts relate to the things conceived by them. So these complexive concepts can be represented by functions taking concepts into complex concepts, the semantic relations of which will be determined how they are constructed by way of these complexive concepts.

For example, the copula, 'est', is a complexive concept, taking other, simple or already complex, categorematic concepts as its arguments (and connoting some time t), yielding a mental proposition, like this:[20]
$$RAT('est')(c_1)(c_2)(RAT(t)) \in W.$$ (Where $RAT(t)$ is the concept of the present time connoted by the copula of the proposition. So RAT is defined not only for linguistic expressions, but also for time-points, or intervals.)

Accordingly, the mental proposition corresponding to 'Deus est Deus' may be constructed as follows:
$$RAT("Deus\ est\ Deus")(RAT(t)) = RAT('est')(RAT('Deus'))(RAT('Deus'))(RAT(t))$$

On the other hand, the concept of propositional negation, RAT('non'), is a one-place functor taking a mental proposition as its argument, yielding a complex concept, another mental proposition, the truth value of which is the opposite of that

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sicut post dicetur. Nec ista oratio 'omnis homo est animal' plus vel minus vel aliud significat praeter conceptus animae quam ista 'nullus homo est animal'. Unde signa solum significant quo modo termini vocales et mentales eis correspondentes supponunt, nihil ultra significando. Et istae copulae 'est' et 'non est' significant diversos modos complectendi terminos mentales in formando propositiones mentales, et illi modi complectendi sunt conceptus complexivi pertinentes ad secundam operationem intellectus, prout ipsa addit super primam operationem. Et ita etiam istae dictiones 'et', 'vel', 'si', 'ergo' et hujus modi designant conceptus complexivos plurium propositionum simul, vel terminorum, in mente, et nihil ulterius ad extra. Et tales voces vocantur 'pure syncategorematicae' quia non sunt significativae ad extra nisi cum aliis, ad istum sensum quod totum aggregatum ex dictionibus categorematicis et syncategorematicis significat bene res extra conceptas, sed hoc est ratione dictionum categorematicarum. SL, Tractatus Quartus: De Suppositionibus, c.2, 3.

[20] Cf.: "Credo enim quod illi conceptus a quibus sumuntur istae dictiones syncategorematicae 'et', 'vel', 'si', quamvis sint conceptus complexivi plurium propositionum vel terminorum, tamen non sunt complexi ex pluribus, sed simplices. Et ita etiam est de conceptu hujus verbi 'est' prout praecise sumitur tamquam copula. Unde sic est dictio pure syncategorematica; tamen forte prout connotaret certum tempus, jam exiret a simplicitate, nec esset purum syncategorema, prout alias dicetur." SL, Tractatus Quartus: De Suppositionibus, c.2, 4.

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of its argument. So the mental proposition signified *apud mentem* by 'Deus non est Deus' is to be constructed as follows:
$$RAT("Deus\ non\ est\ Deus")(RAT(t)) =$$
$$RAT('non')(RAT('est'))(RAT('Deus'))(RAT('Deus'))(RAT(t))$$

Since according to Buridan spoken or written sentences are true only in virtue of being subordinated to true mental propositions,[21] indeed, truths and falsities are nothing but true or false mental propositions, in our model theory we can define truth as the set of all true mental propositions, and the truth-conditions of these propositions as the conditions of membership in this set.

For example, if V is the set of all truths:
$$RAT("Deus\ est\ Deus")(RAT(t)) \in V\ iff$$
$$SUP(RAT('Deus'))(t) = SUP(RAT('Deus'))(t)$$

But of course, in the actual construction of the model theory we shall have to build such and similar particular conditions into general recursive rules defined for whole classes of expressions and concepts associated with them. However, as I indicated in the introduction, for want of space I cannot present here a complete model theory for the fragment of Latin constructed above. So I am going to provide only some of the most essential clauses along with some illustrations of how they are supposed to work, and base my concluding discussion on these.

SEMANTIC CATEGORIES

As from the foregoing it should be clear, for the formulation of the semantic definitions we shall have to introduce some further classifications of the expressions of our fragment beyond those provided by the syntactic construction.

First of all, univocity or equivocity are semantic properties of terms that are not reflected by their syntactic categories. In our fragment the only equivocal term is 'canis', which, in mediaeval examples, in one sense was taken to signify man's best friend, in another, the corresponding constellation. Accordingly, in the definitions above and hereafter all specifications concerning equivocity or univocity concern the term 'canis' on the one hand, and the rest of categorematic terms, on the other. So, if by EQU, we denote the set of equivocal terms, then this set in our fragment is defined simply as follows:
$$EQU := \{canis_{gc}\}.$$

Correspondingly, the set of univocal terms (UNI) is defined in the following manner:
$$UNI := TRM \cup VOC-EQU$$

Secondly, for semantic purposes we have to distinguish between absolute (ABS) and appellative terms (APP):
$$ABS := PN_{gnom} \cup CN_{gnom} \cup RP_{nenom};\ APP := TRM-ABS.$$

It will greatly simplify the formulation of semantic definitions if we distinguish

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[21] "Et ideo non dicitur oratio vel propositio vocalis nisi quia designat orationem vel propositionem mentalem, nec dicitur propositio vocalis vera vel falsa nisi quia designat mentalem veram vel falsam, sicut nec urina dicitur sana vel aegra nisi quia designat animal esse sanum vel aegrum." SL, Tractatus Primus: De Propositione, c.1, 6.

between functorial and non-functorial expressions, and also between functorial expressions of different arities. Functorial expressions are appellative terms of our vocabulary subordinated to simple concepts, plus the syncategorematic terms:

FUNC: $= (VOC \cap APP) \cup SYNC$.

Indeed, we may treat non-functorial expressions, i.e., absolute terms, as 0-ary functorial terms, which will also simplify later formulations. The sets of n-ary functorial terms, $FUNC_n$ are defined by the following clauses:

$FUNC_0$: $= ABS$

$FUNC_1$: $= \{non, quod_{gc}\} \cup Sig \cup PN_{gen} \cup CN_{gen}$

$FUNC_2$: $= \{vel, albus_{gc}, videns_{nenom}, habens_{nenom}, mortuus_{nenom}\}$

$FUNC_3$: $= \{est, videns_{gc}, habens_{gc}, mortuus_{gc}\}$

$FUNC_4$: $= \{fuit, erit, debens_{nenom}\}$

$FUNC_5$: $= \{debens_{gc}\}$

Note here that adjectives, participles and relative pronouns in the neutral gender and nominative case, which can form standalone terms without a head-noun, appear also in a lesser functorial category. Let us denote the set of these functorial terms by F_{n-1}.

As from the above definitions can be seen, all complex terms are appellative, but not all appellative terms are complex. As Buridan insists, semantic simplicity or complexity is not determined by syntactic simplicity or complexity. This is determined on the level of concepts, to which the several, either simple or complex syntactic items are subordinated. Since, however, he admits the possibility of there being simple appellative *concepts*,[22] in this fragment I shall treat all syntactically simple appellative terms as being subordinated to some simple appellative concept, except for 'caecum', which, for illustrative purposes, I shall regard as synonymous with the phrase "animal non habens visum". Accordingly, I will treat 'caecum' as semantically complex, being subordinated to the same complex *ratio* as its nominal definition: 'animal non habens visum'.

The sets of simple (SIM), and of complex (COMP) terms are, therefore, defined as follows:

SIM: $= VOC-\{caecum_{gc}\}$; COMP: $= TRM-SIM$.

Furthermore, we need to distinguish between apmliative (AMPL) and non-ampliative terms. Also, among ampliative terms we have to distinguish those that ampliate to the past ($AMPL_P$), from those that ampliate to the future ($AMPL_F$) and from those that ampliate to the possible ($AMPL_M$) and from the further possible combinations of these specifications, such as from those ampliating to the future and the possible ($AMPL_{FM}$), etc. In our fragment:

$AMPL_P$: $= \{mortuus_{gc}\}$

$AMPL_{FM}$: $= \{debens_{gc,dat,acc*}\}$, where the asterisk indicates that it is the accusative complement that is ampliated to the future and possible.

Again, we have to distinguish intentional participles (INT), i.e., participles that signify mental acts, and which, therefore, make (some of) their complements appel-

[22] See especially in this connection A. Maierù: 'Significatio et Connotatio chez Buridan', in: J. Pinborg (ed.): *The Logic of John Buridan*, Copenhagen, 1976. pp.110-111.

late their *rationes*. In our fragment:

INT: $= \{debens_{gc,dat,acc*}\}$, where the asterisk indicates that it is the accusative complement that is forced to appellate its own *ratio*.

THE MODEL

A model for the above-defined fragment is the following set-theoretical structure:

$$M: = <W,T,I,C,S,A,P,CON,RAT,SG,0>,$$

where W, T, I, C and S are nonempty sets, such that $T,I,C,S \subset W$, $A(t) \subset P(t) \subset W$, where $t \in T$; $CON(m)(X) \in C$, provided X is some univocal expression of our fragment ($X \in UNI$), otherwise $CON(m)(i)(X) \in C$, where $m \in S$, $i \in I$ and X is an equivocal expression of our fragment ($X \in EQU$);

$RAT(X) = CON(m)(X)$ if $SG(CON(m)(X)) = SG(CON(m')(X))$, for any m', otherwise $RAT(X) = 0$, where $X \in UNI$, and

$RAT(i)(X) = CON(m)(i)(X)$ if $SG(CON(m)(X)(i)) = SG(CON(m')(X)(i))$, for any m', otherwise $RAT(X)(i) = 0$, where $X \in EQU$;

$0 \notin W$, and SG is a function defined recursively below.

Intuitively, W is the universe of discourse, the set of all items signifiable by expressions of our fragment, T is a set of time-points, or time-intervals, I is a set of acts of imposition, C is a set of concepts, S is a set of human souls or minds, A(t) and P(t) are the sets of signifiable things that are actual, and of those that are potential at time t, respectively; CON is a function assigning individual acts of individual human minds, m, with respect to some act of imposition, i, to expressions, X, of our fragment; RAT is a function assigning concepts to expressions in some mind m, provided that the concepts associated with the same expressions signify the same in any other mind, either directly, if the expression in question is unequivocal, or depending on some act of imposition otherwise; SG is the function representing the relation of signification, defined both for concepts of human minds and for linguistic expressions subordinated to these.

In the same model categorematic concepts and expressions will have further semantic values, namely *significata* and *supposita* (also *connotata* and *appellata* in the case of appellative terms) to be assigned to them by functions in a similar manner as in standard quantification theory value-assignments defined for variables assign several values to variables in the same model.

"MENTALESE" AND SIGNIFICATION

In the subsequent clauses $RAT = CON(m)$, and the metavariables t, s, t_i, c_i and u_i range over elements of T, Sig, TRM, C and of W, respectively.

The *rationes* of (syntactically as well as semantically) simple terms are given by the following seven clauses:

(RATun) If $X \in UNI$, then $RAT(X) \in C$

(RATeq) If $X \in EQU$ and $i \in I$, then $RAT(X)(i) \in C$

(RATfn) If $X \in FUNC_n$, then $RAT(X)(c_1)...(c_n) \in C$ (Of course, if $n = 0$, then $RAT(X) \in C$.)

(RATfn-1)   If $X \in FUNC_{n-1}$, and $c_1...c_n$ are as above, then $RAT(X)(c_2)...(c_n) \in C$. (This should be understood so that if $X \in FUNC_{1-1-0}$, then $RAT(X) \in C$.)

(RATnon)   If $c = RAT(X)$, where $X \in FUNC_n$, then $RAT(non)(c)(c_1)...(c_n) \in C$

(RATadj)   If $a_{nec} \in Adj$, then $RAT("[non] \ a_{gc}") =$
$RAT("[non] \ a_{gc}")(RAT(a_{gcabs})) =$
$[RAT(non)](RAT(a_{gc}))(RAT(a_{gcabs})) =$
$RAT(a_{gc})(RAT([non] \ a_{gcabs})) \in C$, where a_{abs} is the abstract form of an adjective signifying quality (in our fragment: '$album_{gc}$'$_{abs}$ = 'albedo').

(RATmort)   If $p_{nec} \in Prtc \cup AMPL_P$), then
$RAT(p_{nec})(RAT(t'))(RAT(t)) \in C$, where $t' < t$

The *rationes* of semantically complex expressions are given as follows:

(RATamb)   If $F_i(x_1)(x_2)...(x_m) = X = F_j(y_1)(y_2)...(y_n)$, then
$RAT(i)(X) = RAT(x_1)(RAT(x_2))...(RAT(x_m))[(RAT(w_o))]$,
$RAT(j)(X) = RAT(y_1)(RAT(y_2))...(RAT(y_n))[(RAT(w_o))]$, where w_o is some further, syntactically unanalysed concept needed to complement $RAT(x_1)$ or $RAT(y_1)$, say the concept of some past, present or future time required by the concept of a participle, marked syntactically by the tense of the participle alone.

(RAT1a)   If $p_{nec1[,c2][,c3]} \in Prtc-(INT \cup AMPL)$ and $t2_{c2}$, $t3_{c3} \in TRM$, then
$RAT("p_{nec1,c2[,c3]} \ t2_{c2} \ [t3_{c3}]") =$
$RAT(p_{nec1,c2[,c3]})(RAT(t2_{c2}))[(RAT(t3_{c3}))](RAT(t))$

(RAT1b)   If $p_{nec1,c2[,c3]} \in Prtc-(INT \cup AMPL)$ and $t2_{c2}$, $t3_{c3} \in ITRM$, then
$RAT("[s2_{c2}] \ t2_{c2} \ [[s3_{c3}] \ t3_{c3}] \ p_{nec1,c2[,c3]}") =$
$[RAT(s2_{c2})]([RAT(s3_{c3})](RAT(p_{nec1,c2[,c3]})(RAT(t2_{c2}))$
$[(RAT(t3_{c3}))](RAT(t))))$

(RAT1c)   If $p_{nec1[,c2][,c3]} \in Prtc \cup AMPL_{FM} \cap INT)$ and $t2_{c2}$, $t3_{c3} \in TRM$, then
$RAT("p_{nec1,c2,c3^*} \ t2_{c2} \ t3_{c3}") =$
$RAT(p_{nec1,c2,c3^*})(RAT(t2_{c2}))(RAT(t3_{c3}))(RAT(t3_{c3}))(RAT(t'))(RAT(t))$,
where $t' > t$

(RAT1d)   If $p_{nec1[,c2][,c3]} \in Prtc \cup AMPL_{FM} \cap INT)$ and $t2_{c2}$, $t3_{c3} \in TRM$, then
$RAT("t2_{c2} \ t3_{c3} \ p_{nec1,c2,c3^*}") =$
$RAT(p_{nec1,c2,c3^*})(RAT(t2_{c2}))(RAT(t3_{c3}))(RAT(x_{c3}))(RAT(t'))(RAT(t))$,
where $t' > t$ and x_{c3} is some term coextensive with $t3_{c3}$.

(RAT2)   If $n_{gc} \in PN \cup CN$, $a_{gc} \in Adj$, then $RAT("n_{gc} \ [non] \ a_{gc}") =$
$RAT([non] \ a_{gc})(RAT(n_{gc}))(RAT(a_{gcabs})) =$
$[RAT(non)](RAT(a_{gc}))(RAT(n_{gc}))(RAT(a_{gcabs})) =$
$RAT(a_{gc})(RAT(n_{gc}))(RAT([non] \ a_{gcabs}))$, where a_{abs} is the same as above.

(RAT3)   If $n_{gc} \in PN \cup CN \cup NA$, $t1_{gen} \in TRM_{gen}$, $t1_{nom}$ is $t1_{gen}$'s nominative form and $nt1_{gen}$ is $t1_{gen}$'s head-noun, then
$RAT("<n_{gc}> <t1_{gen}>") = RAT(nt1_{gen})<(RAT(n_{gc}))> <(RAT(t1_{nom}))>$

Here should follow four clauses running parallel with (RAT1a-d) above (indeed, we would need also a fifth one corresponding to (RATmort)), inserting the *ratio* of the head-noun with which a participle is construed, but for brevity, I omit them.

(RAT5)   If $X \in TRM \cup PROP \cup Cop \cup Prtc \cup Adj$, then
$RAT("non \ X") = RAT(non)(RAT(X))$

(RAT6)   If $t_{gc} \in ITRM$ and $s_{gc} \in SIG$, then $RAT("s_{gc} \ t_{gc}") = RAT(s_{gc})(RAT(t_{gc}))$

(RAT7)   If $t2_{nom} \in TRM$ and $q_{nenom} \in RP$, then $RAT("q_{gnenom} \ est \ t2_{nom}") =$
$RAT(est)(RAT(q_{nenom}))(RAT(t2_{gnom}))(RAT(t))$

(RAT7a)   If $t1_{gnom} \in TRM$, $t2_{nom} \in TRM$ and $q_{gnom} \in RP$, then
$RAT("t1_{gnom} \ q_{gnom} \ est \ t2_{nom}") =$
$RAT(est)(RAT(q_{gnom})(RAT(t1_{gnom})))(RAT(t2_{gnom}))(RAT(t))$

Here further clauses should follow taking care of relative clauses in different tenses, but for the sake of brevity I omit them. See, however, the analoguous clauses for propositions below.

(RAT8)   If $t1_{gc}$, $t2_{gc} \in TRM$, then $RAT("t1_{gc} \ vel \ t2_{gc}") =$
$RAT(vel)(RAT(t1_{gc}))(RAT(t2_{gc}))$

(RAT9)   If $t1 \in TRM_{gnom}$ and $t2_{nom} \in TRM \cup Adj_{gnom} \cup Prtc_{gnom}$ then
$RAT("t1 \ [non] \ est \ t2")(RAT(t)) =$
$RAT([non] \ est)(RAT(t1))(RAT(t2))(RAT(t))$

(RAT10)   If $t1 \in TRM_{gnom}$ and $t2_{nom} \in TRM \cup Adj_{gnom} \cup Prtc_{gnom}$ then
$RAT("t1 \ [non] \ fuit \ t2")(RAT(t'))(RAT(t)) =$
$RAT([non] \ fuit)(RAT(t1))(RAT(t2))(RAT(t'))(RAT(t))$, where $t' < t$

(RAT11)   If $t1 \in TRM_{gnom}$ and $t2_{nom} \in TRM \cup Adj_{gnom} \cup Prtc_{gnom}$ then
$RAT("t1 \ [non] \ erit \ t2")(RAT(t'))(RAT(t)) =$
$RAT([non] \ erit)(RAT(t1))(RAT(t2))(RAT(t'))(RAT(t))$, where $t' > t$.

(RAT12a) $RAT(caecum_{gc}) = RAT("animal_{gc} \ non \ habens_{gc} \ visum") =$
$RAT("non \ habens_{gc}")(RAT(animal_{gc}))(RAT(visus))(RAT(t)) =$
$RAT(non)(RAT(habens_{gc}))RAT((animal_{gc}))(RAT(visus))(RAT(t))$

(RAT12b) $RAT("n_{gc} \ [non] \ caecum_{gc}) = RAT("n_{gc} \ [non] \ non \ habens_{gc} \ visum") =$
$RAT("[non] \ non \ habens_{gc}")(n_{gc})(RAT(visus))(RAT(t)) =$
$RAT([non] \ non)(RAT(habens_{gc}))(n_{gc})(RAT(visus))(RAT(t)) =$
$[RAT(non)](RAT(non)(RAT(habens_{gc})))(RAT(n_{gc}))$
$(RAT(visus))(RAT(t))$

The purpose of these clauses is to assign a *ratio* to all expressions of our fragment, i.e. a concept common to all those who understand these expressions in the same way. Since understanding of the complex expressions should depend on the understanding of the simple ones that build them up, the *rationes* of complex expressions are to be determined in a compositional manner, on the basis of the *rationes* of their simple constituents.

Simple univocal terms are assigned a single *ratio*, by the first clause, while simple equivocal terms are assigned different *rationes* relative to different impositions. For example $RAT(i)(canis)$ is a concept representing man's best friend, while $RAT(j)(canis)$ is another concept, representing the constellation.

Simple functional n-ary terms are assigned concepts, which are themselves functions that take further concepts in their arguments, yielding further concepts, etc., n times. For example, $RAT(videns) \in C$ is a concept, which is such that it can be complemented with further concepts, to yield a further concept, like this:

RAT(videns)(c_1)(c_2) $\in$ C, where c_1 is a concept signified immediately by an accusative that can be constructed with the term 'videns', while c_2 is a concept of a time-point (or interval) connoted by the present tense form of this participle, though not marked by a distinct part of speech. If the *ratio* of 'videns' is complemented with both of these kinds of concepts, then it yields a concept that cannot be complemented any further, being in itself "saturated", making some perfect, determinate sense, like the concept corresponding to "videns hominem". Indeed, we get the concept corresponding to this complex phrase, if we complement the concept of 'videns' first with the concept corresponding to 'hominem', and then with the concept of the time of the actual application of this phrase, just as it is prescribed by clause (RAT1a), like this:

RAT("videns hominem") = RAT(videns)(RAT(hominem))(RAT(t)).

Simple functional n-ary terms may also appear in constructions in which they need less complements to make perfect sense. Indeed, in the above example, 'videns' appeared like this, in its capacity to form a standalone term, without being an adjunct to a noun. However, when it *is* such an adjunct, as in "homo videns hominem", then its *ratio* is complemented first with the *ratio* of the noun which is in the same case as itself, and only afterwards with the other complements, like this:

RAT("homo videns hominem") =
RAT(videns)(RAT(homo))(RAT(hominem))(RAT(t)), as it would be prescribed by the rule corresponding to (RAT1a) omitted here for brevity.

Notice that what makes the difference of this construction from that above is that the first complement concept here is a concept corresponding to the noun which is in the same case as the participle. If this head-noun is in the accusative itself, then so is the participle, yielding:

RAT("hominem videntem hominem") =
RAT(videntem)(RAT(hominem))(RAT(hominem))(RAT(t)).

Clause (RATnon) stipulates that if the concept complementing the argument-place of the *ratio* of negation is an n-ary concept (i.e. a concept corresponding to an n-ary simple term), then the resulting concept is n-ary too, that is to say, it may, and indeed, should be complemented by n further concepts to yield a saturated concept. For example, if the concept to which the concept of negation is applied is the concept signified by the term 'videns', then the resulting concept is still to be complemented, as it is so complemented in the complex concept corresponding to the phrase "homo non videns hominem", like this:

RAT("homo non videns hominem") =
RAT(non)(RAT(videns))(RAT(homo))(RAT(hominem))(RAT(t)).

Notice here that we are compelled to introduce this narrow-scope concept of negation, i.e., a negation that negates only a part of a term, as opposed to a negation negating a whole complex term yielding an infinite term, in order to distinguish the concept corresponding to "homo non videns hominem" from that corresponding to "non homo videns hominem". For the latter, at least on one of the possible readings of this phrase can be constructed as follows:

RAT(1)("non homo videns hominem") =

RAT(non)(RAT(videns)(RAT(homo))(RAT(hominem))(RAT(t))),

where the concept of negation is applied to the whole concept corresponding to the complex term: "homo videns hominem".

Evidently, this distinction needs to be made, because while the latter concept may apply to anything that is not a man seeing a man, like a stone, the former can apply only to a man not seeing a man.

But the above, as I said, is only one of the possible readings of "non homo videns hominem". We can also understand this phrase so that the negation is applied only to the concept corresponding to the term 'man' in it, like this:

RAT(2)("non homo videns hominem") =
RAT(videns)(RAT(non)(RAT(homo)))(RAT(hominem))(RAT(t)),

Notice that in accordance with clause (RATamb), these two constructions are based on the two different analyses of the same syntactically ambiguous phrase, i.e., on the two different ways this complex phrase may be built up from its components according to the syntactic rules of our fragment. Using the characteristic functions defined above, we can distinguish these two analyses in the following manner:

(1) F_8(non)(homo videns hominem) =
               F_8(non)(F_6(videns)(homo)(hominem))
(2) F_6(videns)(non homo)(hominem) =
               F_6(videns)(F_8(non)(homo))(hominem)

The first of the remaining two clauses assigning a *ratio* to simple terms is (RATadj), which specifies that the concept of an adjective in the neutral gender in its capacity to form a standalone term is such that it gets saturated with the concept of the quality connoted by this adjective, like the concept of whiteness connoted by 'album', i.e., the concept signified immediately by the term 'albedo'.

In a similar manner, the last of this group of clauses specifies that the *ratio* of an ampliative participle of the neutral gender having no complements and ampliating to the past, like 'mortuum', gets saturated by the concepts of some past and the present time. Actually, this clause is very *ad hoc*, and is added only for the sake of the term 'mortuum' in our fragment. But since I think the more general formulations could quite easily be given on the basis of the formulations I provide here, I am ready to sacrifice generality on the altar of simplicity in this case.

Because of their semantic diversity, we have four different clauses for complex terms formed by participles in the neutral gender with their complements. For the first of these we have already seen an example above, with 'videns'. The second clause serves to make the semantic distinction between, e.g., "videns omnem hominem" and "omnem hominem videns". Clearly, to these complex terms there should correspond different concepts. For consider the following sentences: "Videns omnem hominem est equus" and "Omnem hominem videns est equus". The first can be true only if there is some horse that sees every man, while the latter can be true, if every man is seen by some horse or other. But so to these sentences there should correspond different mental propositions, which, however can only differ in their subjects, which are precisely the concepts signified by our two complex terms differing only in word order.

Now according to the first clause (RAT1a), the *ratio* of "videns omnem hominem" is to be constructed as follows:

RAT("videns omnem hominem") =

RAT(videns)(RAT(omnem hominem))(RAT(t)) =

RAT(videns)(RAT(omnem)(RAT(hominem)))(RAT(t))

On the other hand, in accordance with the second clause (RAT1b), the *ratio* of "omnem hominem videns" can be obtained thus:

RAT("omnem hominem videns") =

RAT(omnem)(RAT(videns)(RAT(hominem))(RAT(t)))

As I think already these simple illustrations sufficiently show how the construction of complex *rationes* could be achieved in this system, instead of going into further details let me try to round out the picture by some simple schematic indications of how the remaining semantic properties of expressions of our fragment could be defined and base my concluding remarks on these.

I hope it is already clear from the foregoing that if all simple *rationes* building up a complex one were syntactically marked and the syntactic construction faithfully mirrored the conceptual construction, one simple and elegant clause could do the whole job of assigning *rationes* to complex expressions in the following manner:

If $X = F_n(x_0)(x_1)...(x_n)$, then $RAT(X) = RAT(x_0)RAT(x_1)...RAT(x_n)$.

Indeed, all the clauses above seem to agree with this general pattern, the only reason for their complexity apparently lying in the diversity of the ways different expressions in the various syntactic categories of our fragment indicate (or fail to indicate) the arity of the concept corresponding to them, and the type of concepts this concept requires as its complements.

On the basis of such a simple clause, also the further semantic values of the expressions of our language would be easy to assign, along the lines indicated in the preliminary semiformal discussion. *Significata* of simple terms should be first assigned by free-choice functions of appropriate arity, which could then determine the *significata* of complex expressions parallel with the construction of the corresponding complex *ratio*. Significations could then be defined as appropriate sets of *significata* and *connotata*, these sets providing suitable identity conditions for the *rationes* of simple categorematic terms. On this basis *supposita* of simple as well as complex terms could be defined as those *significata* of the terms of a proposition which are (or were or will be) actual at the time connoted by the copula (or by the ampliative terms, if there are any) of the proposition. Of course, to this end separate clauses would be needed to determine the effect of syncategorematic, and ampliative terms on the supposition of a complex term in which they occur. Finally, on this basis a definition of truth could be provided, based on the idea that the truth of an affirmative proposition requires the identity of the *supposita* of its terms. Here again, a whole series of separate clauses would be needed to define truth for categorical propositions of different quantity, quality and tense. Also, since the quantity of oblique terms, depending on word-order influences supposition and truth conditions in different ways (identifying different mental propositions as corresponding to the sentences in which these oblique terms occur, as we could see), separate clauses

should take care of these different cases as well.[23]

But now, instead of going into these details, let us turn to the methodological questions raised in the introduction, to reflect on this complexity of the semantic theory, arising so unexpectedly for such a simple fragment as we have been considering.

CONCLUSION: SOME METHODOLOGICAL LESSONS

As I remarked in the previous section, if all simple *rationes* building up a complex one were syntactically marked and the syntactic construction faithfully mirrored the conceptual construction, one simple clause could do the job of assigning *rationes* to complex expressions, since in this case, the way complex concepts are built up from simple ones could be directly read off from the syntactic construction. Indeed, it is precisely this easy identifiability of conceptual structure on the basis of perceptible syntactic structure that seems to motivate the construction of artificial languages, to develop some direct "conceptual notation", *Begriffsschrift*, to help the mind's eye in discerning the thoughts not so revealed by the syntactic structures of natural languages.

On the other hand, the very idea of the constructibility of a single conceptual notation presupposes that there is some uniform conceptual structure, identifiable as such lurking behind the various, accidentally developed façades of natural languages. Now despite the apparently Aristotelian origin of this idea, and despite Buridan's own avowal of Aristotelianism even in this respect, I think the Buridanian approach to semantics presented above suggests a much more intricate and intimate relationship between language and thought, determining further the relationship of language to reality.

As the very complexity of the above clauses shows, a natural language, indeed, even such a simple fragment of it as presented above, uses various different syntactic clues to identify concepts in different semantic and syntactic categories. But these different clues seem to do even more than just showing various ways to hit upon this or that concept, which would be there anyway, whether we have this clue to identify it or another. Some concepts owe their very existence to these syntactic clues: whence according to this semantic approach, different people using different languages *must* have different conceptual structures operative in their minds, owing to the differences in the structure of their languages. For example the idea of definiteness (unicity in a certain context) carried uniformly in English by the definite article is certainly not so carried in Latin, which lacks articles. So while in a Buridanian semantics for English we probably should have a simple syncategorematic concept corresponding to the definite article, the same concept could not occur in the Buridanian semantics of Latin.

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[23] For a thorough discussion of the problems arising for Buridan's semantics in this regard, see: É. Karger: "Un débat médiéval sur le concept de sujet d'énoncé catégorique: étude d'un texte de Jean Buridan", in: z. Kaluza-P. Vignaux: *Preuve et raisons à l'Université de Paris: logique, ontologie et théologie au XIVe siècle*, Paris, 1984.

As even these simple considerations show, on the Buridanian approach there is no uniform semantics for all natural languages: there are as many different semantics, as there are different languages. Indeed, since even users of the same idiom may widely differ in their usage, different socio-linguistic communities may have further strong claims to autonomous semantics, on account of their specific usage, associated with specific concepts. Buridan himself is perfectly aware of these implications of his approach: his references to jargon and obligational disputes clearly indicate this.[24]

On the other hand, all this semantic and conceptual diversity need not necessarily impede communication and understanding between people brought up using different idioms. As the concepts of others are not in principle inaccessible, as argued above, despite the fact that they are not directly observable, it is possible to *acquire* the concepts of others and *develop* common concepts between users of different languages. In such a case, however, we do not have even those relatively safe syntactic clues to the meaning of others as we have with persons speaking our own idiom. It is only through cooperation and coexistence, sharing the same form of life that our concepts can get so harmonized that we shall be able eventually to speak the same language.

But if this is so, then we may indeed not expect anything so simple and perspicuous from a natural language semantics as we are used to in our formal semantic studies. However unwieldy and cumbersome the Buridanian approach may seem in comparison to, say, a Fregean approach, it probably more faithfully reflects the *real* semantic situation, with all its intricacies, uncertainties and contingencies.[25]

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Anonymus Cordubensis, *Questiones super primum librum Posteriorum.* A Partial Edition: Prologue and qq. 1-5

Costantino Marmo

1. The anonymous questions on *Posterior Analytics* I, 71a 1-79b 23, are preserved in only one ms., Cordoba, Bibl. del Excellentissimo Cabildo, cod.52: ff.80va-100rb (C - beginning of the XIVth cent.).[1] Two other mss. contain a different version of this commentary: Firenze, Bibl. Medicea Laurenziana, S.Croce, cod. plut.XII sin., 3: ff.28ra-35ra (F - beginning of the XIVth cent.),[2] and München, Bayerische Staatsbibl., Clm 8005: ff.1ra-16ra (M - XIVth cent.).[3] Some of the questions belonging to this latter version have been edited by Jan Pinborg (Ebbesen & Pinborg 1970: 17-22; and Pinborg 1973: 49-62). In his introduction to the Leonine edition of Thomas' exposition on the *Posterior Analytics*, René-Antoine Gauthier (1989) described the MF version as a rearrangement of the C questions. In what follows, I would like to add some further evidence of this, and to argue that the MF version had probably also a different author, and to suggest that both of them could have been written before 1277.

2. Since the text I want to edit is only a part of the whole work (prol. and qq.1-5), and since M lacks the prologue and the first 6 questions, this ms. will neither be used in the following edition, nor closely examined. Commenting only on *Post. An.* I, 71a 1-79b 23, C offers a series of 92 qq. vs. the 78 qq. of the MF version on the same portion of text. I give a comparative table of C questions and MF questions.

Numbers and Titles (C version)	C	F	M	Numb. MF vers
\<Prohemium: Sicut dicit Aristotiles\>	80va	27va	- - -	
q. 1: u. logica sit scientia	81ra	27vb	- - -	q. 1
q. 2: u. logica sit scientia communis	81rb	28ra	- - -	q. 2
q. 3: u. logica sit de ente sicut de subiecto	81va	28ra	- - -	q. 3