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INTENSIONAL VERBS AND QUANTIFIERS*

This paper discusses the semantics of intensional NP-taking verbs such as *need*, *want*, *recognize*, and *hire*. It proposes several new linguistic criteria for intensionality besides the traditional ones of failure of existential quantification and substitutivity, and it defends two different semantic analyses for different intensional verbs. For the majority of verbs, the paper argues for a partialized version of the intensional quantifier analysis originally proposed by Montague, but for a single class of verbs, verbs of comparison, it adopts the property analysis recently proposed as a general analysis of intensional verb constructions by Zimmermann (1992). The paper also includes a systematic classification of intensional verbs according to the type of lexical meaning they involve.

1. INTRODUCTION

It has long been recognized that verbs like *look for* allow for two different readings of an indefinite NP-complement:

(1) John is looking for a horse.

On the first, extensional reading, (1) is equivalent to (2):

(2) There is a horse *x* and John is looking for *x*.

On the second, intensional reading, using Quine's (1956) phrase, John is looking for "mere relief from horselessness". The identification and the semantic analysis of this second, intensional reading with different kinds of verbs is the subject of this paper.

The main aim of the paper consists in defending two different semantic analyses for different kinds of intensional verbs. The first one is what I call the 'property analysis'. On this analysis, which has recently been defended by Zimmermann (1992), an intensional verb takes a property as its argument (in (1) the property of being a horse), and it is assumed that an indefinite NP may denote such a property. I will argue that the property analysis is appropriate only for one class of intensional verbs, namely verbs of comparison.

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The second analysis of intensional readings of verbs is what I call the 'intensional quantifier analysis'. On this analysis, which was originally proposed by Montague (1970, 1973), the NP-complement denotes an intensional quantifier, a function from contexts to sets of properties, rather than an extensional quantifier, a set of sets. I will argue for a partialized version of the intensional quantifier account for the majority of intensional verbs. On my account, the NP-complement of an intensional verb denotes a function from possible situations to (extensional) quantifiers ranging over entities in those situations. In connection with this account, I will defend and formalize the often made suggestion that strong quantifiers presuppose their domain. This domain presupposition explains the absence of certain potential intensional readings with strong quantifiers.

A secondary aim of this paper consists in a reevaluation of the phenomenon of intensional verbs based on a new set of criteria for intensionality. Traditionally, the tests for the intensional reading are failure of existential quantification, that is, an inference such as from (1) to (2), and substitutivity. This paper establishes several new criteria of intensionality which are more linguistic in nature and which differentiate more sharply between the intensional and the extensional reading of a verb. The resulting class of intensional verb constructions excludes some constructions that have been cited as intensional and includes a number of classes of verbs that traditionally have not been recognized as intensional.

The paper starts by establishing the characteristic properties of intensional verb constructions and then examines three different kinds of analyses as to their adequacy in accounting for these properties. The main part of the paper consists in an elaboration of one of these analyses, the intensional quantifier analysis, and of the domain presupposition thesis, which goes along with it. An appendix discusses in greater detail the various kinds of intensional verbs and their behavior with respect to the intensionality criteria.

I will make use of the following terminology. For 'intensional reading of a verb' or 'verb in an intensional reading' I will simply say 'intensional verb', and for the NP-complement of an intensional verb (in this sense) I will say 'intensional NP' or 'intensional (NP-)complement'. Finally, to refer to an intensional verb together with an NP-complement I will say 'intensional verb construction'.

2. IDENTIFYING THE PHENOMENON

What characterizes the intensional verb construction? Traditionally, there are two tests for whether a verb has an intensional reading with respect

to an NP-complement: the failure of existential quantification (or more generally quantifier exportation) and the failure of substitutivity. The purpose of this section is to clarify these two criteria and to establish a new, more linguistic set of criteria for intensionality.

2.1. *Traditional Criteria*

The first traditional criterion is the failure of existential quantification, that is, of the inference from (1) to (2), or more generally the absence of quantifier exportation, that is, of the inference indicated in (3):

(3) $\dfrac{\text{NP V Q N}}{\Rightarrow \text{For Q}(x)\text{: N}(x), \text{NP V}(x)}$

This criterion appropriately captures the 'nonspecific' character of the intensional reading.

There is one issue, however, relating to failure of existential quantification or quantifier exportation that needs to be addressed. Failure of existential quantification should not be confused with the complement standing for or describing a 'nonexistent' object. As has been noted by Bennett (1974) and Zimmermann (1992), in the case of *John worships a Greek goddess*, we don't find failure of existential quantification, but rather failure of the object NP to refer to an existent object. Failure of existential quantification over existent objects does not identify a 'nonspecific' reading of an NP.[1]

This is an appropriate point for a few words about nonexistent objects in the context of natural language semantics in general. As has sometimes been observed (e.g. Parsons 1980), natural language may, in principle, use

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[1] Besides *worship*, which has been cited as an intensional verb by Montague (1969), *fear* is another verb that has wrongly been classified as intensional (Kaplan 1986). (i.a) does not seem to allow for existential quantificaton, given that the speaker does not commit himself to ghosts or goddesses. However, *fear* does not allow for the relevant nonspecific reading with a singular indefinite in (i.b):

(i) a. John fears ghosts.
b. ?John fears a ghost.

Unlike (1) in the text, (i.b) does not seem to have a reasonable interpretation at all (except as something like 'For any given ghost, John develops an attitude of fear toward it'), and the possibility of a bare plural in (i.a) with a nonspecific reading seems to be due to the fact that bare plurals may denote kinds (and kinds need not have instantiations) (cf. Carlson 1977a). – Aside from such interpretive differences, *fear* and *worship* differ from true intensional verbs in that they do not exhibit the other diagnostics for intensionality discussed in Section 2.2. See fn. 5.

the same terms and quantifiers to stand for or quantify over 'nonexistent' objects as to refer to or quantify over existent objects. Throughout this paper I will adopt the assumption that such nonexistent objects may form semantic value of NPs (though this does not exclude that such objects are ultimately reducible to properties or intentional acts).[2]

What is crucial is that not all nonexistent objects are treated alike in the context of natural language. In particular, a distinction has to be made between *nonexistent entities accepted by the speaker* and *nonexistent entities accepted only by some other agent*. The former include fictional entities and any entities the speaker believes exist. These entities are treated exactly like existent objects: they may form values of referential NPs in extensional contexts, constitute domains of quantification, and may have most properties existent objects may have. The second sort of nonexistents are entities that play a role mainly in the context of the description of an attitude of some other agent. Such objects may also form the value of NPs in extensional contexts. However, only certain kinds of predicates can be true of them, namely only 'extranuclear predicates' in Parson's (1980) terminology, that is, basically, existence and psychological predicates (all other predicates being nuclear predicates). Compare (4b) and (4c) as continuations of (4a) (where the speaker does not believe that there is a woman threatening John):[3]

(4) a. John believes that a woman threatens him.
b. But she is a figment of his imagination/does not exist.
c.# She has red hair/is old and fat.

Here, as elsewhere, '#' means 'is unacceptable on the relevant reading/in the relevant situation'. Although John is mistaken about there being a woman threatening him, (4b) with its extranuclear predicates yields possible continuations of (4a), but (4c) with its nuclear predicates does not.

Another distinction has to be made between possible objects that are accepted by someone and *merely possible, nonaccepted objects*. For the latter, no predicates are acceptable in extensional contexts. Consider (5):

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[2] For theories of nonexistent objects see Parsons (1980), Fine (1982), and Zalta (1983, 1988). For the distinction between accepted nonexistents or fictional entities ('actual nonexistents') and merely possible nonexistent entities ('nonactual nonexistents') see in particular Fine (1982).

[3] As was pointed out to me by Kit Fine, certain intensional objects are not subject to the constraint against nuclear predicates, namely those objects that in a relevant sense are created objects (such as objects of fantasy) rather than merely intensional objects:

(i) John is fantasizing about a castle. It is all white and near the ocean.

(5) a. John and Mary's wedding did not take place/was planned a long time ago.
b.#John and Mary's wedding lasts several days.

Suppose John and Mary planned to, but did not marry, then 'John and Mary's wedding' is an object accepted by them, and hence (5a) (with an extranuclear predicate) may be true, but (5b) (with a nuclear predicate) is unacceptable (even if the wedding was supposed to last several days). But if John and Mary did not plan to marry at all (and no one else planned for them), then their wedding is a merely possible object, and both (5a) and (5b) are inappropriate. Merely possible objects cannot form the values of referential or quantificational NPs in extensional contexts at all, but only in the scope of a modal operator or in a conditional.

The second traditional criterion for intensionality is failure of substitutivity of coreferential terms or predicates. For example, (6) is invalid (despite the extension of *unicorn* (the empty set) coinciding with that of *golden mountain*):

(6) John is looking for a unicorn.
[[*unicorn*]] = [[*golden mountain*]]
$\not\Rightarrow$ John is looking for a golden mountain.

Failure of quantifier exportation and of substitutivity are the only criteria that have been employed in the literature on intensional verbs. However, there are a number of other tests that identify NP–verb constructions as intensional. These new criteria are not only illuminating for the semantics of the intensional verb construction in general; they also provide necessary additional conditions on the intensional verb construction as it is investigated in this paper. For there are constructions that exhibit failure of existential quantification and substitutivity, yet do not exhibit the new criteria (see Section 2.3).

The new intensionality criteria are useful also because failure of quantifier exportation and substitutivity are difficult to apply, or not applicable at all, to some of the verbs that ultimately require the same semantic analysis as intensional verbs. This is discussed in more detail in the Appendix.

2.2. *New Criteria for Intensionality*

The additional criteria for intensionality are somewhat more linguistic in nature, and they discriminate rather sharply between extensional and intensional interpretations of verbs.

2.2.1. *Lack of Anaphora Support*

The first of these criteria, noted in passing in Montague (1973), is the lack of (definite) anaphora support. Complements of intensional verbs generally do not support definite anaphora, as seen in (7a) as opposed to (7b) (here '#' means 'lacks an intensional reading'). Anaphora support is possible only if the anaphor occurs in the context of modal subordination, as in (7c):

(7) a.# John is looking for a horse. Mary is looking for it too.
b. John saw a horse. Mary saw it too.
c. John is looking for a horse. It must be white and have a golden mane.

Lack of anaphora support is familiar from NPs in clauses embedded under certain attitude verbs (cf. Karttunen 1976); there as well, modal subordination is a way to make anaphora support possible across sentences (cf. Roberts 1989).

2.2.2. *Use of Impersonal Proforms*

Another criterion for intensionality involves the use of proforms. Unlike extensional verbs such as *meet*, intensional verbs allow only impersonal proforms (*something*, *what*, *-thing*) to stand for their complement and disallow personal ones (*someone*, *whom*, *person*), regardless of the descriptive content of the complement NP:

(8) a. John is looking for something, namely a secretary.
b.# John is looking for someone, namely a secretary.
c.# John met something, namely a secretary.
d. John met someone, namely a secretary.

(9) a. What is John looking for? – A secretary.
b.# Whom is John looking for? – A secretary.
c.# What did John meet? – A secretary.
d. Whom did John meet? – A secretary.

(10) a. John is looking for two things, a secretary and an assistant.
b.?? John is looking for two people, a secretary and an assistant.
c. # John met two things, a secretary and an assistant.
d. John met two people, a secretary and an assistant.

2.2.3. *Identity Conditions*

The third criterion involves the *identity conditions* for the semantic value of the complement. Consider the use of *same thing* and free relative clauses in (11) and (12):

(11) a. John is looking for the same thing as Mary, namely a new assistant.
b.#John is looking for the same person as Mary, namely a new assistant.
c.#John met the same thing as Mary, namely a new assistant.
d.#John met the same person as Mary, namely a new assistant.

(12) a. John is looking for what Mary is looking for, namely a new assistant.
b.#John is looking for whomever Mary is looking for, namely a new assistant.
c.#John met what Mary met, namely a new assistant.
d. John met whomever Mary met, namely a new assistant.

Same thing is appropriate in (11a) even if it is clear that John will hire a different assistant than Mary and even if John has a different kind of assistant in mind than Mary. For example, (11a) may be true even if John intends to hire a French assistant, but Mary wants a German assistant.

But when exactly are the denotations of two NPs considered identical? The invalid inferences in (13) below indicate that basically two conditions have to be satisfied: first, the determiners have to be semantically equivalent, and second, the intensions of the head nouns have to be identical:[4]

(13) a. John is looking for an assistant and Mary is looking for two assistants,
$\not\Rightarrow$ John and Mary are looking for the same thing.

[4] Note, however, that the following inference appears valid:

(i) John is looking for a German assistant, and Mary is looking for a French assistant.
$\Rightarrow$ John and Mary are looking for the same thing (an assistant).

The reason is that *John is looking for a German assistant* implies that John is looking for an assistant, and similarly in the case of Mary. *Same thing* in (i) then can relate to something only implied by the two premises.

b. John needs at least two assistants, and Mary needs at most two assistants.
⇏ John and Mary need the same thing.

c. John is looking for a golden mountain, and Mary is looking for a unicorn.
⇏ John and Mary are looking for the same thing.

Thus, the identity of any entities that could fulfill the satisfaction conditions expressed by the verb or the identity of any intensional objects the relevant agents may have in mind does not play a role in when the semantic values of intensional NPs count as identical.

2.2.4. *Consequences*

We now have three additional diagnostics for the intensional verb construction besides the two traditional ones. The five criteria together define a general task for a semantic account of the construction: any such account must be able to explain why the construction exhibits all five of these characteristics.

The three new criteria in effect rule out one possible account of the intensional verb construction, namely what can be called the '*nonexistent-objects account*'. This is the account on which the NP-complement of an intensional verb stands for a nonexistent object, a view that has been defended both by philosophers (Zalta 1983, 1988) and linguists (May 1985). On this account, for example, *a horse* in (1) would refer to some 'generic' nonexistent horse, an object which exhibits (or, in Zalta's terms, 'encodes') just one property, namely the property of being a horse.

Even though, as was mentioned earlier, it seems possible to talk about nonexistent objects in natural language, the terms used to designate them do not exhibit the relevant semantic characteristics of intensional NPs. In particular, they do allow for anaphora support (14a), are not restricted to impersonal proforms (14b), and exhibit different identity conditions (14c).

(14) a. The golden mountain does not exist; it is a figment of people's imagination.
b. The perfect woman does not exist, and she will never exist.
c.# John imagined whom Bill imagined, a very beautiful woman.

The nonexistent-objects account would also have difficulties in explaining the use of *same* in example (11a). If John and Mary have different kinds of assistants in mind, then they will stand in the search relation to dif-

ferent nonexistent objects. But this conflicts with the appropriateness of the use of *same* in that sentence.[5, 6]

2.3. *Intensional Verbs with Definite NPs*

So far I have restricted the discussion of intensional verb constructions to verbs with indefinite NP-complements. Traditionally, however, intensional verbs with definite NPs, as in (15), have been considered intensional verb constructions of the same sort:

(15) John is looking for the dean.

Indeed, it can be observed that failure of quantifier exportation (or existential generalization) and substitutivity obtain in just the same way with them. Under the relevant circumstances, the following inferences do not go through:

(16) a. John is looking for the dean.

the dean = the father of Mary

$\not\Rightarrow$ John is looking for the father of Mary.

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[5] In some cases, intensional verbs obviously take nonexistent objects as arguments, e.g., in (i):

(i) John is looking for Eldorado.

Ludlow (1986), however, notes that in such a case, an indefinite NP has a rather different status, as can be seen from (ii):

(ii) John is looking for a mythical city.

Unlike in the intensional verb constructions, (ii) does not imply that John thinks the city he is looking for is mythical. Moreover, (ii) does not have the relevant nonspecific reading.

[6] Applying the new tests to *fear* and *worship* (cf. fn. 1) shows that these verbs pattern with extensional rather than intensional verbs. First, *fear* and *worship* allow for definite anaphora support:

(i) a. John fears ghosts. They really frighten him.
b. John worships a goddess. She is very popular in this region.

Second, they act like other extensional verbs with respect to the choice of proforms:

(ii) a. John worships someone / ? something, namely an ancient goddess.
b. Who / ? What does John worship? – John worships Zeus.

Finally, they display different identity conditions than intensional verbs regarding the semantic value of their complement:

(iii) (#) John worships the same thing as Mary, namely an ancient goddess.

(iii) is impossible if the goddess John worships if different from the one Mary worships.

b. John is looking for the dean.
$\not\Rightarrow \exists x(\text{dean}(x)$ & John is looking for $(x))$.

However, intensional verbs with definite NPs do not exhibit the other intensionality diagnostics. Unlike indefinite NPs as arguments of intensional verbs, definite NPs on an intensional reading do allow for definite anaphora support:

(17) John is looking for the dean. Mary is looking for him too.

Moreover, they are not subject to the restriction to impersonal proforms:

(18) a. John is looking for someone / # something, namely the dean.
b. Whom / # What is John looking for? – The dean.
c. John is looking for two people / # two things, the dean and the president.

This indicates that definite objects of intensional verbs involve a different semantics than indefinite ones. Most plausibly, definite complements of intensional verbs refer to conceived (accepted nonexistent) objects, which, as was mentioned earlier, are treated in the same way as existent entities (as regards anaphora and proforms). On the relevant reading of (15), then, *the dean* stands for a nonexistent object (let's say, the object exhibiting just the property of being the dean) which is accepted by John. Of such an object, recall, the extranuclear property of being sought by John may be true.[7] Because of their different behavior and presumably different underlying semantics, I will disregard intensional verbs with definite NPs in what follows.

Having discussed the semantic characteristics of the intensional verb construction, we can now turn to the question: what are the verbs that are intensional according to those criteria? In the next section, I will briefly characterize the different classes of intensional verbs with representative examples.

3. Types of Intensional Verbs

Look for is only one of a broad range of verbs that demonstrably have an intensional reading with NP-complements. Intensional verbs can be divided into various different subclasses according to the general scheme of their

[7] This is not entirely plausible, though. The intensional quantifier analysis I will defend later for intensional verb constructions applies to definite complements equally well. On that analysis, *the dean* would denote the function mapping every situation *s* to the set of sets including the only object in *s* that is the dean in *s*. See Section 6.3.

lexical meaning – and ultimately according to the role the intensional argument plays in that meaning. The different intensional verbs and their behavior with respect to the five intensionality diagnostics are discussed in detail in the Appendix.

The first class of intensional verbs consists of what I call *verbs of comparison*, for example *compare* in (19):

(19) John compared Charlie to unicorn.

Roughly, *compare* here expresses the fact that John perceives a similarity between Charlie and possible instances of unicorns.

The second class of intensional verbs consists of what I call *verbs of absence*. Verbs of absence in turn divide into two subclasses: *modal verbs of absence* such as *need*, as in (20a), and *psychological verbs of absence* such as *look for*, as in (20b):

(20) a. John needs an assistant.
b. John is looking for an assistant.

Modal verbs of absence characteristically involve a modal operator or counterfactual conditional somewhere in their lexical meaning.[8] Adopting Lewis's (1972) semantics of conditionals, (20a) in a first approximation can be analyzed as 'In all worlds maximally similar to the actual world in which John's needs are satisfied, John has an assistant', and (20b) roughly as 'In all worlds in which John's search is satisfied, John has an assistant' (but see the Appendix).

Verbs of comparison and verbs of absence are the two sorts of verbs that are generally discussed in the literature on intensional verb constructions. However, there are two other important classes of intensional verbs which have received no or much less attention. The first one consists of epistemic verbs. They include the familiar (nonveridical) *see*, as in (21), but also verbs such as *recognize*, *count*, or *find* (on one reading; cf. the Appendix):

(21) John saw a tree.

On the relevant reading, (21) can be paraphrased as 'John saw a particular situation s_0 and he takes s_0 to have the property of containing a tree'.

The second class of new intensional verbs consists of what I call *resultative verbs*. They include, for instance, *hire* as in (22):

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[8] Further evidence that what I call 'modal verbs of absence' are indeed modal comes from the possibility of free-choice *any*, which is reserved for generic and modal contexts:

(i) John needs anyone who speaks French fluently.

(22) John hired an assistant.

On the relevant reading, (22) can be paraphrased as 'There is a situation *s* resulting from John's hiring activity such that in *s*, there is an assistant of John'. What is crucial is that the person John hired need not have been an assistant before.[9]

There are a few other classes of intensional verbs, for instance verbs of creation such as *paint* and verbs of ownership such as *inherit*. For a discussion of these verbs and their properties, I again refer to the Appendix.

This classification of intensional verbs raises the question: why is it not sufficient to restrict oneself to a single intensional verb in developing a semantic analysis of the intensional verb construction? The reason is twofold. First, two different semantic analyses of the NP-complement will be required for different kinds of intensional verbs. Second, in order to explain certain semantic characteristics of the intensional verb construction – in particular, the way quantified intensional complements are understood – a rudimentary lexical analysis is necessary, and different classes of intensional verbs differ precisely in that they involve different types of rudimentary lexical analyses.

4. Three Analyses of Intensional Verbs

There are three plausible analyses of the intensional-verb construction: the *propositional analysis*, the *property analysis*, and the *intensional quantifier analysis*. These analyses fare much better in explaining the semantic characteristics of intensional verbs than the nonexistent-objects account. In what follows, I first want to examine these analyses as to their ability to explain those semantic characteristics. I will then turn to another set of data, namely intensional verb constructions with quantified complements. Those data will provide the crucial criterion for the choice of one analysis over another for particular classes of intensional verbs.

4.1. *The Propositional Analysis*

On the propositional analysis, the argument of an intensional verb is taken to be a proposition. The ambiguity between the intensional and exten-

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[9] The intensional readings of resultative verbs correspond to an alternative construction with the same verb involving *as*-phrases and referential NP-complements:

(i) a. John hired Bill as an assistant.
b. The Americans elected Clinton as president.

sional reading of a verb is then construed as a scope ambiguity: in the first case, the quantifier the NP stands for takes scope inside the clause, and in the second case outside of the clause. Thus, the extensional reading of (23) would be represented as in (24a) and the intensional reading as in (24b), where *R* is some contextually given relation (for example the relation of possession or the relation of being in the disposition of):

(23) John needs a horse.

(24) a. $\exists x(\text{horse}(x) \,\&\, \text{needs}(\text{John}, \hat{}R(\text{John}, x)))$
b. $\text{need}(\text{John}, \hat{}\exists x(R(\text{John}, x) \,\&\, \text{horse}(x)))$

There are two versions of the propositional account: a *syntactic* version and a *lexical* version. The syntactic version takes the syntactic complement of the intensional verb to be a clause, with the NP, most plausibly, being the argument of some implicit predicate. The lexical version takes the syntactic complement of the verb to be just the NP itself, but conceives of the value of the NP as part of a proposition that forms a component of the lexical meaning of the verb. McCawley (1974) is an early proponent of the syntactic version, Montague (1970) a proponent of the lexical one.

The syntactic version of the propositional analysis applies straightforwardly to intensional verbs such as *need*, which take both clauses and NPs as complements. The lexical version is more plausible for verbs such as *look for*, which disallow overt clausal complements. Thus, Montague assume that *look for* takes an NP as its argument, but construes its lexical meaning as containing a proposition as a component (analyzing *look for* as *try to find*).

Some verbs, for instance epistemic *find*, lack an obvious paraphrase involving a proposition. However, this is not a valid argument against the propositional account, since whether the lexical meaning of a verb could be paraphrased in a simple way in English is independent of what the meaning of the verbs might ultimately be.

On the propositional account, the behavior of the NP with respect to existential quantification and substitutivity will be explained in whatever way it will be explained for overt clausal complements. Also, the restriction to impersonal proforms and the identity conditions are expected, since they are found in the same way with clauses:

(25) John tries the same thing as Mary, namely to find a horse.

However, the propositional analysis has its problems. First of all, the syntactic version does not obviously explain the behavior of the complement with respect to anaphora support, since clauses do support definite anaphora:

(26) a. John needs to have an assistant, and Mary needs it too.
b. John tried to find a horse and Mary tried it too.

The lexical version has less difficulty in this regard, since anaphora in general take syntactic elements as antecedents rather than components of lexical meanings.

A more serious problem for the clausal account consists in the fact that such an analysis seems highly unlikely for many intensional verbs, even if no straightforward paraphrase is required; this holds in particular for verbs of comparison (Zimmermann 1992), but also for many epistemic and resultative verbs, such as *count* and *hire* (cf. Appendix).

The most serious problem for the clausal account, however, resides in certain differences in the behavior of particular quantifiers in the overtly clausal and the NP-construction. The problem, hinted at in Zimmermann (1992), arises with non-increasing quantifiers such as *no*, *few*, *at most two*, and *exactly two* (that is, quantifiers Q that do not allow for an inference from $B \in Q(A)$ to $B \in Q(A')$ for any $A \subseteq A'$). The crucial observations are that (27a) and (27b), as well as (28a) and (28b), have different truth conditions:

(27) a. John needs at most two assistants.
b. John needs to have at most two assistants.

(28) a. John needs no assistant.
b. John needs to have no assistant.

The difference between (27a) and (27b) resides in the satisfaction conditions for John's needs. (27b) says that John's needs are satisfied only if he has no more than two assistants. (27a) says something weaker: it does not exclude that John's needs are satisfied even if he happens to have ten assistants. Rather, (27a) says that in the minimal situation in which John's needs are satisfied, John has at most two assistants. That is, only the NP-construction in (27a) specifies how many assistants John has in a minimal possible situation in which John's needs are satisfied. I will come back to the notion of minimal situation later.

Similarly, the clausal construction in (28b) requires that in a world in which John's needs are satisfied, he be assistantless. By contrast, the weaker NP-construction in (28a) only specifies that in a minimal possible situation in which John's needs are satisfied we should not find any assistant of John. I will discuss the intensional readings with *no* in more detail in Section 5.1.

These differences do not follow if the NP-construction is analyzed as equivalent to the clausal one. (It may be objected that the equivalence is

only partial, since the NP-construction involves an implicit relation, whereas the clausal one has an overt predicate. But the implicit relation with the NP-construction may be intended to be precisely the relation, or one of the relations, expressed by the explicit predicate, in which case we should find equivalence, which we don't.)

4.2. *The Property Analysis*

On the property analysis, the intensional complement of an intensional verb stands for a property. Thus, (1) would be analyzed as in (29), where *look for* is construed as a relation between objects and properties:

(29) look for (John, λx[horse(x)])

The property analysis, briefly discussed but rejected by Dowty, Wall, and Peters (1981), has recently been defended by Zimmermann (1992) as a general analysis of intensional verb constructions.

Along with the semantic analysis in (29) comes a natural assumption about the function of the intensional complement. If the complement simply stands for a property, it should have the status of a predicate – in the same way as *a lawyer* in (30):

(30) John is a lawyer.

Thus, on the property analysis, the intensional NP would naturally be regarded as a predicative NP. Then, intensional verbs would differ from copula verbs such as *be*, *become*, and *remain* not in their lexical argument structure, but simply in their lexical meaning: intensional verbs do not involve predication of the property argument of the subject and generally have a more complex lexical structure.

On the property analysis, the five characteristics of intensional verb constructions follow straightforwardly. For existential quantification and substitutivity, this is obvious. For lack of anaphora support, impersonal proforms, and identity conditions the parallel can be drawn with predicative NPs, which pattern in just the same way:

(31) a. John is a lawyer. # Bill is him / it too.
b. What / # Who is John? – An idiot.
c. John is what Bill is, a lawyer.

However, there are important differences between predicative NPs and NP-complements of a number of intensional verbs including *need*, differences which will require abandoning the property analysis for those

intensional verbs. These differences concern the determiners that can occur with predicative NPs and with NP-complements of intensional verbs.

First of all, intensional NP-complements not only allow for the singular indefinite determiner *a*, but also allow for cardinality attributes such as *two*:

(32) John needs two secretaries.

At first sight, cardinality attributes do not pose a threat to the property analysis semantically, since, as pointed out by Zimmermann (1992), they can be analyzed as group properties, given the widely accepted view that plural nouns denote sets of groups or sums (cf. Link 1983 and others). *Need* in (32) would take the property in (33a) as its argument, with *two* construed as a group predicate as in (33b). Here '*sum*' is the operation of sum formation, forming groups from sets of individuals:

(33) a. λx[secretaries(x) & two(x)]
b. $x \in$ [*two*] iff $\exists yz(y \neq z \ \& \ x = \text{sum}(\{y, z\}))$

However, as a matter of fact, cardinality attributes are considerably worse with predicative NPs in copula verb contexts, as are group-denoting NPs in general (cf. Stowell 1991):[10]

(34) a. ? John and Bill are/became two doctors.
b.??I consider John and Bill two nice people.
c. ? John and Bill are a doctor and a lawyer.

The second, and more important, problem for the property analysis concerns the possibility of quantificational determiners for intensional NPs, an issue I will discuss in greater detail in Section 5.3. In (35), intensional readings are perfectly available with quantificational complements of modal and psychological verbs of absence and with epistemic and resultative intensional verbs:[11]

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[10] In some cases, cardinality attributes seem to be acceptable with verbs of comparison, for instance in (i):

(i) They look like two lovers.

Whatever the underlying condition may be, it appears that in those cases, cardinality attributes are possible with copula verbs as well:

(ii) They seem to be two lovers.

[11] Zimmermann (1992) mentions the apparent absence of an intensional reading of (i) below as evidence that quantificational NPs disallow an intensional reading:

(i) John is looking for at most ten assistants.

However, the lack of an intensional reading of (i) seems to be due to an independent

(35) a. John needs at most two secretaries.
b. John is looking for exactly ten assistants.
c. John saw at most ten trees (though there were actually twelve trees in front of him).
d. John hired at least two assistants.

One might try to reanalyze quantifiers such as *at most two* and *exactly two* as group predicates as well. For (35a), this will yield (36a), with the meaning of *at most two* in (36b) and *exactly two* in (36c), where 'At' means 'is an atom':

(36) a. need(John, λx[secretaries(x) & at most two(x)])
b. at most two(x) iff $\exists yzw$ ($At(y)$ & $At(z)$ & $At(w)$ & x = sum({y, z, w}) $\rightarrow$ $y = zvy = wvz = w$).
c. exactly two(x) iff $\exists yz(At(y)$ & $At(z)$ & $y \neq z$ & x = sum ({y, z}))

However, if (36c) were right, then the meanings of *exactly two* and *two* would collapse, since *two* should have the same meaning as given in (36c). But in fact the two determiners are semantically distinct, as can be seen from the nonequivalence between (37a) and (37b):

(37) a. John needs two secretaries.
b. John needs exactly two secretaries.

(37a) and (37b) have different truth conditions. (37a) does not exclude that John needs four, and perhaps exactly four secretaries. But (37b) would be false in such a situation.

Note that it would be inadequate to analyse *two* as meaning 'at least two'. For this would yield wrong results in other contexts, for instance in (38):

(38) Only two people came.

On that suggestion, (38) would mean 'Only a group consisting of at least two people came'. But in actual fact (38) is false if more than two people (e.g. only a group of four people) came.

There are other determiners that allow for an intensional reading but cannot be analyzed as group predicates, for instance *no*, *no . . . except John*, and *every*, as in (39). (Those will be discussed more in Section 5.1 and section 6.3.)

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implication of *look for* that there must be something the agent is looking for. Note that in (ii), *at most ten* does display an intensional reading:

(ii) John is looking for several assistants, but he is looking for at most ten assistants.

(39) a. John needs no assistant.
b. John needs no assistant except Bill.
c. John wants every painting by Matisse.

No assistant in (39a) allows for an intensional reading, but can hardly be analyzed as denoting a property. Now it may be argued that the negative element of *no* actually modifies the verb, rather than the NP *no assistant*, which would be interpreted simply as *an assistant*. But such an explanation would not carry over to *no assistant except John* in (39b), where the negative universal quantifier is necessary to license the exception phrase. *Every painting by Matisse* also allows for an intensional reading, but, again, it cannot be analyzed as denoting a property.

The difficulties for the property analysis arising with quantified complements are rather severe so that the analysis should better be abandoned as a general account of the intensional verb construction. However, there is one particular class of intensional verbs for which it is adequate. The examples discussed so far as being problematic for the property analysis involved only verbs of absence, epistemic verbs, and resultative verbs, not verbs of comparison. For the latter class, the property analysis turns out to have an appropriate application. Verbs of comparison disallow quantifiers, and moreover, like copula verbs, they disallow cardinality attributes:

(40) a.?? They resemble at most ten / exactly ten kings.
b. John and Bill resemble kings / ?? two kings.
c. John compared Sue and Ann to queens / ?? two queens.

It is also rather plausible that in the intensional reading, verbs of comparison involve a simple property rather than a quantifier, since such verbs care only about qualitative, not numerical aspects of objects.[12]

To conclude, the property analysis accounts for one class of intensional verbs, but it fails for the other classes.

4.3. *The Intensional Quantifier Analysis*

The intensional quantifier analysis has been proposed by Montague (1970, 1973). On Montague's account, the complement of an intensional verb stands for an intensional quantifier, that is, a function from possible worlds to sets of properties. I will later propose a somewhat different version of the intensional quantifier account, namely a partialized version on which

[12] In his defense of the property analysis, Zimmermann (1992) actually discusses only verbs of comparison.

intensional quantifiers are construed as functions from situations (partial possible worlds) to extensional quantifiers ranging over entities in the domains of those situations.

First, however, I want to address the question of how the intensional quantifier account explains the semantic characteristics of the intensional-verb construction. Again, for existential generalization and substitutivity, this is obvious (and familiar). Concerning the other three characteristics, let us start with the observation that intensional quantifiers are functions of one sort. Functions of another sort are denoted by definite NPs such as *John's trainer* or *the temperature* in the context of predicates such as *change* or *rise*, as in (41):

(41) a. John changed his trainer.
b. The temperature rises.

Functional NPs such as *John's trainer* and *the temperature* denote 'individual concepts', functions from contexts (times and locations) to objects or numbers (degrees).[13]

Crucially, definite functional NPs of this sort exhibit exactly the same behavior with respect to definite anaphora support, choice of proforms, and identity conditions:[14]

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[13] Montague (1970) also cared about functional NPs like *the temperature*. He took those NPs to be of type $\langle s, e\rangle$, and hence intransitive verbs such as *rise* to be of type $\langle\langle s, e\rangle, t\rangle$. This presupposes that such functional NPs are definite. But functional NPs are also possible with quantifiers. For example, in (i.a), we have an indefinite and (i.b) a universal functional NP:

(i) a. An address changed.
b. Every address changed.

With quantifiers we see a crucial difference between functional NPs that are complements of intensional verbs and functional NPs that are complements of verbs like *change*. With quantifiers, the first sort of NP will denote a function from worlds to quantifiers ranging over the domain of that world (that is, it will be of type $\langle s, \langle\langle e, t\rangle, t\rangle\rangle$, whereas the second sort of NP will denote a quantifier ranging over functions from contexts to objects (that is, it will be of type $\langle\langle\langle s, e\rangle, t\rangle, t\rangle$).

[14] However, this does not hold for all functional NPs. Some functional NPs seem to allow for anaphora support:

(i) John changed his address. Mary changed it too.

Alternatively, the pronoun here might be analyzed as a pronoun of laziness. Note that NPs denoting number-valued functions seem to always allow for definite anaphora:

(ii) a. The temperature stayed low yesterday. But it increased today.
b. The number of visitors has increased rapidly in the last decade. But it didn't increase at all last year.

Moreover, functional NPs in subject position seem to allow for personal proforms:

(42) a. John changed his trainer. # Bill changed him/it too.
b. John changed this year what he changed last year, his trainer.
c. John changed two things / # two people, his trainer and his secretary.

The identity conditions exhibited obviously correspond to the identity conditions on functions, and whatever governs the possibility of definite anaphora and the choice of proforms seems to treat different sorts of functions in just the same way. The extension of the noun *thing*, as given in (43), for example, includes functions of a very general sort:

(43) $[\![\textit{thing}]\!] = \{D \setminus \{x \mid \text{person}(x)\}\} \cup \{f \mid f$ is a function from (n-tuples of) contexual indices to elements of $D\}$

Thus, the special behavior of intensional NPs reduces to the special behavior more generally of NPs denoting functions.

We can now turn to the most important issue of this paper, namely intensional readings of verbs with different kinds of quantifiers.

5. Intensional Verbs with Quantified Complements

What is the range of complements allowing for an intensional reading? As a first generalization, we note that all weak quantifiers allow for an intensional reading with verbs of absence, epistemic verbs, and resultative verbs:

(44) a. John needs an assistant / at least two assistants / exactly two assistants / at most two assistants / more assistants than secretaries.
b. John needs no assistant.
c. John needs no assistant except Bill.

(45) a. John is looking for a castle / two castles / at least two castles / exactly two castles / more castles than churches.
b. John saw a tree / at least one tree / exactly two trees / more trees than bushes.
c. John hired an assistant / two assistants / at least three assistants / at most two assistants.

For *at least two*, *exactly two*, *at most two*, and *more . . . than* in (44a), the intensional readings are obvious. But for *no* and *no . . . except Bill* in

(iii) a. The president is elected every four years. He has the most responsibilities.
b. John's trainer changed again today. He has never changed so often as in this year.

(44b, c) such readings may be less so. How do we know that (44b) and (44c) have intensional rather than extensional readings?

As was mentioned in Section 4.2, the negative quantifier *no* cannot generally be analyzed as taking scope over the verb, since in the present case, it has to license the exception phrase in *no . . . except Bill* in (44c). But perhaps (44c) has an extensional reading with the meaning: 'For every assistant *x* except Bill, John does not need *x*.' However, this is not the only reading the sentence can have, and in fact it is not a plausible reading in the first place. (44c) does not have to mean that John does not need any of his actual assistants except Bill. (Perhaps John does not even have assistants other than Bill, in which case the sentence would be trivially true.) Rather, (44c) most naturally means 'Except for Bill, John does not need any assistant whatsoever', involving quantification over possible assistants of John. But this is an intensional reading: in any minimal possible situation *s* in which John's needs are satisfied, John has no one who is an assistant of his in *s* except Bill. Note that two different readings of the same sort can be distinguished for (44b). Thus, negative quantifiers as well display intensional readings.

A few words about the notion of quantifier I assume, and in particular about the use of 'weak quantifier'. I take quantified NPs in natural language to stand for generalized quantifiers, construed as sets of sets (cf. Barwise and Cooper 1979). Thus, *exactly two men* will stand for the set of sets whose intersection with the set of men amounts to exactly two, and *every man* for the set of sets that include the set of men as a subset. Determiners such as *exactly two* and *every* then denote functions from sets to sets of sets. Thus, *exactly two* will denote the function that maps a set A to the set of sets B such that $|A \cap B| = 2$, and *every* will denote the function that maps a set A to the set of sets B such that $A \subseteq B$. Intensional quantifiers (in the sense in which I will make use of the term) are functions from possible worlds (or situations) to sets of sets. Thus, *exactly two men* in the intensional reading denotes the function from possible worlds w to the set of sets whose interaction with $[\![men]\!]^w$ (the extension of men in w) is of cardinality two.

I want to use the notion of weak quantifier in the empirical sense as comprising exactly those quantifiers that naturally occur in *there*-sentences (cf. Milsark 1977, Barwise and Cooper 1979, Keenan 1987) and in the formal sense as comprising exactly those quantifiers that are intersective (cf. Keenan and Westerståhl 1995):

(46) A quantifier Q is intersective iff for all A, B, A', B', if $A \cap B = A' \cap B'$, then $B \in Q(A)$ iff $B' \in Q(A')$.

Strong quantifiers then are those that are not intersective. Weak quantifiers on this characterization care about entities in the first argument of the quantifier (the restriction) only insofar as those entities also occur in the second argument, whereas strong quantifiers always care about the entire restriction.

Before proceeding in our examination of the range of quantifiers allowing for an intensional reading, let us see how the intensional quantifier analysis accounts for this readings with weak quantifiers. In order to do so, it is necessary to spell out schematically the form of the lexical meaning of different types of intensional verbs.

Let us start with *need*. In a first approximation, (44a) with *exactly two* can be paraphrased as in (47a), and more formally in (47b), where *P* is some contextually given satisfaction condition (e.g. being happy, being able to complete the job, being able to impress Mary) and *R* some appropriate, contextually given relation (for example the relation of employment):

(47) a. For every world *w* (maximally similar to the actual world) such that John is *P* in *w*, John stands in *R* to exactly two assistants in *w*.
b. For every world *w* maximally similar to w_0 such that P^w(John), $\{x \mid R^w(\text{John}, x)\} \in [\textit{exactly two}]^w([\textit{assistants}]^w)$

However, (47) is not yet adequate – because of what was mentioned in Section 4.1 in relation to the propositional analysis of the intensional verb construction: if the sentence in question is true, then, given (47), John's needs could not be satisfied in a world in which he has more than two assistants. But this is not excluded by what (44a) with *exactly two* actually means.

It was already hinted that this requires going partial for verbs like *need* (and, as we will see, other NP-taking intensional verbs). The complement in (44a) and (44b) specifies what John must have in a *minimal* situation in which his needs are satisfied. Thus, (44a) is better analyzed as in (48a) and (48b):

(48) a. For every minimal situation s (maximally similar to w_0 in the respects relevant in *s*) such that John is *P* in *s*, John stands in *R* to exactly three assistants in *s*.
b. For every minimal situation s such that P^s(John), $\{x \mid R^s(\text{John}, x)\} \in [\textit{exactly two}]^s([\textit{assistants}]^s)$

Here situations are taken to be partial possible worlds, viewed as primitives (as, for instance, in Humberstone 1981 and Kratzer 1989). Like

possible worlds, they may act as contextual indices with respect to which an expression is evaluated.

Treating the conditional in the analysis of *need* as involving situations rather than possible worlds requires a corresponding modification of the intensional quantifier: the quantifier is now a function from possible situations to extensional quantifiers ranging over the domains of those situations, that is, sets of sets of entities in those situations. For *exactly two* we then have (49), where $D(s)$ is the domain of entities in the situation s:

(49) For a situation s and a set X, $X \subseteq D(s)$, $[\textit{exactly two}]^s(X) = \{Y \mid Y \subseteq D(s) \;\&\; X \cap Y = 2\}$

I will refrain from trying to spell out an analysis for psychological verbs of absence such as *want*. It is less clear that such verbs can be analyzed in terms of quantification over satisfaction situations; rather, they might involve propositions in a more fine-grained sense (see the Appendix).

Epistemic verbs such as *see* also denote relations between objects and intensional quantifiers. However, the intensional quantifier plays a very different role in the lexical meaning of such verbs. The role of the quantifier can approximately be captured by the following implication of the lexical meaning of intensional *see* applied to an agent, a concrete situation, and an intensional quantifier:

(50) For an object x, a situation s_0 and an intensional quantifier Q, if $\langle x, s_0, Q\rangle \in [\textit{see}]$, then Accept$(x, \langle s_0, \lambda s[D(s) \in Q^s]\rangle)$

Here 'Accept' is taken to denote a relation between an agent and a proposition (construed as a pair consisting of a situation and a property of situatons). Applied to (35c), this means that John takes the situation he sees to have the property of having at most ten trees in its domain.

(35) c. John saw at most ten trees.

Concerning resultative verbs, the role of the intensional quantifier is approximately captured by the following implication of the meaning of *hire* (using a Davidsonian event argument):

(51) For an event e, an object x, and an intensional quantifier Q, if $\langle e, x, Q\rangle \in [\textit{hire}]$, then for the minimal situation s_0 resulting from e, $D(s_0) \in Q^s_0$.

Thus, (35d) implies that there are at least two assistants in the domain of the minimal situation resulting from John's hiring:

(35) d. John hired at least two assistants.

Given this account, the intensional quantifier analysis obviously yields readings for intensional verbs with any of the weak quantifiers.

However, it also generates readings for all strong quantifiers, and unfortunately (setting aside the question whether strong quantifiers allow for intensional readings at all), the analysis yields readings for strong quantifiers that in many cases are unavailable. Given the way the intensional quantifier approach was spelled out, (52a) should have the semantic analysis in (52b):

(52) a. John needs every horse / most horses / both horses.
b. For every minimal situation *s* (maximally similar to w_0 in the respects relevant in *s*) such that John is *P* in *s*, John stands in *R* (in *s*) to every horse (most/both horses) in *s*.

However, (52b) allows for readings that are in fact absent. The unavailability of the relevent readings can best be seen by the invalidity of the inference from (53a) to (53b) and from (53a) to (53c):

(53) a. John needs exactly two horses.
b. John needs every horse.
c. John needs most/both horses.

Suppose (53a) is true. Then every minimal situation satisfying John's needs contains exactly two horses that John stands in the relevant relation *R* to. Now given the minimality condition on satisfaction situations, such a situation will contain no other horses. Thus, the sentences in (53b) and (53c) would also be true. But intuitively, they aren't (given that there are more horses in the world).

The same problem arises with epistemic and resultative verbs. The analysis predicts that any sentence in (45b) implies (54):

(45) b. John saw a tree / at least one tree / exactly two trees / more trees than bushes.

(54) John saw every tree.

However, this is intuitively wrong. (54) implies that John saw every relevant tree there is, not just the trees in the situation he saw.

Similarly, any sentence in (45c) ought to imply (55):

(45) c. John hired an assistant / two assistants / at least three assistants / at most two assistants.

(55) John hired every assistant.

This is because, if any sentence in (45c) is true, then John hired every assistant in the minimal situation resulting from his hiring. But this is not what (55) means. (55) means that John hired every assistant there is.

Thus, the partialized intensional quantifier account in conjunction with the rudimentary account of the lexical meaning of intensional verbs predicts readings of strong quantifiers that are in fact absent. Fortunately, however, the analysis can be rescued: there is an independently motivated condition associated with strong quantifiers that rules out the unavailable readings, a condition which I will call the 'domain presupposition' of strong quantifiers.

6. Domain Presuppositions

6.1. *A Simple Version of the Notion of Domain Presupposition*

It has often been suggested that strong quantifiers differ from weak quantifiers not only in their logical properties, but also in a certain discourse-related property (Milsark 1977, Enç 1991, Diesing 1992, Zucchi 1995): strong quantifiers have to be interpreted with respect to a previously established domain of discourse.[15] Extending the familiar notion of presupposition, one may put this as the thesis that strong quantifiers presuppose their domain:

(56) *Domain Presupposition Thesis*
Strong quantifiers presuppose their domain.

In a first approximation, the domain presupposition thesis means that a clause containing a strong quantifier is acceptable in a context *c* only if the domain of the quantifier is included in the domain of *c* (the set of entities that are accepted in *c*).[16]

Why should strong quantifiers carry a domain presupposition, but not

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[15] The phenomenon of domain presupposition is different from the better-known phenomenon of discourse-relatedness (cf. Pesetsky 1987, Enc 1991). Discourse-related NPs, for example *which men* or *which of the men*, involve a set that must have been introduced into the discourse previously. In this sense, they require an anaphoric relationship between sets. By contrast, domain-presupposing quantifiers only require that their domain be included in the domain of the context set, without this domain necessarily being explicitly represented as a discourse referent.

[16] A much weaker condition, adopted in that form by Diesing (1992) and Zucchi (1995), is that strong quantifiers presuppose a nonempty domain. For extensional contexts, this condition would amount more or less to the same since it is supposed that quantifier domains depend only on the discourse context anyway. However, the present concern is domains of counterfactual situations, and here the two conditions diverge completely.

weak quantifiers? A motivation for the domain presupposition may be obtained from the characterization of strong quantifiers as non-intersective quantifiers. Strong quantifiers involve two sets: the restriction and the intersection of the restriction with the scope. By contrast, weak quantifiers only involve the second set. It may then be the need to reduce the complexity of semantic processing that leads to the requirement that the first set should be an already familiar set (that is, a quantifier should not establish more than one new set).

The notion of domain presupposition is a difficult and, as it turns out, rather problematic one. It certainly requires more discussion than there is room for in this paper. The notion is related to the notion of a presupposition of a proposition in the sense of Stalnaker (1973). According to that notion, a presupposition influences the acceptability of a sentence relative to the common ground, the set of beliefs shared by speaker and addressee that are relevant in the context of communication. Suppose the common ground is construed as a set of possible worlds – the 'context set' – then a sentence is acceptable in a context set W just in case its (propositional) presuppositions are true in every world in W:

(57) *Propositional Presupposition*
A sentence with a presupposition p is acceptable for a context set W only if for every $w \in W$, p is true in w.

In Section 6.4., I will briefly discuss the way the notion of domain presupposition can be construed in close analogy to the notion of propositional presupposition. However, in order to keep things as simple as possible for the issues at hand, I will restrict myself for the moment to a much simpler (and, as we will see, ultimately inadequate) notion of domain presupposition.

In order for the domain presupposition to make sense at all, the additional assumption has to be made that strong quantifiers presuppose a nonempty quantification domain to moreover, something has to be said about what the domain of a context is and how it relates to the context set. I will address this issue in Section 6.3. For the present, I will simply assume that any context c is associated with a set or domain $D(c)$ containing the entities established in c. Then, for current purposes, the following notion of domain presupposition for strong quantifiers will be sufficient:

(58) If D is a strong determiner, then for a context c and any situation s $[\text{D N}']^s$ is defined relative to c only if $[\text{N}']^s = [\text{N}']^{D(c)}$.

That is, a strong NP can be interpreted with respect to a possibly counterfactual situation s only if the extension of the restriction of the quantifier

in *s* is the same as when it is evaluated relative to the domain of the context.

One other assumption about contexts should be made explicit: as a general condition, the domain of an (underived) context should restricted to accepted entities (and hence exclude merely possible entities):

(59) *Acceptance Condition on Domains of Underived Contexts*
For a context *c*, $D(c)$ contains only entities that the speaker and the addresses accept.

6.2. *The Effects of the Domain Presupposition with Intensional Verbs*

How does the domain presupposition condition rule out the absent readings? Here we have to consider the different types of intensional verbs individually. The domain presupposition thesis together with the analysis of *need* given earlier implies the following:

(60) *John needs every horse* is acceptable in a context *c* only if for every minimal situation *s* such that P^s(John), $[horse]^s = [horse]^{D(c)}$, and for every *x*, $x \in [horse]^s$, R^s(John, *x*).

Thus, the minimal satisfaction situations must include exactly the same horses as the domain of the discourse context. But if John needs only fewer horses than there are in the domain of the context, then, because of the minimally condition, the domain of the satisfaction situation will contain only those horses, and hence the domain presupposition will not be satisfied.

The same sorts of explanations rule out the impossible reading with epistemic and resultative verbs. Thus, for *see* we have, for example:

(61) *John saw every tree* is acceptable in a context *c* only if for the domain D' which John takes the situation that he sees to have, $[tree]^{D'} = [tree]^{D(c)}$, and $D' \in [every\ tree]^{D'}$.

Again, unless the domain of the visual situation contains all the accepted horses, there will be a clash between the two domains, and the domain presupposition will not be satisfied.

For the case of resultative verbs, we get the following condition:

(62) *John hired every assistant* is acceptable in a context *c* only if for the minimal situation *s* resulting from John's hiring activity, $[assistant]^s = [assistant]^{D(c)}$ and for every $x \in [assistant]^s$, John hired *x*.

Thus, the resulting situation must include all the assistants in the domain of the context for the domain presupposition thesis to be satisfied. But this will not be the case if there is a person *x* that becomes an assistant only as a result of John's hiring; *x* will not count as an assistant in the domain of the context previous to the utterance, but will be added to the domain only in the course of the utterance describing John's hiring (see also Section 8.4).

6.3 *Intensional Readings with Strong and Discourse-Related Quantifiers*

We have seen how the domain presupposition thesis rules out the unavailable readings noted in Section 5. The question now is, are there any intensional readings available for strong or, more generally, domain-presupposing quantifiers? It appears that *every* and *all* allow for intensional readings, at least with verbs of absence:[17]

(63) a. John needs every book about Picasso.
b. John wants every painting by Matisse.

(63a) allows for a reading in which John's needs pertain to the totality of (actual) books about Picasso, and (63b) has a reading in which John's desire aims at exhausting the paintings by Matisse (possibly without John desiring any painting in particular – he may not even know about any specific painting).

The intensional quantifier account will construe the intensional reading of (63a) as follows: every minimal situation in which John's needs are satisfied includes all the actual books about Picasso. For (63b) something like this would hold: for every minimal situation *s* satisfying John's desire, John has all the actual paintings by Matisse in *s*.

How do other strong quantifiers, in particular *most*, behave? For *most*, identifying an intensional reading is difficult:

(64) John needs most classrooms in the building today.

(64) disallows a reading according to which in every satisfaction situation John has a possibly different majority of classrooms in the building. However, (64) is rather bad even on an extensional reading: *most* seems to dislike nongeneric readings in general (and disfavor object positions in particular). Thus, the data with *most* are hard to judge. But it may still be

[17] An example with *look for* and a universal quantifier displaying an intensional reading is due to David Dowty (cited in Zimmermann 1992):

(i) John was looking for every typo in the manuscript.

useful to note that the domain presupposition would prevent an intensional reading under certain conditions. If (64) on an intensional reading is true, then any given minimal satisfaction situation *s* will include a majority *X* of the classrooms and John will have all those classrooms in his disposition in *s* (because of minimality). Now, if *X* is not identical to the actual extension of *classrooms in the building*, then the domain presupposition will not be satisfied. But if *X* is identical to it (for any satisfaction situation), then (64) will describe the same situation as *John needs every classroom in the building*.

These observations about potential intensional readings of *most* may suggest that all proportional quantifiers ranging over a previously established domain disallow an intensional reading in case the satisfaction situations don't include all the relevant entities in the domain of the context. However, this is not the case. There is one quantificational construction involving a previously established domain that always allows for an intensional reading, namely partitives. In the following examples, we get intensional readings both with weak quantifiers as in (65a) and with strong (proportional) quantifiers as in (65b), though, again, *most*, as in (65c), is more resistant toward such a reading:

(65) a. John needs two / exactly two / more than three of the solutions (in order to be able to pass the exam).
b. John needs more than half / two thirds of the solutions (in order to pass the exam).
c.?? John needs most of the solutions.

The contrast between (65a) and (65b) on the one hand and (65c) on the other hand indicates that *most* resists an intensional reading for reasons independent of its being a strong quantifier.

Why do partitives always, even with strong quantifiers, allow for an intensional reading? An explanation can be obtained from the fact that the restriction of the quantifier is expressed by a separate NP (*the solutions* in the examples in (65)). This NP can be interpreted extensionally; that is, it can be evaluated relative to the domain of the context and need not be evaluated relative to the same situation in which the quantifier is evaluated. More specifically, *the solutions* in (65b) can be interpreted relative to the domain of the context, but *half of the solutions* must be interpreted relative to a satisfaction situation, that is, it must take as its argument a set obtained from entities in the satisfaction situation. For (65b) with *more than half*, we then get (66) as its meaning, where the extension of *the solutions* is taken to be the set of solutions in the context domain $D(c)$:

(66) For any minimal situation s, P^s(John), $\{x \mid R^s(\text{John})\} \in$ [*more than half*]^s [*the solutions*]$^{D(c)}$)

Thus, the quantifier restriction is not given by a noun which would be subject to the domain presupposition, but rather by the definite NP, which receives a purely extensional interpretation. The domain presupposition condition as formulated in (58) only affects quantifiers applied to noun denotations, not quantifiers applied to the denotation of an NP.

(66) straightforwardly establishes a proper intensional reading. Any satisfaction situation s may contain only a subset (though a majority) of the solutions in $D(c)$ (since the domain presupposition need not be satisfied). Moreover, every satisfaction situation may contain a different majority of the solutions in $D(c)$.[18]

Let me add one further remark about intensional readings with definite NPs. In Section 2.3. definite NPs seemed to act like referential terms, standing for conceived objects. But definite NPs may also be considered generalized quantifiers, ranging over different domains in different situations, and when so considered they count as strong (cf. Barwise and Cooper 1979; Keenan 1987). The question then is, how do they behave with respect to intensional readings and the domain presuppositon? It appears that the domain presupposition takes it effect here as well ruling out an intensional reading of (67a) (in a situation in which John tries to get married):

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[18] The crucial parameter, therefore, is whether a quantifier obtains its restriction from a definite NP or from a noun. In this connection, it is useful to look at *some*, which occurs in both partitive and nonpartitive NPs, but does not obey the restrictions *most* seems to be subject to:

(i) a. John needs some of the solutions.
b. John needs some solutions.

Before commenting on (i), let us note that there are two kinds of *some* with plurals and mass nouns, namely unstressed and stressed:

(ii) a. John needs some (/sm/) assistance / some (/sm/) assistants.
b. #John needs SOME assistance / SOME assistants.
c. The popcorn is missing some salt.

Stressed *some* is domain-presupposing, unstressed *some* is not.

Now, getting back to (i), we note that (i.a) always allows for an intensional reading, whereas (i.b) does so only if *some* is unstressed. If *some* is stressed, hence domain-presupposing, and if it does not occur in a partitive, then it disallows an intensional reading. This then supports the explanations given in this section for the availability of intensional readings with quantifiers involving a preestablished domain.

Note that with singular count nouns *some* seems to behave rather differently. For many speakers, it carries a special, usually pejorative effect, as in (iii):

(iii) Some man saw Mary.

(67) a.#John is looking for his wife.
b. John is looking for a wife.

In (67a), given standard circumstances, the uniqueness and existence condition of *his wife* as a generalized quantifier would be satisfied in every satisfaction situation of John's search. Still, instead of the definite *his wife*, the indefinite NP *a wife* in (67b) has to be used. The reason can only be the domain presupposition. The domain presupposition of *his wife* cannot be satisfied in a satisfaction situation if John does not actually have a wife.

6.4. *Domain Presuppositions within a General Dynamic Account of Presuppositions*

Even though the notion of domain presupposition as used so far is sufficient for explaining the absent intensional readings, at closer reflection it turns out to be rather inadequate. Given the way the domain presupposition thesis has been formulated above, *every assistant* in (68a) should not be able to range over the ten possible assistants John has in a given counterfactual world specified by the antecedent, that is, over assistants that are not in the domain of the previous context. In its present formulation, the domain presupposition thesis is adequate only for a case like (68b), in which *every assistant* ranges over all the actual assistants:

(68) a. If John had ten assistants, he wouldn't pay every assistant very well.
b. If John had every assistant, he would be able to finish the job.

The reason why *every assistant* in (68a) may have such a counterfactual domain is that the antecedent of the conditional appropriately introduces the relevant entities into the counterfactual situation relative to which the consequent is evaluated.

This corresponds to the general behavior of presuppositions in conditionals. Thus only (69b), but not (69a), presupposes that John smoked before:

(69) a. If John smoked before, he stopped smoking.
b. If John stopped smoking, Mary would be happy.

The projection behavior of presuppositions is most commonly explained in terms of a dynamic view of sentence meaning as a context change potential, a function from context sets to context sets (cf. Stalnaker 1973; Karttunen 1973). A sentence applied to a context set some of whose elements don't support the presuppositions will lead to the empty context,

whereas a sentence applied to a context set all of whose elements support its presuppositions will lead to a possibly smaller context set by eliminating all the possibilities which do not support the assertive part of the sentence. On such a view, the antecedent of a conditional changes the context to which it applies in order to see whether the new context supports the consequent. Crucially, in order for the antecedent to change the initial context, its presuppositions have to be true in the initial context; but in order for the consequent to be true in the new context it is sufficient for its presuppositions to be true in the new context.

The analogue should hold for domain presuppositions. In order for the domain presupposition of a strong quantifier in the antecedent to be satisfied, the quantifier domain should be the same as in the previous context. But in order for the domain presupposition of a quantifier in the consequent to be satisfied, it is sufficient to see whether its domain coincides with the one it would have in the new context.

This is the rough picture. However, there are two major issues to be addressed. The first one concerns the notion of a domain of a context. If a context is construed as a set of possible worlds, then every such world may be associated with a possibly different set $D(w)$ of entities (the entities existing in that world) – roughly, the set of entities the speaker considers possibly actual. Only the intersection of the domains of all situations in a context set constitutes the set of entities the speaker considers in fact actual. This set of shared entities in all worlds in a context set would constitute the 'domain of the context set'. Thus, we would have $D(W) = \{x \mid \forall\ w \in W\ x \in D(w)\}$ for a context set W. The notion of domain presupposition is then naturally construed as follows: if a quantifier presupposes its domain, then its restriction must be nonempty and identical for every world in the context set in which the sentence containing the quantifier must be acceptable.

(70) A sentence containing a domain-presupposing quantifier D N′ is acceptable in a context set W only if $[\text{N}']^w = \emptyset$ and $[\text{N}']^w = [\text{N}']^{w'}$ for any $w, w' \in W$.

The meaning of a (simple intransitive) sentence with a domain-presupposing quantifier (and no other presuppositions) can then be formulated as the following context change potential:

(71) For a sentence S of the form D N′ V, where D is domain-presupposing and W a context set,

$$W + S \begin{cases} = \{w \mid w \in W \ \&\ S \text{ is true in } w\}, \text{ if } [\text{N}']^w \neq \emptyset \text{ and } [\text{N}']^w = [\text{N}']^{w'} \text{ for any } w, w' \in W \\ = \emptyset \text{ otherwise.} \end{cases}$$

In the case of a domain-presupposing quantifier occurring in the consequent of a conditional, such as *every assistant* in (68a), the domain presupposition would have to be satisfied with respect to the set of possible worlds appropriately satisfying the antecedent *if John had ten assistants*.

There are a number of problems that arise with the notion of domain presupposition so construed. First, how can the notion of a possible domain be understood; that is, how do we now what the possible entities in the domain of a world are? Domain presuppositions of strong quantifiers make sense only if it is assumed that different worlds in a context set may have domains with different sets of possible entities. Generally, a possible world in a context set is characterized as one possibility compatible with what the agent accepts at that stage in the conversation. Analogously, a possible domain should be understood as a possibility compatible with what the agent accepts. But what are the entities compatible with a particular set of assumptions? They will not be limited to actual entities, but include possible entities as well, and there we don't know the limits.

Second, the proposal does not account appropriately yet for the satisfaction of the domain presupposition of *every assistant* in the consequent of the conditional (68a). Unlike strong quantifiers, weak quantifiers need not have the same restriction in all worlds in the context set. Thus, if *John had ten assistants* is applied to a context set *W*, then we will get a context set *W′* each of whose worlds includes ten assistants of John. But these assistants need not be the same in each world in *W′*, in which case the domain presupposition for *every assistant* in the consequent would not be satisfied. Automatic local accommodation would have to be invoked to restrict *W′* to a subset whose elements contain the same assistants, in order to explain the acceptability of (68a); but the sentence does not sound as if this is taking place.

A third problem with the account is that it seems to admit too strong implications from the context set satisfying the domain presupposition. For example, an acceptable utterance of *Every student left* does not imply that the speaker knows how many students there were. In order to prevent such implications, a more fine-grained notion of the information content of a context is required.

Fourth, the domain presupposition does not seem intuitively valid for all uses of strong quantifiers. For example, in (72) no domain presupposition seems to have to be satisfied:

(72) Every student of this school stayed home.

In (72), the quantifier *every student of this school* ranges over whatever satisfies the property *student of this school*, without the speaker having

any particular student in mind, or even knowing about any particular student. There is an alternative view, however, of cases like (72) in which a quantifier domain is wholly dependent on a property. These cases may be regarded as generic uses of the quantifier – in which case the domain presupposition, by general assumption, would not have to hold. For, as is commonly assumed, a generic sentence applies to several possible domains or possible situations, and not just one domain or one situation, and if a quantifier like *every student* specifically ranges over possible domains different from the domain of the relevant context set, then the quantifier can be exempt from the domain presupposition – in the same way as a quantifier like *every possible student*, which obviously does not carry a domain presupposition (see also the next section).

Thus, the domain presupposition condition faces a number of empirical and conceptual problems, partly arising from the particular way in which a context is formally represented (as a set of possible worlds with possibly different domains). But clearly, addressing these problems any further goes far beyond the scope of this paper.

Let me turn to the second issue concerning domain presuppositions within a dynamic view of meaning. It concerns the satisfaction of domain presuppositions with modal verbs of absence. The problem is that given the schematic analysis of *need*, the relevant domain-presupposing quantifier does not occur in the antecedent of a conditional, but rather in the consequent. Hence the domain presupposition would not have to be met with respect to the discourse context, but rather with respect to the set of minimal satisfaction situations specified by the antecedent. Hence the absent intensional readings can't be explained in the way they were. The explanation rested crucially on the domain presupposition of the quantifier having to be satisfied with respect to the previous discourse context.

However, there is evidence that it is in the nature of verbs like *need* that presuppositions do not have to be satisfied with respect to the antecedent of the conditional such verbs involve. Modal verbs such as *must* pattern exactly the same way with respect to presuppositions, including propositional presuppositions. *Must* as in (73a) also involves a conditional, with the antecedent characterizing possible worlds by some accessibility relation *R* to the actual world as in (73b).

(73) a. John must stop smoking.
b. For all worlds *w*, if $w \; R \; w_0$, then John stops smoking in *w*.

Again, *must* in (73a) requires the presupposition that John smoked before to be satisfied with respect to the previous discourse context, rather than the worlds satisfying the antecedent. This, again, does not fall out from the

dynamic account of conditionals and presupposition satisfaction. Given (73b) and the way presuppositions in conditionals are supposed to be satisfied, (73a) should allow for a reading in which the presupposition that John smokes is filtered out. Suppose we are in a world in which everyone at some point has to undergo a test of willpower and start smoking and then stop, and suppose John fails to do so. Then (73a) would still be true without its presupposition being true in the actual world.

Apparently, modal verbs differ in some crucial way from overt conditionals with respect to presupposition satisfaction. Modal verbs are holes: a simple sentence with a modal verb presupposes all the presuppositions of the proposition the modal verb applies to. Whatever the explanation for that may be, we can certainly regard modal verbs of absence as belonging to the same semantic class as modal verbs like *must*. Hence their presupposition projection behavior should fall out from a more general semantic property of such verbs.

6.5. *Special Cases of Strong Quantifiers with Intensional Verbs*

There are other cases in which strong quantifiers seem to display an intensional reading with intensional verbs. Modified by certain kinds of relative clauses, it appears that an NP can always range over merely possible entities and thus display an apparent intensional reading, as in (74a) and (74b), as opposed to (74c), where such a reading is impossible.

(74) a. John needs every book about Picasso that he can get.
b. John is looking for every doctor that can improve his condition.
c. John is looking for every doctor that has outstanding abilities.

(74a) and (74b) are acceptable even if John cannot get any book about Picasso and even if no doctor can improve his condition. Thus, the sentences seem to involve quantification over possible entities (possible books about Picasso and possible doctors).

But this does not mean that the sentences have intensional readings. The fact that the domain includes possible entities seems to be due in this case not to the intensional verb, but rather to the presence of the modal verb in the relative clause, which may define the quantifier restriction as consisting of merely possible objects. The NP modified by the relative clause then may range over such possible objects. Thus, *every book about Picasso that he can get* will range over possible books *x* about Picasso such that John gets *x*. (74a) claims that for every such book *x*, John needs *x*. Similarly, *every doctor that can improve his condition* in (74b) will range over possible

doctors that improve John's condition, and the sentence claims that for every such doctor *x*, John is looking for *x*.

Given the Acceptance Condition on Domains of Underived Contexts in (59), the availability of such possibilistic quantifier domains means that relative clause modification cannot be treated in the standard semantic way by intersecting the denotation of the relative clause with the denotation of the head noun. Rather, the head noun must be interpreted 'inside' the relative clause. This is possible given a syntactic structure in which the head noun is base-generated inside the relative clause, an assumption about relative clause constructions often made by syntacticians (the earliest being Vergnaud 1974). Thus, (74a) would have the underlying syntactic structure in (75):

(75) John needs every *e* [that he can get [$_{NP}$ *e* book]]

Book about Picasso that he can get will then have the denotation {*x* | ◇(book about Picasso(*x*) & get(John, *x*))}.

Given such denotations of the relative clauses, (74a) and (74b) do not display intensional readings, but rather extensional readings in which the quantifier ranges over possible, rather than actual objects and takes scope over the verb.

The assumption that the head noun may be interpreted within the relative clause is supported by another construction with intensional verbs, pointed out to me by Ed Keenan:

(76) The person that John needs would have to be very wise.

Here the subject NP refers to a possible person *x* such that in some satisfaction situation *s*, John has *x* in *s*. Note that in this construction, the main clause requires a modal or indicator of counterfactuality such as *would*:

(77) #The person John needs is very wise.

This means that *the person that John needs* in (76) refers to an entity that is not accepted by the speaker and hence cannot have been included in the domain of the previous context. This in turn means that *person* must be evaluated within the relative clause inside the scope of the modal operator, and hence that *the* does not carry a domain presupposition.

One other construction in which universal quantifiers appear to systematically display intensional readings involves relative clauses with *there*, as in (78):

(78) a. John is looking for every golden mountain that there is.
b. John needs every book about Picasso that there is in the library.

What is interesting is that *there*-sentences generally don't allow relative clause formation, since the variable left behind by the relative pronoun is classified as definite (Heim 1987). But there is one construction in which this is possible, and that is amount relatives (Carlson 1977b). Amount relatives differ from ordinary relative clauses in a number of ways; for example, they only allow universal or plural definite determiners, they allow for antecedent-contained deletion, they don't allow for *wh*-relative pronouns (*what, which*), and they allow for *there*-sentences as relative clauses. These peculiarities suggest that amount relatives involve a rather different semantics than ordinary relative clauses and, as concerns the present issue, that their distinctive semantics may be the basis for right analysis of (78a) and (78b).

Unfortunately, though, it is not clear at all what the proper semantics of amount relatives is. Heim (1987), following Carlson (1977b), suggests that NPs modified by amount relative clauses don't range over ordinary objects, but rather stand for maximal degrees or numbers measuring the collection of entities satisfying the content of the relative clause. On this account, (78b) would be equivalent to 'John needs as many books about Picasso as there are in the library'. But this is not what (78b) means: if (78b) is true, John would not be satisfied with just any set of possible books about Picasso that has the same cardinality as the books about Picasso in the library; rather, he has to have all the actual books about Picasso in the library, whatever their cardinality. Thus, the only suggestion about the semantics of amount relatives available so far seems inadequate. In any case, however, it is clear that something special is going on semantically with the sentences in (78a, b) and that they involve amount relatives, rather than ordinary relative clauses.

7. Further Predictions of the Intensional Quantifier Account

Together with appropriate lexical analyses of intensional verbs, the intensional quantifier account explains a particular reading of disjunction. It has been noted (Keenan and Faltz 1985) that intensional verbs allow for an additional reading of disjoint complements as in (79a) which is not available for extensional verbs:

(79) a. John needs a cook or a maid.
b. John needs a cook or John needs a maid.

On the crucial reading of (79a), *or* does not distribute over the predicate, that is, (79a) is not equivalent to (79b). By contrast, in extensional cases such as (80a), such a distribution is always possible, as in (80b):

(80) a. John met a cook or a maid.
b. John met a cook or John met a maid.

On the relevant reading of (79a), not equivalent to (79b), John's needs would be satisfied both if he had a cook and if he had a maid. On the other reading of (79a), equivalent to (79b), John's needs would be satisfied only if he had a cook or only if he had a maid.

Corresponding readings of *or* are available with epistemic verbs as in (81a) and resultative intensional verbs as in (81b):

(81) a. John recognized a potential partner or a potential assistant.
b. John found a maid or a cook.

On the relevant reading, (81a) is true if John recognized someone as a potential partner or a potential assistant, without necessarily either recognizing him as a potential partner or recognizing him as a potential assistant. (81b), on the relevant reading, means that John found someone whom he might make a maid and make a cook without necessarily having decided whether to make her a maid or a cook.

The special reading of disjunction with intensional verbs receives a natural treatment within the intensional quantifier account. *Or* can apply to intensional quantifiers, yielding a disjunctive intensional quantifier. Then, for example, the denotation of *a cook or a maid* in (79a) will be a function from situations *s* to the union of the set of sets of entities in *s* that include a maid in *s* and the set of sets of entities in s that include a cook in *s*:[19]

(82) $\lambda s[[a\ maid]^s \cup [a\ cook]^s]$

Using such disjunctive intensional quantifiers, we get the relevant intensional readings straightforwardly. (79a) then means: for any minimal situation *s* satisfying John's needs, there is an *x* in *s* such that *x* is a cook or a maid in *s*.

Clearly, that a second reading of *or* is available with verbs of absence and epistemic or resultative verbs is due to the fact that these verbs involve situations for the evaluation of the quantifier different from the worlds with respect to which the entire sentence is evaluated. This also corresponds to the second reading of *or* found in clausal complements of intensional verbs, as in (83) (cf. Partee and Rooth 1983):

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[19] The other, wide-scope reading is best obtained by lifting the intensional quantifier denotation to a higher type, namely a set of properties of intensional quantifiers. We then get the following denotation for *a cook or a maid*:

(i) $\{P \mid P(\lambda s[[a\ maid](s)])\} \cup \{P \mid P(\lambda s[[a\ cook](s)])\}$

Applying the predicate to such a denotation will automatically yield the distributive reading.

(83) John believes that he met a maid or a cook.

Another advantage of the intensional quantifier account is that it explains why *need* is upward-entailing with respect to its object argument, that is why an inference such as from (84a) to (84b) is valid:

(84) a. John needs two French secretaries.
b. John needs a secretary.

If (84a) is true, then in any minimal situation satisfying John's needs, John will have two French secretaries. In any such situation, he will also have a secretary, and hence (84b) holds. The reason why such an inference is possible is that the object NP gives only a partial characterization of the satisfaction situation.[20]

8. CONCLUSIONS

This paper had a variety of goals concerning the phenomenon of intensional readings of NP-taking verbs. One of them was to expand the range of criteria for intensionality and, along with that, to establish a lexical classification of intensional verbs. Second, I have defended two different semantic analyses for different classes of intensional verbs. Third, I have offered a new version of the intensional quantifier analysis originally proposed by Montague and shown how, in conjunction with an independently motivated condition on strong quantifiers, it can appropriately account for the available intensional readings with different intensional verbs.

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[20] Keenan and Faltz (1985) actually consider a verb of absence such as *look for* ambiguous between a use that is upward-entailing in its object position and one that is not. I do not see a good reason for postulating such ambiguity and think that an inference such as in (84) is valid in general.

Zalta (1988) considers the related inference from (i.a) to (i.b) a crucial argument for his and against Montague's account of intensional verbs (cf. Section 2.2.4):

(i) a. John is looking for a horse.
b. John is looking for something.

On Montague's account the inference in (i) can be accounted for only by an additional meaning postulate on *look for* (provided one disregards Montague's meaning postulate by which *look for* is identified with *try to find*, which should allow for the inference). By contrast, on Zalta's account, the inference is valid because in (i.a), John stands in the relation 'look for' to a particular abstract, nonexistent object (the one encoding the property of being a horse), and hence there is indeed an object ('something') that John stands in that relation to. Note, though, that Zalta's account does not really apply to (84).

The inference in (i) is explained also on the present intensional quantifier account. *Something* is a proform that need not stand for an object but may stand for a function (e.g. an intensional quantifier). More precisely, it may act as a higher-order quantifier, ranging over functions.

APPENDIX: CLASSES OF INTENSIONAL VERBS

1. *Traditional Classes of Intensional Verbs*

Two major classes of predicates have been discussed as intensional in the literature: *predicates of comparison* and *predicates of absence*.

Predicates of comparison include *resemble*, *compare*, and *differ*, the comparative construction, and certain prepositions such as *like*:

(1) a. John resembles a ghost.
b. John compared Bill to a unicorn.
c. Bill is bigger / has a different color than a unicorn.
d. Charlie differs from a unicorn in that he has two tails.
e. John acts like a ghost.

Clearly, predicates of comparison in the intensional reading display failure of existential quantification and substitutivity. Moreover, they satisfy the other three intensionality criteria, as demonstrated by the following data:

Lack of definite anaphora support:
(2) a.# Bill resembles a unicorn, and Max resembles it too.
b. Bill resembles a unicorn, and Max resembles one too.

Restriction to impersonal proforms:
(3) a. What does John act like? – John acts like a king.
b.# Who does John act like? – John acts like a king.

Identity conditions:
(4) Charlie resembles the same thing as Max, namely a Greek god.

Predicates of absence divide into two subclasses: *modal verbs of absence* and *psychological verbs of absence*.

Modal verbs of absence include *need, lack, is due to, owe*, and *promise*.

(5) a. John owes Mary a pen.
b. The car lacks exactly one wheel.
c. A wheel is lacking.
d. We need a housekeeper.
e. A housekeeper is needed.
f. Half of the furniture is due to Bill.
g. John promised Mary a castle.

The common characteristic of these verbs, giving rise to the label, is that they all involve a modal operator – or better, universal quantification over counterfactual situations – in their lexical meaning. Thus, (5a) can roughly be paraphrased as in (6a), (5b) as in (6b), and (5d) as in (6c):

(6) a. It is (deontically) necessary for John to give Mary a pen.
b. It is normal for exactly one additional wheel to be part of the car, and the car does not have exactly one additional wheel.
c. It is necessary in order for us to be satisfied (e.g. have a good household) that we have a housekeeper.

In this paper, I have made use of the following schematic lexical analysis of *need*:

(7) need(x, Q) iff for every minimal situation s such that $P(x, s)$, $Q^s(\{y \mid R(x, y)\})$

However, not all modal verbs of absence can be analyzed along the same schema. *Lack*, as in (5b) for instance, involves situations in somewhat different ways. (5b) does not mean that in every minimal situation in which the car is complete, the car has exactly one wheel (rather, in such a situation it will have exactly four wheels). Instead, (5a) means that for any minimal situation s which supplements the car's actual situation s_0 so that the car is complete in the more complex situation consisting of s and s_0, the car has exactly one wheel in s. Formally this is given in (8), where '$\text{Complete}_{\text{CAR}}$' is a predicate holding of objects if they are complete relative to the object type of cars, and 'sum' is the operation of sum formation applying here to situations:

(8) For every minimal situation s such that $\text{complete}_{\text{CAR}}$(the car, sum($\{s, s_0\}$):
[*exactly one wheel*]^s(λx[part-of^s(x, the car)])

Despite such differences, modal verbs of absence have one thing in common: they all involve universal quantification over possible situations in one way or another.

Modal verbs of absence obviously disallow existential quantification and substitutivity, and they also satisfy the new intensionality criteria:

Lack of definite anaphora support:

(9) a.#John needs a pen. It is blue.
(cf.: John needs a pen. It must be blue.)
b.#We need a housekeeper. He is French.
(cf.: We need a housekeeper. He must be French.)
c. John needs a pen. Mary needs # it / one too.

Restriction to impersonal proforms:

(10) a. John needs something / ? someone, a housekeeper.
b. What/# Whom does John need? – A housekeeper.

Identity conditions:

(11) a. John needs the same thing as Sue, namely a housekeeper.
b. John needs what Mary needs, a housekeeper.

As indicated in parentheses in (9a) and (9b), modal verbs of absence do support anaphora in certain constructions, namely those involving 'modal subordination' (cf. Roberts 1989). This has to do with the fact that modal subordination contexts involve a modal operator (in (9a, b) *must*) which invokes the modal context introduced in the preceding clause.

Psychological verbs of absence include *seek, look for, want*, and *long for*:

(12) a. John was looking for a blue pen.
b. John was looking for a new assistant.
c. John wanted / longed for a castle near the ocean.

(12a) and (12b) illustrate two different meanings of *look for*. In (12a), *look for* has an epistemic meaning involving the propositional attitude of recognition, as in the paraphrase in (13a), whereas in (12b), it has a resultative meaning implying some new state of affairs resulting from John's activity, as in the paraphrase in (13b):

(13) a. John tried to find (i.e. come across) an *x* while recognizing that *x* is a pen.
b. John tried to find (i.e. come across) an *x* to make *x* his new assistant.

As we saw in Section 4.2., these two meanings of *look for* correspond to two intensional readings of *find*.

Unlike modal verbs of absence, psychological verbs of absence exhibit hyperintensionality:

(14) a. John needs an eye doctor.
$\Rightarrow$ John needs an ophthalmologist.
b. John wants an eye doctor.
$\not\Rightarrow$ John wants an ophthalmologist.

This indicates that psychological verbs of absence should ultimately not be analyzed in terms of quantification over satisfaction situations, but rather in terms of a more fine-grained notion of propositions appropriately construed.

There may be still other kinds of verbs of absence, for instance event-related verbs such as *prevent*:

(15) John prevented a disaster.

Prevent does not involve satisfaction situations, but rather possible situations that would have occurred had the described act of prevention not taken place. The intensional complement then has to be evaluated with respect to such situations.

So far we have seen that in general, the verbs that have traditionally been cited as intensional do satisfy the new intensionality criteria. However, there are also many verbs that often have been considered purely extensional, but which turn out to have intensional uses. The reason they appeared to be extensional is that they all involve some sort of existential import and thus do not obviously satisfy the traditional intensionality test of lack of existential quantification. In the next section, we will see good reasons to consider such verbs intensional as well.

2. *New Categories of Intensional Verbs*

The new criteria of intensionality establish two new categories of intensional verbs: epistemic verbs and resultative verbs.

2.1. *Epistemic Verbs*

Epistemic verbs will involve a propositional attitude, generally a state of acceptance, which in some way relates to whatever the object NP denotes.

One kind of epistemic verb that has already been recognized as intensional are perception verbs like *see* (or *feel* or *hear*), as in (16):

(16) In front of John there was a tree; but John saw a man.

But there are other epistemic (or, perhaps better, cognitive) verbs that display an intensional reading. Among those are *distinguish, recognize* and *discriminate*. The intensionality of *recognize* is seen in (17):

(17) a. When John talked to his wife yesterday, he recognized a genius. # Bill recognized her too.
b. John recognized what Bill recognized, namely a person with extraordinary abilities.

Clearly, in (17a) John does not stand in the relation of recognition to a person; he will have recognized his wife long before. Rather, what John recognizes according to (17a) is a certain quality in his wife.

The verb *count* as well appears to have an intensional use:

(18) John counted 28 ships.

On its extensional reading, (18) means 'There is a group *x* of 28 ships such that John counted *x*'. But there is another reading, which is an intensional one. On this second reading, (18) can be paraphrased as 'When counting ships, John arrived at the number 28' (though perhaps John miscounted the ships, which actually might be 26 or 30 in number – by either skipping some of them or counting some of them twice, or by mishandling numbers). There may even be a third reading of (18), which, again, is intensional. On this reading, John saw 28 ships and counted what he saw as 28 ships, though there were actually 29 ships, two of which John did not distinguish.

Why is the second reading intensional? First of all, this reading displays failure of existential quantification, since it does not imply the first reading. Second, this reading displays the other diagnostics for intensionality. Thus it can be shown that intensional *count* requires appropriate determiners, as in (20), but not in (19):

(19) John counted the 28 ships / every ship / most ships. (namely 28 of them).

(20) a. John counted at most ten ships.
b. John counted at least ten ships / exactly ten ships / more ships than boats.

The intensionality of the second reading is also supported by the fact that anaphora support is impossible in (21) on the relevant reading:

(21) #John counted 10 ships and Bill counted them too (though there were actually 12 ships)

Moreover, the impersonal proform must be used even when the NP-complement describes people:

(22) What / # Whom did John count? – 10 men and 15 women.

Finally, *count* displays different identity conditions for the denotation of the complement with the second reading than it does with the first. Thus, (23a) below, on the relevant reading, is fine even if the people John counted were different from those Mary counted, whereas (23b) implies that John arrived at a different number than Mary or that the objects of his counting were different than for Mary.

(23) a. John counted what Mary counted, namely 10 men and 15 women.
b. John did not count what Mary counted.

However, there is some reason to question whether *count* has an intensional reading in the same way as *recognize*. The complement of *count* in the intensional reading does not seem to act as a quantifier in the usual way. For example, in (20a) *at most ten* does not specify the amount of things in the (epistemic) situation resulting from John's counting – perhaps John is not even in the possession of the number ten in which case we can still describe John's arriving at the number eight that way. By contrast, *at least ten* in (20b) does seems to characterize the number John arrived at when doing the counting. This function of the quantifier seems to be similar to the one it has in measure constructions such as (24):

(24) The box weighs at least two kilos.

In (24), *at least two* does not specify that there are at least two kilos *x* such that the box weighs *x*. Rather it means that the number representing the box's weight in kilos is at least two.

There may then be a genuinely different use of a quantifier besides its intensional and extensional reading: in measure constructions, a quantifier simply characterize a number, rather than counting entities in actual or possible situations. In measure contexts the NP, has to be weak. However, there seem to be more constraints: weak quantifiers that can't characterize a number, for example *no kilo except one*, are unacceptable.

2.2. *Resultative Verbs*

The second new class of intensional verbs consists in what I call 'resultative verbs', that is, verbs which imply that, as a result of the event described by the verb, some entity acquires the property conveyed by the complement NP. Examples of resultative verbs are *appoint*, *hire*, *elect*, *choose*, and *find* (on one reading). The examples in (25) have both intensional and extensional readings:

(25) a. John appointed a professor.
b. John is hiring an assistant.
c. The Americans elected a president.
d. John chose a supervisor.

On the intensional reading, (25a) excludes that John appointed somebody who was already professor in perhaps another function. (Rather, the person appointed becomes professor as a result of John's hiring.)

The familiar criteria support the intensionality of the relevant reading of resultative verbs. First, there are difficulties with existential quantifica-

tion. Inferring (26a) from (25b) does not seem valid intuitively; instead, something like (26b) follows:

(26) a. There is an assistant *x* such that John is hiring *x*.
b. There is an *x* such that John is hiring *x* as an assistant.

The reason why (26a) seems invalid is that the entities the existential quantifier ranges over are already assistants; but the meaning of the verb implies that they actually may become assistants only on the basis of John's hiring. We see a similar effect with strong determiners, as in (27a):

(27) a. John is hiring every assistant / most assistants.
b. John is hiring an assistant / at least three / exactly three assistants.

The examples in (27a) seem to imply that the people John is hiring are already assistants, whereas the examples in (27b) lack such an implication.

Also, certain proforms and the identity conditions show the intensionality of these verbs:

(28) a.? John hired two things, a secretary and an assistant.
b. What did John hire? – An assistant.
c. John hired what Mary hired, a new assistant.

In addition to the three intensionality criteria, there is another test which indicates the intensional reading of resultative verbs, namely a certain type of inference which is impossible with resultative verbs but generally possible with extensional verbs:

(29) a. John hired an assistant.
The assistant John hired is Mary's babysitter.
$\not\Rightarrow$ John hired a babysitter.

b. John met a student.
The student John met is Mary's babysitter.
$\Rightarrow$ John met a babysitter.

(29a) is intuitively invalid on one reading of *hire* (which is intuitively well-discriminated from the other reading).

The verb *find*, which is often cited as a typical instance of an extensional verb, turns out to have two intensional uses: an epistemic use and a resultative use. Thus, three meanings of *find* have to be distinguished.

The first, extensional meaning is that of 'accidental' *find*. With this meaning, *find* is roughly equivalent to 'come across', as in *The cat found*

the pencil (where the cat need not have recognized the thing it found as a pencil nor have in any way changed the object it found).

The second meaning of *find* is an epistemic one. Here it is crucial that the subject referent recognizes in the object that he or she came across an instantiation of the property conveyed by the NP-complement:

(30) In the class he is teaching, John found a student who is able to solve the problem.

In the intensional reading of *find* in (30), John does not stand in the relation 'find' to the object that is the student in question. (John may never have come across the student – the student may always have come to John.) Rather, *find* on this reading only involes the property 'student who can solve the problem'.

The third meaning of *find* is resultative. Here an object acquires the property conveyed by the NP-complement on the basis of the agent's coming across the object:

(31) a. John found a secretary.
b. John found a wife.

The intensionality of epistemic and resultative *find* is again supported by applying the relevant criteria. First, we can observe the failure of inferences of the sort in (32):

(32) a. John found a secretary.
The secretary John found = Sue's babysitter (= Mary).
$\not\Rightarrow$ John found a babysitter.

b. John found a wife.
The wife John found = Mary.
$\not\Rightarrow$ John found Mary.

c. John found a great talent.
The talent John found = the only descendant of Max.
$\not\Rightarrow$ John found the only descendant of Max.

Moreover, resultative *find* displays difficulties with existential quantification, though this criterion is hard to apply in this case. Consider the inference from (31b) to (33):

(33) There is a wife *x* such that John found *x*.

As a sentence of English, (33) seems strange, because it suggests that the wife John found was his wife already before John found her, not as a result of his finding her.

Furthermore, and quite clearly, the use of proforms and the implied identity conditions are those of intensional verbs:

(34) a. What / # Whom John found in New York was a new wife.
b. At least John found one thing / # one person today, a new assistant.

(35) a. Today, John found the same thing / # the same person as Mary, namely a student who is able to solve the problem.
b. Today, John found what / # whomever Mary found, a new assistant.

Thus, two major new classes of verbs have to be added to the traditionally recognized set of intensional verbs: epistemic and resultative verbs. For the sake of completeness, one other class of verbs should be mentioned that may be considered intensional, namely verbs of creation. In the next section, some evidence is given for intensional uses of such verbs.

2.3. *Verbs of Creation*

Let us first consider the class of physical creation verbs such as *paint*, *write*, and *draw*, and focus on *paint*. Three readings of *paint* can be distinguished. First, *paint* has an extensional reading, as in (36a). Second, it has two intensional readings. One is available in (36b), the other one is the second reading of (36c) (besides the extensional one where John produced a painting of a tree without there necessarily being an actual tree):

(36) a. John painted an actual tree.
b. John painted a picture.
c. John painted a tree.

Why are the last two readings of *paint* intensional? The usual diagnostics apply. For example, the third reading does not allow for anaphora; (37) has only an extensional reading:

(37) John painted a king, and Mary painted him.

Moreover, the intensionality is shown by the choice of proforms:

(38) a. What did John paint? – A king.
b. Whom did John paint? – A king.

(38a) allows only for an intensional reading, whereas (38b) allows only for an extensional one. Finally, we have the evidence from identity conditions. This diagnostic shows that both the second and the third reading are intensional:

(39) a. John painted the same thing as Mary, namely a nice picture. (ambiguous)
b. John painted the same thing as Mary, namely a tree. (ambiguous)
c. John painted the same thing as Mary, namely a king. (unambiguous)

(39a) is ambiguous between the first and the second reading of *paint*, and is acceptable even when it is clear that the picture John painted (in the second and third sense) is different from the one that Mary painted. (39b) is ambiguous between the extensional and the third, intensional reading. But this ambiguity disappears in (39c), because of the use of the impersonal proform, allowing only for the third reading.

Verbs of mental creation such as *imagine*, *plan*, or *conceive* form another class. They exhibit exactly one intensional reading. (40a) allows for this intensional reading, whereas (40b) has only the extensional one:

(40) a. John imagined a golden mountain.
b. John imagined Bill (differently).

The intensionality of the relevant reading in (40a) is supported, for instance, by the choice of proforms and the identity conditions. Thus, (41) unambiguously displays an intensional reading:

(41) John imagined the same thing as Bill, namely a beautiful woman.

To summarize, verbs of creation of both sorts display intensional readings by the criteria of intensionality that have been established. Note that the intensionality of such verbs is not a conceptual necessity. After all, verbs of creation imply the coming into existence of an actual, though perhaps fictional object, and as was mentioned earlier, such objects are treated just like existent objects in natural language.

2.4. *Verbs of Ownership*

Zimmermann (1992) (in attribution to Mats Rooth) notes that, given existential quantification as a criterion, even verbs like *own* and *inherit* may display a 'nonspecific' reading:

(42) a. John owns one third of the gold mines.
b. Mary inherited one half of the house.

(42a) and (42b) have readings in which quantifier exportation fails (there may be no particular third of the gold mines that John owns in (42a)). But, as Zimmermann (1992) notes, (42a) and (42b) allow for substitutivity. This alone, however, should not be reason not to classify these verbs

as intensional, since they exhibit other criteria for intensionality – and since substitutivity falls out from the way these verbs may be analyzed semantically. (43a–d) show lack of anaphora support and identity conditions:

(43) a.# John owns one third of the gold mines. Bill owns them too.
b. John owns one third of the gold mines. Bill owns the same thing.
c. John owns one third of the slaves. Bill owns the same thing.
d. John owns what Bill owns, namely one third of the gold mines.

Verbs of ownership can in fact naturally be analyzed in terms of intensional quantifiers. On the intensional reading, such verbs plausibly involve universal quantification over certain possible situations, namely those situations which are legal and in which the object in question has been divided into concrete possessions. Thus, (42a) would mean: for every possible legal situation *s* in which there are only concrete possessions, for a third *x* of the gold mines, John owns *x*.

This completes the list of verbs that allow for intensional readings. I would assume that this list is indeed more or less complete; that is, there should not be any type of verb that exhibits the intensionality diagnostics but involves intensional quantifiers in a significantly different way in its lexical meaning than the types of verbs discussed in this Appendix. But nothing theoretically significant hinges on it being otherwise.

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