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Domain-related Dynamic Semantics and the Weak-Strong Distinction

Dynamic semantics is motivated mainly by phenomena of anaphora and presuppositions. This paper explores a different sort of dynamic semantic phenomenon, which involves not propositions or discourse referents (or assignments of objects to variables), but rather domains of quantifiers. I will argue that strong or nonintersective quantifiers (*every, most, neither, the*) are subject to a particular dynamic semantic condition, namely their restriction has to be identical with the one they would have relative to the previous context. That is, strong quantifiers 'presuppose their domain.' The domain presupposition of strong quantifiers manifests itself first in contexts in which the quantifiers have a restriction that contains a variable obligatorily bound by some other quantifier in the sentence, such as event-dependent modifiers, *there*-sentences, and the *have*-constructions and second in constructions that involve the introduction of a new context with a new domain, such as conditionals, intensional verbs taking quantifiers as arguments, attitude reports, and modal verbs. These constructions exhibit rather striking differences between the behavior of weak and strong quantifiers. The general result of the paper will be that domain-related semantic phenomena support a dynamic perspective on sentence meaning. At the same time, they impose particular conditions on the notion of context which seem to be met only by a semantic, not a syntactic approach to the dynamics of meaning.

1. The weak-strong distinction

The distinction between weak and strong quantifiers is most familiar from *there*-sentences. *There*-sentences reject the quantifiers in (1) and accept the quantifiers in (2):

(1) a. # *There is every man / the man / John in the garden.*

b. # *There are most men men in the garden.*

c. # *There are many / few students in the garden.* ('many / few relative to the set of students')

d. # *There are some students in the garden.* ('some of the students')

e. # *There is everybody except John in the garden.*

f. # *There are either all or not all students in the garden.*

g. # *There are if all, then some students in the garden.*

(2) a. *There is a man / three men / a few men / many men in the garden.*

b. *There are few men / less than two / more than three / exactly two men / more men than women in the garden.*

c. *There are no men in the garden.*

d. *There are some (sm) students in the garden. (some of the students).*

e. *There is noone except John / only John in the garden.*

f. *There are zero or else more than zero students in the garden.*

g. *There are if some, then all students in the garden.*

There are two different sorts of proposals concerning the acceptability of quantifiers in *there*-sentences: logical ones and discourse-related ones. However, there are problems with both sorts of proposals in the form in which they have been made.

Barwise and Cooper (1979) logical characterization of quantifiers in *there*-sentences in terms of strength of a quantifiers faces problems with the contrast between (1f) and (2f) which both come out as strong. Keenan (1987, 1996) therefore gives a different account according to which simple quantifiers acceptable in there-sentences as those that are intersective:

(27) A quantifier is *intersective* iff $Q(A)(B) = Q(A')(B')$ if $A \cap B = A' \cap B'$.

Moreover, boolean combinations of quantifiers are acceptable in *there*-sentences just in case they are composed only of simple intersective quantifiers. The problem with this account is that it has to make a rather unmotivated recourse to the syntactic structure in order to account for (2f), and it does not capture the contrast between (1g) and (2g).

The often made discourse-related proposal (cf. de Jong 1987, Enc 1991, ter Meulen/Reuland 1987, Introduction) that quantifiers occurring in *there*-sentences have to introduce new entities or enlarge the domain of discourse faces problems with examples with downward entailing quantifiers, as in (2b, c). The alternative discourse-related account of Zucchi (1995), which requires quantifiers acceptable in *there*-sentences to not carry a presupposition of a nonempty domain, also faces problems, namely with quantifiers with exception phrases or *only*, as in (2e), which obviously do presuppose a nonempty domain.

The account I will propose with adopt the characterization of simple weak quantifiers (i.e. simple quantifiers acceptable in *there*-sentences as intersective), but correlates a quantifier being intersective with a discourse-related property, namely the property of having a restriction that coincides with the one the quantifier would have relative to the previous discourse context. Extending the standard notion of presuppositions from a proposition having to obtain in the previous context to the domain of a quantifier having to be identified in the previous context, let me call this correlation the Domain Presupposition Thesis, informally given in (1):

(1) <u>Domain Presupposition Thesis (DPT)</u>

Simple strong quantifiers presuppose their domain.

Certain complex quantifiers inherit the domain presupposition of simple quantifiers they are composed of such as the quantifiers *if all, then some* in (1g), but not by the quantifier *if some, then all* in (2g), in conformity with standard rule of presupposition projection.

Before discussing *there*-sentences and deriving the prohibition against domain-presupposing quantifiers from their inherent semantics, let me first present a related phenomenon which gives an equally strong motivation for the DPT, namely quantified complements ranging over a domain whose identification depends on the event described by the verb.

2. Event-dependent modifiers

One type of event-dependent complements are NPs modified by *new* in an event-related reading. *New*, as in (3) has a reading on which it does not mean 'recently having come into existence', but rather, roughly, 'recently having participated in the event described by the verb (relative to other objects of the same sort when participating in an event of the same type)':

(3) *John used a new pen.*

On this reading, (3) would be formalized as in (4), where the meaning of *new pen* is construed as a three-place relation between objects, events and sets of objects such as *x* is a a pen and new when involved in e relative to other pens when being involved in an event of the same type as e:

(4) ∃e∃x(used(e, John, x) & *new pen*(e, x, [*pen*]))

The important observation is that only weak quantifiers, as in (5a), but not strong ones as in (5b) can be used for the event-related reading:

(5) a. *John used two / exactly two / at most two / no / few new pens.*

b. *John used every new pen / most / both new pens / the new pen.*

The absence of the event-related reading of the examples in (5b) cannot be ruled out for other reasons, let's say because of a redundancy of a quantifier with a restriction that includes the information given by the predicate. For standard redundancies as in (6) are considerably better than event-related readings of the examples in (5b):

(6) *John used every pen that he used.*

Rather, indefiniteness effect with event-dependent complements ought to be explained on the basis of the domain presupposition. The restriction of the quantifier denoted by *a new pen* contains a variable bound by the event quantifier that is part of the meaning of the same sentence. Hence the restriction cannot be identoified outside the scope of that event quantifier.

The indefiniteness effect appears to arise systematically with all quantified complements whose restriction depends on the event introduced by the sentence. One other case is an event-related reading of *first* as in (5a), where *first* means 'first among the books John wrote'. Such a reading is not available in (5b) with the strong quantifier *the*. Here *first* must mean 'first among the books previously mentioned (or otherwise relevant in the context)':

(5) a. *John wrote a first book.*

b. *John wrote the first book.*

Again, on the relevant reading, *a first book* denotes a quantifier with a restriction dependent on the event quantifier. On that reading, *first book* denotes a relation between events e, books x, and a set X of books if x is first when involved in e among the entities in X when involved in an event of the same type as e. Thus, again the restriction cannot be identified outside the scope of the quantifier.

Another case of a complement with an event-related restriction is *other* as in (6a). With the weak quantifier *a(n)*, *other* in (6a) can mean 'other than the chapter John already wrote'. But with the strong quantifier *every* in (6b), *other* can only mean 'other than the chapter mentioned before'.

(6) a. *John wrote another chapter.*

b. *John wrote every other chapter.*

3. First formalization of domain presuppositions

Let us first consider some adequacy conditions on how the domain presupoposition should be conceived. Clearly, strong quantifiers need not be anaphoric to a particular set-denoting expression in the previous discourse context, since (7a) (with an incomplete description) and (7b) (with a complete description) are perfect, uttered out of the blue:

(7) a. *Every student failed the exam.*

b. *Every student in this class failed the exam.*

Moreover, strong quantifiers need not even relate to a unique set of entities. Thus, we can have (8), where the existential quantifier *ten children* need not introduce a specific set of children, but rather may introduce different sets of children in the different worlds in the context set, and hence yields several possible domains for *every child*:

(8) *John saw ten children this morning. He gave every child an apple.*

Thus, a context should not be construed as having a single domain, but rather as consisting of a set of domains, the possible domains of entities compatible with what speaker and addressee accept at that stage in the discourse (i.e. the domains of the different possible worlds in the context set of the context). Only the entities occurring in all domains are accepted by the interlocutors as part of what they take to be the actual world. Any (possible or actual) entities ocurring on only some of the domains in the context are merely not excluded by the what speaker and addresse accept about the world (though such entities need not be taken under active consideration). Suppose then c is a context with W the set of worlds (context set) with possibly different domains. The function of a quantified sentence then is to apply to a context c eliminate worlds from c which either not contain the right amount of entities or which do not assign the appropriate properties to the entities in their domain.

We can now turn to formalizing the notion of domain presupposition. When formulating it, the goal is to capture the most general case, which means anticipating the way the domain presupposition plays a role in the other contexts to be discussed below. Basically, the condition is that a complex sentences *S* containing a clause of the form 'D N' Pred' with a strong determiner D is defined for a context *c* only if for all alternatives *w'* in which the clause must be true in order for the entire sentence to be true, the extension of N' in *w'* must be the same as in any world *w* to which *w'* is related by a relevant relation *R*:

(9) <u>The Domain Presupposition Thesis (DPT) (formally)</u>

For a context c, c + '[... [Q N' Pred] ...]' is defined only if for all worlds w (or times t) in c the following holds:

if for some relation R, for all worlds (or situations) $w \in c$ (or times t in c) and w' (or times t'), $w\ R\ w'$ ($t\ R\ t'$), '[Q N' Pred]' must be true in w' in order for [... [Q N' Pred] ...] to be true in w, then $[N']^{w'} = [N']^{w}$.

The relation R will be important for modal and intensional contexts. Intutively, *if S were the case, then S' would be the case* applies to a context c by checking whether for every world w in c such that S holds in a minimal revision w' of w, S' also holds in w'. In this case, w' stands in the relevant relation R to w. If S contains a strong quantifier Q, then (9) requires that the restriction of Q be the same in w as in w'. The qualification 'or times' in brackets will be relevant for temporal cases and the qualification 'or situations' for intensional NP-taking verbs such as *need*.

The Domain Presupposition Thesis applies in the case of event-dependent modifiers in a much simpler way. Here no relation R between worlds is involved. The unacceptability of event-dependent modifiers with strong quantifiers simply follows because the extension of the quantifier restriction is not defined outside the scope of the quantifier binding a variable occurring in the restriction.

4. *There*-sentences

Why are domain-presuppositing quantifiers impossible in *there*-sentences? Ideally, one would like to derive this condition from the inherent semantics of the *there*-construction. The semantics that would allow for such a derivation is not so easy to come up with, though. In the following, I will propose an account based on a suggestion by Higginbotham (1987).

Higginbotham suggests that *there*-sentences differ from other sentences in the role the described event (i.e. the Davidsonian event argument) plays in the interpretation of the NP. The suggestion is based on the view that even nouns have an argument position for an event. Thus, *man* denotes a relation between men and states in which they are men. In general, this event argument position is quantified away by an existential quantifier inside the restriction of the quantifier denoted by the NP. But when occurring in a *there*- sentence, the event argument position is bound by the event quantifier associated with the copula verb. Thus, a simple *there*-sentence would have the logical form in (10):

(10) $\exists$e(*is*(e) & Qx N'(x, e))

The main argument Higginbotham gives for this proposal is that a sentence such as (11a) can be true even if different people were in the garden during the day, unlike (11b):

(11) a. *(The whole day,) there remained three men in the garden.*

b. *(The whole day,) three men remained in the garden.*

What remained according to (11a) is the situation in which there are three men in the garden (which allows for successive relacement of men). But what remained according to (11b) is three men sharing a particular property, namely of being in the garden. Slightly modifying Higginbotham's suggestion, (11a) is therefore to be analysed as in (12), where *remain* is construed as a two-place relation between an event and a property of an event (the property the event continues to have), wheras (12b) is to be analysed as in (12b), where *remain* denotes a two place relation between individuals and properties of individuals:

(12) a. $\exists e([remain](e, \lambda e'[\text{THREE}([men], \{x \mid [in\ the\ garden](x, e) = 1\})]) = 1)$

b. $\text{THREE}([men], \{y \mid [remain](y, \lambda x[[in\ the\ garden](x) = 1]) = 1\})$

More generally, a *there*-sentence of the form in (13a) will have the analysis in (13b):

(13) a. *There* V D N' XP

b. $\exists e(V(e, \lambda e'[Q(\{x \mid [N'](x, e') = 1\}, \{x \mid [XP](x, e) = 1\})) = 1)$

The analysis explains straightforwardly the restriction of *there*-sentences to weak quantifiers. The crucial point in the analysis is that the NP in a *there*-sentences has an event-dependent restriction. The restriction to weak NPs then follows. Strong NPs have to have a restriction that is identified relative to the previous discourse context. But this is impossible when the restriction contains a variable bound only by an event quantifier in the same sentence.

Let me mention that the same kind of account can apply to another context that requires weak NPs, namely the *have*-construction:

(14) John has many friends / exactly two friends / no friends / # every friend / # the friend.

The restriction of the object of *have* to weak quantifiers can be explained in the same way as in the case of *there*-sentences, but without appeal to the event quantifier.

In the examples in (14), the head noun of the object NP *friend* contains a second argument which is occupied by whatever the subject refers to. Let us assume that this is based on the second argument position of the noun being coindexed with the subject NP, as in (15):

(15) *John*$_j$ *has many friends*$_j$.

Let us assume that this binding relation is obligatory. Then the domain presupposition rules out strong quantifiers in the same way as in the case of event-dependent modifiers and *there*-sentences. The quantifier the object of *have* stands for will have a bound variable in its restriction, and hence its restriction cannot be identified outside the restriction of the quantifier, with respect to the previous context. This explanation may still have a difficulty with *have*-constructions that don't involve a relational noun such as (16):

(16) *John has a car*.

But even here it is plausible that the NP enters a binding relation to the subject referent, namely via the second argument position of an implicitly present relational predicate, which in the case of (16), this relational predicate stands for the relation of possession (but in other cases, depending on the context, it may stand for a different kind of relation).

Sofar, the domain presupposition of strong quantifiers was used in order to explain the distinct behavior of strong and weak quantifiers with restrictions of quantified NPs containing a bound variable. There is another set of data in which domain presuppositions manifest themselves in rather different ways. These data, which involve conditionals and NP-taking intensional verbs, exhibit rather striking differences between strong and weak quantifiers with respect to derived context sets.

5. Conditionals

Consider the contrast between (17a) and (17b), and (18a) and (18b):

(17) a. *If John owned every horse, Mary would be happy.*

b. *If John had a horse, he would ride it to school.*

(18) a. *If John owned every unicorn, he would start a zoo.*

b. *If John owned a unicorn, he would start a zoo.*

Suppose with Lewis (1972) that conditionals involve universal quantification over worlds maximally similar to the actual world. Then we observe that in the case of (17a), those worlds must all contain exactly the same horses in their domain as the actual world, though those horses will, in part, be assigned different properties (being owned by John). Crucially, those worlds cannot differ from the actual world in containing fewer horses. Such domain variation, however, is not excluded by the semantics (or pragmatics) of conditionals, e.g. by violating a constraint on the similarity relation. This can be seen from (17b), in which the relevant worlds may differ from the actual world in that they contain an additional horse standing in the relation of ownership to John. Similarly, (18a) must involve quantification over actual unicorns, whereas (18b) may involve quantification over ‘counterfactual unicorns’.

Thus, the domain of a strong quantifier must be the same for any of the relevant counterfactual worlds and the actual world. This is not so for the consequent of a conditional, where the domain of a strong quantifier may simply correspond to the domain it has relative to any of the relevant worlds satisfying the antecedent, as in (19):

(19) *If John had ten unicorns, he would feed every unicorn well.*

Suppose counterfactual conditionals involve a revision of the current context, roughly along the lines of Heim (1992). This is given in (20), where rev is the operation that maps a context c and a sentence p to the largest superset of c in which the presuppositions of c are true.

(20) c + *if p would q* = $\{w \,\varepsilon\, c \mid Sim_w(rev_p(c) + p) + q = Sim_w(rev_p(c) + p)\}$

What is crucial is that $rev_p(c)$ is defined only if the presuppositions of p hold in c. In the case of a domain presupposition, this means that any strong quantifier occurring in p must have the same restriction in any world w in c and in the worlds in $Sim_w(rev_p(c) + p)$. Thus, the data in (17a) and (18a) are explained by this account in combination with the DPT as formulated in (9), whith R being the relevant revision relation between possible worlds.

6. NP-taking intensional verbs

Intensional verbs such as *need*, as in (21a), arguably have the analysis in (21b), where P is a contextually given satisfaction condition and and R some contextually given relation:

(21) a. *John needs exactly two assistants.*

b. For any minimal situation s, if P(j, s), then $[$*exactly two*$]^s([$*assistants*$]^s)(\lambda x[R(John, x)])$

That is, John needs exactly two assistants just in case, in the minimal situation in which John has whatever defines the satisfaction of his needs in the context, he stands in the contextually given relation R to exactly two assistants.

The minimality condition, which is important for the present concerns, is motivated by the difference between (21a) and (22) and the one between (23a) and (23b) (cf. Zimmermann 1992):

(22) *John needs to have exactly ten assistants.*

(23) a. *John promised only two papers.*

b. *John promised to write only two papers.*

Unlike (21a), (22) cannot be true if John is satisfied even in a world in which he has ten assistants, and unlike (23a), (23b) cannot be true if John kept his promise and wrote three papers.

Given the conditional analysis in (21b), intensional verbs arguably also involve a change in context: the antecedent applied to a context c yields a set that includes for every w in c a minimal situation s which satisfies the antecedent in (21a) and is otherwise maximally similar to w. Let min be an operation mapping an a set of worlds and a sentence p to the maximal set of situations that are parts of any of those worlds in which p is true.

(24) c + *John needs exactly two assistants* =

$\{w \in c \mid SIM_w(min_{P(j)}(rev_{P(j)}(c)) + [$*exactly two assistants*$](\lambda x[R(j, x)]) = SIMw(min_{P(j)}(c))\}$

As in the case of counterfactual conditionals, $rev_{P(j)}(c)$ is defined only if ‘P(j)’ is defined in c.

Domain presuppositions also manifest themselves empirically in intensional verb contexts: without DPT being true, potential readings of strong quantifiers are generated which are in fact absent. Consider (25):

(25) *John needs every assisstant / both assistants / most assistants.*

On such a reading, (25) follows from (21a), since John will have every assistant (both and most assistants) in any minimal satisfaction situation.

Such readings should be excluded because the domain of *every assistant* in the minimal satisfaction situation will not coincide with the domain it has in any of the worlds in the previous context set.

Similarly, an intensional reading of (26a) is impossible, as opposed to (26b) with a weak quantifier:

(26) a. *John is looking for his wife.*

b. *John is looking for a wife.*

On a potential intensional reading of (26a), every minimal satisfaction situation contains a unique possible woman that is John's wife (hence the uniqueness and existence condition of the Russelian account are satisfied). The reason why this reading of (26a) is excluded can only be the domain presupposition condition: the domain of *his wife* in any satisfaction situation does not coincide with the domain *his wife* has in the previous context. Thus, (26b), with a weak nonpresuppositional determiner has to be used instead.

Thus, the absence of the relevant intensional readings should be derived from the strong quantifiers having to have a restriction coinciding with that of the previous context. That is, the domain of the strong quantifier in any satisfaction situation s has to coincide with that it has in any w in the previous context set from which s is derived.

Some additional work, however, has to be done for the explanation to work out. Unlike in the case of overt conditionals, in the case of the analysis of modal intensional verbs as in (21b), the quantifier occurs in the consequent, not the antecedent, of the conditional. Hence it should be able to be interpreted with respect to the derived context defined by the antecedent. But then we would not expect the DPT to have the effect we wanted it to have. However, the special behavior of quantifiers in intensional verb constructions can be traced to a more general property of modal verbs (to which intensional verbs like *need* arguably belong) as regards presupposition projection. This property requires a special treatment of modal verbs in general. The observation is that modal verbs always project the presuppositions of the proposition they apply to, even though, in their logical analysis, they involve a conditional which would set up a new context for the presupposition to be satisfied. Consider (27):

(27) *John must stop smoking.*

Suppose we are in a culture 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 in all worlds in which the relevant rules are obeyed (which exclude the actual world), John starts and stops smoking. Relative to that set of worlds the presupposition of *John stop smoking* would be staisfied. But this this seems impossible. On any reading, in any context, (27) presupposes that John smoked in this world.

The following explanation can be given for that. On the standard account, modals define a set of possible worlds via some accessibility relation. In the case of deontic modals, for example, these are all the worlds in which the relevant laws or rules are obeyed; in the case of *need*, these are the situations maximally similar to the actual world in which the needs are satisfied. Now what the behavior of presuppositions with modals suggests is that is that the context set defined by a modal should not only be restricted by the relevant accessibility relation, but also by the information speaker and addressee have about the conditions associated with the modal: the set of worlds introduced by a modal should represent the information speaker and addressee share about the worlds in which the relevant rules are obeyed or the situations in which the needs are satisfied. The utterance of a sentence with a deontic modal then effects not really a change in the common ground, the information shared by speaker and addressee, but rather a change in the second set of worlds or situations representing the information given sofar about the satisfaction of the relevant conditions. This change, of course generally consists in an elimination of some worlds and hence an increase in information. The crucial point is that for (27), uttered out of the blue, this set would consist of the set of all possible worlds, because sofar no information has been given explicitly about the worlds in which the relevant rules are obeyed. But this means that the presupposition that John smoked could not possibly be satisfied with respect to that set of worlds.

Given this view of the dynamic semantics of modals, we will get a new conception of the notion of context (as the target and output of the dynamic meaning of sentences). A context now need not consist in a single context set, but rather may of a sequence of context sets. One of those will be the primary context set that corresponds to the sentence or discourse as a whole, the other ones will be secondary context sets corresponding to the modalities used in the discourse.

7. Why do strong quantifiers carry domain presuppositions?

DPT says that simple quantifiers are strong just in case they presuppose their domain. I take this to be a universal condition on such quantifiers. But then why does the condition hold?

A plausible explanation can be obtained from the characterization of strong quantifiers as those that are not intersective (cf. Keenan 1996). An intersective quantifier involves just one set, whereas a nonintersective quantifier involves two: the extension of the restriction and the extension of the scope. I will argue that it is a plausible condition on the upper bound of semantic complexity that a quantifier involve the identification of at most one set in a new context. Hence one of the arguments of a strong quantifier must be identified relative to the previous context.

The domain-related semantic phenomena clearly support the general dynamic perspective of sentence meaning. But they also require a particular notion of context. It seems hard to accommodate the domain presupposition on a syntactic account of context such as the DRT view of context as Discourse Representation Structures (Kamp 1981). A DRS provides only discourse referents and conditions about them; it cannot make the entire domain or the possible domains of the context objects to which any semantic operations or conditions could apply. Domain-related semantic phenomena, thus, support a semantic, rather than syntactic dynamic approach to sentence meaning.