THE SEMANTICS AND PRAGMATICS OF QUANTIFIER DOMAINS*

(Vilem Mathesius Lectures • Prague • March 1998)

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"Remember that part of the ordinary meaning of any idiom of quantification consists of susceptibility to restrictions; and that restrictions come and go with the pragmatic wind." (1986: 164)

There are three parts to these lectures.

1. A survey of some of the data and analyses concerning the use of quantifiers in context.

2. A presentation of recent results by Reinhart (1997), Winter (1997), and Kratzer [, 1998 #796] on the interpretation of indefinite NPs, where choice functions play a central role. A short excursion into a Salish language called St'át'imcets, for which Matthewson (1998) uses the choice function approach to explain some stunning data about distributivity.

3. An exploration of the possibility that a variant of the choice function approach may be used to analyze domain restriction of quantifiers other than indefinites. At the end, some thoughts on the notion of salience and possible connections to Praguian ideas.

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*These lectures have been evolving for a while now. Parts of the first lecture trace back to the few pages on the context-dependency of quantifiers in my dissertation von Fintel, Kai (1994). *Restrictions on Quantifier Domains*. Unpublished Ph.D. Dissertation, Graduate Student Linguistics Association (GLSA), University of Massachusetts, Amherst.]. Reading Recanati's paper on domains of discourse Recanati, François (1996). Domains of Discourse. *Linguistics and Philosophy* 19(5), 445-475.] made me rethink some of my earlier conclusions without in the end actually changing them much. Parts of the second lecture formed the material for several discussions in my seminar on context-dependency at MIT in the fall of 1995. Connecting the choice function approach to indefinites with a general analysis of contextual domain restriction was an idea that I considered then but without working out any details. Conversations with Lisa Matthewson and studying her paper Matthewson, Lisa (1998). On the Interpretation of Wide-Scope Indefinites. Ms., MIT. Submitted to *Natural Language Semantics*] inspired me to tackle the problem again. Connections to questions about the context-dependency of conditional sentences (which are discussed a little in the third lecture) also tickled my fancy, since I have been working on conditionals for a while now. Having the opportunity to present this material at the Vilem Mathesius Series provided the impetus to flesh out some of my vague thoughts. [Specific acknowledgements will be provided in a later draft].

I. The Context-Dependency of Quantifiers

0. Introduction

To get a feel for the wide reach of the pragmatic wind into the interpretation of quantificational constructions, consider the following set of examples (some of these are borrowed from Roberts 1991):

a. Quantificational Determiner

The dinner guests had rhubarb pie for dessert. Everyone developed a rash.

b. Adverb of Quantification

On sunny days, Ali worked in the garden. Jessie generally ran in the park.

c. Modal

I hope to earn enough money next summer to purchase some plants for the garden. If so, I will definitely order some dwarf apple trees. I might buy a Reine des Violettes rose from that place in California, too.

d. Tense/Reference Time

Alice called Gertrude to dinner shortly after dusk. Gertrude gladly put aside her papers and left her desk.

I didn't turn off the stove.

e. *Only*

What did you do last night? Oh, I only watched the X-Files.

f. Superlative

Belgium is a fairly flat country. The highest mountain is not very high.

In these lectures, we will largely be concerned with the context-dependent domains of quantificational determiners, although we will from time to time profit from drawing parallels with other constructions.

Let's start by meditating over a fairly simple example (borrowed from Roberts):

The dinner guests had rhubarb pie for dessert. Everyone developed a rash.

Now, it is of course clear that the universal quantifier in the second sentence is not intended to be quantifying over all the individuals in the world. Evidently, its claim is restricted to the dinner

guests who ate rhubarb pie for dessert. How should this narrowing of the domain of the claim be analyzed?

The radically pragmatic approach. One possible approach to this phenomenon is to maintain that the sentence does literally make a claim about everyone in the world and thus is strictly speaking false. The felicitous use of the sentence in the situation described is explained by an act of charity on the part of the hearer. Since the sentence is obviously false, the hearer searches for a related sentence that may be what the speaker really intended to convey.

I reject this approach because it would be too uncharitable to speakers of natural language: it seems absurd to say that all such context-dependent quantificational statements are literally false. This claim would also have problems with hyperbolic statements, which are intentionally overblown ("You never take out the garbage!"). The latter are not rescued by pragmatic re-interpretation. I think it is best to distinguish (i) hyperbole (literally false, with pragmatic effects), (ii) context-dependent quantifiers. I agree quite strictly with what Lewis says in the motto I chose for these lectures: susceptibility to implicit restrictions is part of the meaning of any idiom of quantification. [1]

Restricted Domains of Evaluation. Another possibility is that the claim made by uttering the sentence was indeed that everyone simpliciter developed a rash but that the claim was made *about the smaller situation* constituted by the dinner party. The idea is to (temporarily) restrict the domain of evaluation for the whole sentence or even the whole discourse. The pragmatics will help us in choosing a suitable universe for the evaluation of a particular sentence, but the semantics can just operate abstracting away from any such choice of a universe.

This is a proposal with a venerable pedigree. Some of the milestones in the history of the idea, including John Wallis, August de Morgan, and George Boole, are conveniently presented in Kratzer's dissertation (Kratzer 1978: 229-230). Westerståhl (1984) calls it the *flexible universe strategy*. Neale (1990) calls it the *implicit strategy.*

The implicit strategy comes in two variants: implicit relativization to sets of individuals or implicit relativization to situations. We will discuss these options in a moment.

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[1] Recanati Recanati, François (1996). Domains of Discourse. *Linguistics and Philosophy* 19(5), 445-475.] rejects the radical Gricean approach for essentially the same reasons. By the way, I do not mean to deny the possibility that in processing such sentences the human parser may at some stage consider the option of having the quantifier quantify quite unrestrictedly, and to only go on to consider more complex restrictions afterwards. The point is that more or less complex restrictions are part of the ordinary grammar of quantification, and not a pragmatic rescue strategy of any sort.

Additional material in logical form. There is another competitor: the *explicit strategy*. The idea here is that the syntactic structure of our sentence in fact contains a covert constituent that effects the restriction to the dinner guests. Here as well, there will be options as to what kind of element is covert and how it interacts with the quantifier.

Neale suggests that the implicit strategy and the explicit strategy might just be "notational variants". We will see in more detail how one might argue for one or the other strategy.

The Saliency Approach. Another possibility (ignored in much of the literature I will be referring to and commenting on) is that domain restriction involves the notion of salience. *Everyone developed a rash* says that every (sufficiently/maximally) salient person developed a rash. This saliency aprroach has been applied mainly to definite descriptions by Lewis (1973a; 1979) and McCawley (1979). I don't know of any work extending the approach to quantifiers in general, but it is certainly worthwhile considering such a move. (I will do so in the third lecture, and I will also discuss the connections to some relevant Praguian notions). For the moment, I will discuss the more widely explored implicit and explicit strategies.

Before we get to the nitty gritty of choosing between analyses, let me introduce two facts that will constrain our theoretical choices: (i) the "locality" of context-dependent domains, (ii) the phenomenon of silent domain restrictions controlled by other quantifiers. I will also briefly discuss which quantifiers are subject to domain restriction.

Locality. There are convincing arguments that the pragmatics of quantifier restrictions has to be locally intertwined with the recursive semantics. The type of sentence that begins to show this contains a quantifier that needs to be contextually restricted plus other material that would be uninterpretable if the same restriction were applied to it. Consider an example from Westerståhl:

> *Sweden is a funny place. Every tennis player looks like Björn Borg, and more men than women watch tennis on TV. But most people really dislike foreign tennis players.*

The contextual restrictions of the last sentence cannot be explained by globally restricting the universe of discourse. The quantifiers *every tennis player* and *most people* are both interpreted as quantifying over Swedes but we need to be able to evaluate also the noun phrase *foreign tennis players* and we cannot do that in a universe made up of only Swedes.

Other examples of this sort were noticed by Lewis (1973a: Section 5.3, 111-117) and McCawley (1979) for silent restrictions on definite descriptions (about which we'll have more to say later as well). First Lewis and then McCawley:

The pig is grunting, but the pig with floppy ears is not grunting.

Yesterday the dog got into a fight with a dog. The dogs were snarling at each other for half an hour, I'll have to see to it that the dog doesn't get near that dog again.

Lastly, Soames (1986) as well gave relevant examples:

a. The cook's father is also a cook.
b. Everybody is asleep and is being monitored by a research assistant.

The point should be clear by now. Could we treat this phenomenon by appealing to implicit arguments of the nominal predicates in these quantifiers? One might think that giving *tennis player* a place argument and identifying that argument anaphorically with Sweden would do the trick. But any reasonable way of interpreting a place argument of the predicate *tennis player* would not interpret it as the place of birth or country of residence but rather as the location of the tennis playing.

Deictic, Anaphoric, and Bound Domains. The implicit domain of determiners behaves like other context-dependent expressions. We find deictic, anaphoric, and bound occurrences. In most cases, it might suffice to say that the most salient domain is picked deictically. This is presumably the correct analysis of cases like this one: Walking into the classroom, I say *Everyone is so quiet. What's wrong?* However, sometimes the domain is established linguistically. Such an anaphoric use occurs for example if I report to you *When I walked into my class today, everyone was really quiet. It made me suspicious.* More such anaphoric examples can be found in van Deemter (1992):

A herd of elephants was visible in the rear window. Two/all sick elephants were lying somewhere in the middle.

When we arrived in the village, several houses were abandoned.

My desk is a mess. Many papers are covered with cigar-ash.

Now, quite importantly, bound variable uses are also possible:

Only one class was so bad that no student passed the exam. *(Heim 1991)*

Here, we might be tempted to analyze *student* as having an implicit argument (you're always a student *of* or *in* something) and have that argument be bound by the higher quantifier *only one class*. But, further examples again show that we have to locate the context-dependency in the determiner:

In most countries I visit, many tennis players try to be like Monica Seles.

Creswell's example (1996: 81ff.) makes the same point:

Whenever we have a party, everybody brings something.

Here the claim is that for every party p everybody coming to p brings something to eat or drink. We see then that it is quite important for an analysis of the context-dependency of quantifiers to make space for domains to be determined under the control of higher operators.

Which Quantifiers Show Domain Restrictions? Claiming contextual domain restriction is a well-rehearsed maneuvre for definite NPs and for universally quantified NPs.[2] Does the phenomenon extend beyond *every* and *the*?The examples I cited above from van Deemter certainly seem to suggest that the answer to this question is "yes".

A (Slight) Problem To be Aware of. Note that there is a well-defined class of quantifiers for which contextual domain restriction will be a little harder to detect. These are the quantifiers that are upward monotone in their first argument: *at least three* may be a good example.

If *at least three students in this room are asleep* is true, then *at least three students in Prague are asleep* is true as well and so will an entirely unrestricted *at least three students (whatsoever) are asleep*.

Thus, if we take an example such as the following

I came into the room. At least three students were asleep.

and ask whether the quantifier *at least three students* here is domain restricted to students in the room that was mentioned in the first sentence, we cannot simply say "yes, of course" just because the sentence would be judged true if at least three students in the room were asleep. The point is that if that is the case then the unrestricted claim that at least three students (whatsoever) were asleep will also be true. So, to show that the quantifier here can be read as contextually restricted, we have to show that someone could object to the second sentence with

That's false. They were all wide awake.

(It seems to me that such a response is quite in order, so that *at least three* can be shown to be subject to contextual domain restriction).

[2]One more reference: Stanley and Williamson Stanley, Jason and Timothy Williamson (1995). Quantifiers and Context-Dependence. *Analysis* 55(4), 291-295.].

For non-monotonic or downward monotonic quantifiers, the test is more direct. All that has to be shown is that these sentences can be true in a certain scenario where the unrestricted reading would be false. The (slight) problem with upward monotonic quantifiers is that we have to overcome the urge for charity and elicit rejection of a test sentence (which would often be true under an unrestricted reading).

Cooper. Robin Cooper (1996: 80f) briefly discusses some data pertaining to our question. He first claims a difference between *most* and *most of the* in that the former cannot be restricted to a particular situation.

> *Most students arrived late for the bus.*
> *Most of the students arrived late for the bus.*

He claims that the first sentence "sounds strange if we are describing some particular event of a school trip". In this bare *most* contrasts with quantifiers like *every* and *three* which could be used for such a particular event.

> *Every student arrived late for the bus.*
> *Three students arrived late for the bus.*

The latter is ok despite the fact that an explicit partitive *three of the* is also available.

I am somewhat skeptical of Cooper's judgment here. How about the following discourse?

> *On our school trip, almost everyone stayed up late on the first night. The next morning, as was to be expected, the teachers were at the bus on time, but most students arrived late.*

If Cooper is right, *most* perhaps patterns with *all* in that it is best used in generic contexts. The following example (modelled after one given by Cooper himself) shows that *most* can take a restricted domain in a generic-quantificational context:

> *Whenever John does an experiment, most people turn up late for it.*

Clearly, more research is needed here.

Cooper goes on to suggest that *many* (compared to *lots of*) may refuse domain restriction:

> *(We were late because) many students were late for the bus.*
> *(We were late because) lots of students were late for the bus*.

He says that the first sentence "sounds rather stilted or foreign", while the second "happily allows the context-dependent" domain.

Lastly, Cooper discusses a difference between *some* and *a*:

> *(We were late because) a student was late for the bus.*
> *(We were late because) some student was late for the bus.*

While the first sentence seems to happily make a claim about one of the students on the trip, the second sentence feels different. It "seems to disavow previous knowledge of the student and gives the impression of 'she wasn't one of us', which seems inappropriate given standard assumptions about the school trip we are describing. The use of *some* would be more appropriate in a case where you could imagine that the individual introduced wasn't previously known." Then he gives the following example

> *(We were late because) some policeman insisted on inspecting the bus*.

[I will leave this issue here, but please note that at the end of this part of the lectures I have a "homework assignment" where I want you to think about this difference between *some* and *a* a little more. I give a longish quotation from a book by Strawson who made a very similar observation.]

Creswell. Creswell (1996: 87) asks the question whether indefinite NPs behave the same way as *every*: Consider three examples he gives:

> *Whenever we have a party, every accountant arrives late.*
> *Whenever we have a party, an accountant arrives late.*
> *Whenever we had a party, an accountant failed to arrive.*

The first sentence clearly displays the domain restriction phenomenon, since it isn't falsified by the non-arrival of any accountant that wasn't invited. Its claim is that every invited accountant arrives late or perhaps just that every accountant who came to the party arrived late.

The second sentence is entirely useless to show anything about domain restriction on indefinites, unless one could reject it because on one occasion only an uninvited accountant arrived late. But I doubt that such a rejection is legitimate.

The third sentence is more interesting. It seems quite clear that this sentence is not verified simply by the existence for any party of some accountant out there in the world who doesn't go to the party. For the sentence to be true an accountant who was invited has to not show up.

Larson & Segal's Puzzle. Application to definites has been popular. It would help save Russell's analysis of definites as quantifiers. Larson & Segal (1995: Chapter 9), however, point out a problem:

Imagine Boris enters the room and leaves the door open. There are other doors to the room. But when we say *The door is open,* we have no problem interpreting this as picking out the door that Boris came through. Now, imagine that Boris enters the room twice through different doors, each time leaving the door open. Suppose there are five doors in the room. Consider *Every door is open*: can this be meant to pick out the two doors that Boris used?

You left every door open, you dope.

1. The Explicit Strategy (Ellipsis Variant) and the Wettstein Argument

Could we simply apply existing theories of ellipsis to our problem? One might say that *Everyone developed a rash* in the current context actually is the phonetic realization of a sentence that for interpretive purposes really is *Everyone ~~of the dinner guests~~ developed a rash* or *Everyone ~~who had dinner that night~~ developed a rash* or *Everyone ~~who had rhubarb pie~~ developed a rash* or … or …, you get the picture.

There are two main theories of ellipsis in current generative grammar: deletion at PF or copying at LF. The first one assumes that the elided material is generated in full early in the derivation and gets passed on as such to the semantics and is only deleted (under the right conditions) on the way to the articulatory interface. The second one assumes that what is generated syntactically is a placeholder constituent which is unpronounced at PF, but which gets filled with interpretable material by operations at LF (again under the right conditions).

An important consideration against using these methods for our problem is that grammatical ellipsis of this sort is subject to strong conditions. In essence, an element of the same meaning as the elided constituent has to be linguistically present in the appropriate configuration. (See Ivan Sag's dissertation and much subsequent work on this point.) Now, these conditions are not obviously satisfied in the case of context-dependent quantifiers.

The other objection to the ellipsis analysis, the one that has gotten a lot of play in the philosophical literature, is the Wettstein argument. In a way, it is not much more than a corrollary of the syntactic argument. The point is that (since there often no clear syntactic antecedents for the supposed elided material) there would be massive indeterminacy as to what the elided material actually is in a given case. Wettstein (1981: 246) wrote

> When one says, e.g., 'The table is covered with books', the table the speaker has in mind can be more fully described in any number of ways, by the use of any number of non-synonymous, uniquely denoting descriptions (for example 'the table in room 209 of Camden Hall at t_1', 'the table at which the author of *The Persistence of Objects* is sitting at t_1', etc.)

Intuitively though it doesn't seem that there is any indeterminacy in the proposition expressed by a sentence like *The table is covered with books* or by our sentence *Everyone developed a rash*. In context, they seem to be quite determinate. The syntactic ellipsis analysis cannot account for this determinacy.

A simple modification of the ellipsis analysis which substitutes a constituent that determinately and rigidly describes the table in questions will also fail the Wettstein test.[3] While the following may indeed express the same proposition, it is still unlikely that the utterance is indeterminate between these equivalent forms:

> *The table over there is covered with books.*
> *The table in front of me is covered with books.*
> *The table in this room right now is covered with books.*

Recanati (1996) and Reimer (1992) reject this approach (ellipsis of directly referential expressions) as still suffering from too much indeterminacy.[4]

The conclusion is that we are not dealing with any kind of ellipsis of the usual sort, where for interpretation "descriptively rich" syntactic material is present (under normal conditions of antecedent-licensing).

2. Contextual Saturation (Implicit or Explicit)

Recanati seems to think that at this point only an implicit approach is still alive. He writes that the process of domain restriction is a kind of "'saturation', the contextual process of assigning semantic values to indexicals and other 'free variables' in the utterance" (Recanati 1996: 452). But of course, there are two ways one could do this. Either the syntactic form of our sentences do not contain any unarticulated constituents and the domain is a parameter of interpretation that needs to be contextually identified (this is the approach Recanati adopts), or the syntactic form of our sentences does contain unarticulated constitutents which are interpreted as free variables whose value is to be supplied by the context. As long as we stay away from the claim that the unarticulated constituent is a placeholder which is given a rich representation at a later stage, the explicit approach is in fact still alive.

The only reason I can think of to dismiss the explicit strategy at this point would be the doctrine that there cannot be such things as phonetically silent free variables which are not syntactically replaced by rich descriptive material but which are given values directly by the context. In fact,

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[3] Salmon Salmon, Nathan (1982). Assertion and Incomplete Definite Descriptions. *Philosophical Studies* 42, 37-45.], Soames Soames, Scott (1986). Incomplete Definite Descriptions. *Notre Dame Journal of Formal Logic* 27, 349-375.], and Neale Neale, Stephen (1990). *Descriptions*. Cambridge, MA: MIT Press. present versions of such an approach. I am glossing over some complexities here, of course.

[4] Schiffer Schiffer, Stephen (1995). Descriptions, Indexicals, and Belief Reports: Some Dilemmas (But Not the Ones You Expect). *Mind* 104(413).] discusses the possibility that what is expressed by such utterances is in fact indeterminate. Reimer Reimer, Marga (1996). The Wettstein/Salmon Debate. Ms., University of Arizona.] also discusses such an approach.

this seems to be the sentiment behind Reimer's rejection of just such an approach. Reimer (1998) writes:

> [C]onsider Grice's technical, but undeniably intuitive, notion of "what is said", according to what is said is essentially linked to "the elements of [the sentence], their order, and their syntactic character" (1989: pp. 24-25). According to such a view, what is said via an assertive utterance of a sentence of the form *The F is G* coiuld not possibly contain any constituent corresponding to a contextually (as opposed to sententially) supplied predicate *H*.

This assumes a quite naîve (and disastrously wrong) theory of grammar, according to which all the elements of a sentence are (phonetically?) articulated. That this cannot be so in general is clear. Morpheme-boundaries, tree structure, null morphemes, and other unarticulated elements are clearly part of the form of a sentence without being phonetically unarticulated. The claim must therefore be more restricted: natural language does not allow unarticulated constituents of the type of pronouns or pro-common nouns. This seems to be wrong as well: pro-drop languages are in the vast majority of languages around the planet.

Anyway, in the theory of grammar that I will be assuming, having silent free variables in the syntactic representation is legitimate and therefore the explicit approach is still in the running.

At this point, it seems we have a standoff, and we might be at the point at which Neale's suspicion that the approaches are notational variants looks correct. But hold on to your hats, there is more to come.

3. How to Deal with Locality

The two approaches will employ different ways of dealing with the locality of contextual restrictions. Under the implicit approach, it is quite important to be working with a dynamic context so that when a particular quantifier is processed, the domain is given by the current contextual domain parameter, and when then another quantifier (or other constituent which is sensitive to the contextual domain parameter) is interpreted this parameter can have shifted.

Under the explicit approach the analysis is more straightforward. A free variable of the appropriate sort is present in the syntactic representation of the sentence and it will be present at some well-specified place in the structure where the quantifier can be sensitive to the value the variable receives.

Of course, it is a given that context changes, so there is no argument here for one approach over the other.

In expository practice for the implicit approach, talking about shifting contexts is rather complicated. One has to annotate examples as to what context is relevant at what point. This should not be mistaken for a committment to domains as part of representations (which is what the implicit approach denies). Recanati for example gives representations like the following:

((The dog)$_i$ got in a fight with another dog)$_j$

(Teri believes that ((a spy)$_i$ is following her)$_j$)$_i$

He doesn't discuss the status of these representations, which he borrows partly from Kuroda (1982). But it is clear that they are supposed to be some kind of meta-linguistic representation, since actual syntactic representations are supposed to be free of domain variables.

For the time being, I will leave the implicit/explicit debate in limbo and will just work with representations that have local domain variables. Adherents of the implicit approach may try to interpret my representations as meta-representations of a shifting context.

4. Sets, Situations, Predicates, Or What?

What exactly are the domain variables? What is their type? (Or, in terms of the implicit approach, what kind of element does the context need to supply to saturate the Kaplanian character of a quantificational expression?)

The options, we should consider are these:

- sets of individuals
- predicates
- situations
- complex functor argument variable structures

(The last option may sound incomprehensible, but you'll see what I mean in a moment.)

The Set Variable Approach

According to this approach, which is perhaps most explicitly proposed by Enç (1991), quantifiers incorporate reference to a contextually salient set of individual. Enç works in an explicit analysis and would use representations such as this one:

There are (some elephants)$_i$ in the meadow. (Most^i females)$_j$ are at the perimeter.

Quantifiers carry indexes to indicate the variables that they bind. They also carry another index which indicates the salient set of individuals that they are relativized to. In this example, the first

sentence sets up a salient set of elephants. The quantifier *most females* in the second sentence is interpreted relative to that set of elephants.

Enç doesn't present a compositional implementation of her system, but one might interpret her as intending a system where quantifiers apart from taking two predicates as arguments, take a third argument of the type of a (plural) discourse referent, which will be represented as a free variable in the LF of such sentences, which will then be provided a value by the context drawing on an inventory of salient sets of individuals.

The Predicate Approach

According to this approach, quantifiers allow the presence of a silent free variable of the type of a predicate. Variants of such an approach are quite common. We would have representations of the following kind:

> *Every R guest developed a rash.*

One might imagine that such structures are interpreted by providing the variable *R* with a value (it will be a predicate) and then conjoining this predicate with the overt common noun predicate *guest*. In our example, one might say that *R* is resolved to be a predicate that is true of the people present at the salient dinner party that we are talking about.

Using predicates instead of sets may help with examples where it seems that a contextual restriction survives into an intensional context without giving rise to transparent readings of the restrictive predicate. Here's an example:

> *When John went to Prague, he studied some Czech beforehand. It was quite possible that nobody would speak Welsh.*

It's reasonable to think that the quantifier *nobody* here is understood as talking about the people John was going to interact with when he was in Prague. Importantly, though, there is no *de re*-claim here about a particular set of people. What should be imported into the logical structure of this sentence is therefore not a variable referring to a set of people but a predicate-type variable which can be interpreted opaquely in an intensional environment.

The Situation Approach

Using situations as the contextually supplied domain is of course the idea of situation semantics, see Barwise & Perry (1983) on resource situations in the interpretation of definites and Cooper

(1993; 1996) on resource situations in the interpretation of quantifiers in general. Recanati (1996) also adopts situations as domains.

This idea is especially appropriate for cases of bound domains controlled by operators that are reasonably treated as quantifying over situations.

Usually, when I go to a dinner party, everybody comments on my haircut.

But doesn't it seem as if the quantifier *everybody* is in fact restricted to a domain of individuals smaller than everybody in the given situation of me going to a dinner party? Might the sentence not be judged true if just everybody I talk to at the party comments on my haircut?

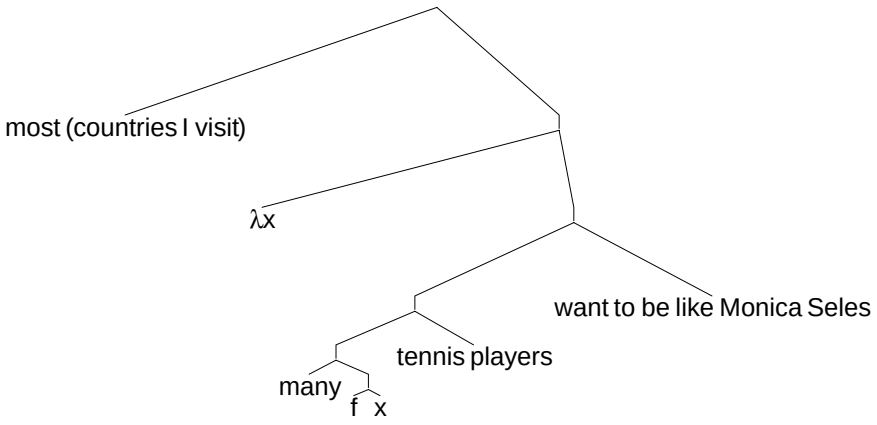
Complex Structures

I would like to advocate a rather eclectic and rich system. It is essentially the one developed by Cooper (1975; 1979) for pronouns, adopted later by Heim (1990) for donkey pronouns, and used by Chierchia (1995) for definites in general. See also the chapter on E-type pronouns in Heim & Kratzer [, 1997 #470].

Consider an example:

In most countries I visit, many tennis players try to be like Monica Seles.

What could *most countries* bind in the LF representation of the subject quantifier? The solution is to posit an implicit domain argument that in turn consists of an implicit function (from countries to people who live there) and its implicit argument (countries, bound by the higher quantifier):



Note that if we don't find a way to make the nuclear scope of *most countries* contain a variable bound by that quantifier, we would end up with a vacuously quantified structure.

6. Syntactic Reality

Let me come back to the issue of whether domain restriction is explicitly represent by covert elements or is achieved implicitly. Under certain assumptions, the explicit analysis predicts that there should be observable effects of the presents of these covert elements.

One question that could be investigated concerns the cases of domain restrictions that are bound in part by other operators, such as the one in the structure just discussed in the previous section. If there is explicit binding of an embedded variable here, we might expect Weak Crossover Effects in these cases.

It is surprisingly difficult to get clear judgments on this issue (which might be taken as an indication that one shouldn't base an argument one way or the other on the data).[5] Here's a survey of what has been said in the literature. The issue has not been studied much with respect to covert domain restriction, but there are some relevant observations on similar effects of binding into covert elements.

Partee (1989) thinks that implicit anaphors do show weak crossover effects, although they may be a little weaker than the effect with overt anaphors. Her examples (with the relevant anaphor underlined):

> *?From five feet away I tried to toss a peanut to every pigeon.*
> *?The leader of the local union wrote a letter to every untenured professor in the state.*
> *?Only the nearest photographer got a good picture of every senator.*

Partee cites a personal communication from Irene Heim, who noted that WCO tends to be milder (but still present?) in German examples with *die Mutter* than with *seine Mutter*. Williams (1994, *Thematic Structure in Syntax*, p. 242ff.) also finds WCO with definites:

> **The hospital administartor hates every surgeon.*

Chierchia (1995, *Dynamics of Meaning: Anaphora, Presupposition, and the Theory of Grammar*: p. 226) has the same judgments:

[5]The worst case that I found of confusion on this matter is the discussion in Culicover & Jackendoff Culicover, Peter and Ray Jackendoff (1995). *Something Else* for the Binding Theory. *Linguistic Inquiry* 26(2), 249-275.], who deal with the anaphor *else* which occurs inside quantifiers like *someone else*. They manage to judge one and the same sentence OK early in the paper and with ?? later on:

> *Who does someone else's mother love?* (OK as (22b) on p. 257, ?? as (37d) on p. 262)

Every young author will have a new book at the fair.

a. Every author will personally present the book to the critics.
*b. *The book will make every author rich.*
*c. *His book will make every author rich.*

Fox (1995, 'Economy, Scope and Semantic Interpretation - Evidence from VP Ellipsis', *NELS 25*, 143-157) has no WCO:

The director admires every movie.

There is also a squib by Richard Campbell in the most recent issue of *Linguistic Inquiry* that contains potentially relevant data, although he doesn't look at the questions from the perspective that we would now bring to them. [I don't have a copy of the paper with me here. But please look at it when you get a chance].

Every young author will have two new books at the fair.
At least one book will make every author proud.
At least one of the books will make every author proud.

Homework Assignment: Strawson on the Difference between *A* and *Some*

Here's what Strawson (in his book *Subject and Predicate in Logic and Grammar*, 1974, Methuen, pp. 110/111) had to say about the difference between *a* and *some*:

> "Consider the following cases:
>
> A policeman has been shot
>
> Some { general / cabinet minister / V.I.P. } has been shot
>
> I've been stung by some insect
> I've been stung by a wasp
> I've been stung by some wasp
>
> She has just been delivered of a boy
> She has just been delivered of some boy
>
> Now what is the difference between the cases in which we use *a* and the cases in which we use *some*? My suggestion is that the choice of *some* rather than *a* embodies what might be called an acknowledgment or recognition of the fact that the identification supplied, though perhaps the best the speaker can do, might be regarded as inadequate to the circumstances of the case; and that the kind of identification which the choice of *some* rather than *a* indicates or suggests inability to provide (though perhaps sometimes accompanied by indifference to or unconcern about) may be either further kind-identification or individual-identification. If this is on the right lines, it would explain some facts about my examples. Thus there is more likely in general to be an individual identification question asked in the case of a cabinet minister (general, V.I.P.) than in the case of a policeman; and more point, therefore, in acknowledging the question, as it were, while disclaiming the ability to answer it. In my next group of three examples, the most satisfactory description of an unsatisfactory situation is given by *I've been stung by a wasp*. That gives all the identification we need of what stung me. *I've been stung by some insect* acknowledges that the kind-identification given falls short of what we generally regard as desirable in such cases (from the point of view, for example, of treatment), even though it may be spoken in a spirit of manly indifference to such concern. *I've been stung by some wasp*, on the other hand, with its suggestion of a possible individual-identification of the wasp in question seems absurd. Even more absurd is the suggestion of a possible individual-identification in the case of *She has just been delivered of some boy*. It is not totally absurd, any more than the question, *Who is the boy she has just been delivered of?* is totally absurd; but it would require an elaborate setting to be given any natural use at all."

How can we formally capture this intuition, which seems right on the money? Please speculate freely and also think about whether a similar effect can be achieved in other languages you are familiar with.

II. Choice-Functions and the Interpretation of Indefinites

I will present a short overview of recent work by Reinhart (1997), Winter (1997), and Kratzer [, 1997 #796]. I will gloss over many complexities. The point is to convince you that choice-functions are a useful tool in the semantics of indefinites. To reinforce that point, I will then report on some very recent work by Lisa Matthewson (1998), who uses the choice function approach to explain some stunning data about distributivity from a Salish language called St'át'imcets.

1. Problematic Wide and Intermediate Scope of Indefinites

Quantifier Raising (QR) is known to be highly sensitive to islands (subjacency), to the point of being almost clause-bounded. In the following examples, the universal quantifier can quite easily take scope over the existential quantifier that dominates it on the surface:

A doctor will interview every new patient.
A doctor will try to assist every new patient personally.
A doctor will make sure that we give every new patient a tranquilizer.

But once the universal quantifier is locked into an island (complex NP or adjunct), the scope reversal is impossible:

A doctor will examine the possibility that we give every new patient a tranquilizer.
A doctor should worry if we sedate every new patient.

But indefinites can easily take wide scope out of islands.

Everyone reported that Max and some lady disappeared.
Most guests will be offended if we don't invite some philosopher.

A possible explanation developed by Fodor & Sag (1982): indefinites are ambiguous between a quantificational reading and a referential reading. The referential reading explains the wide scope in the problematic examples. The quantificational reading is one under which indefinites behave just like other quantifiers. Fodor & Sag thereby make the prediction that indefinites should not give rise to intermediate scope readings:

Each teacher overheard the rumor that a student of mine had been called before the dean.

Fodor & Sag observe that their prediction is correct. This sentence does not appear to have an intermediate scope reading.

Intermediate Scopes Do Exist! But, intermediate scopes of indefinites were recently (re)discovered that need to be explained.

> *Each student has to come up with three arguments which show that some condition proposed by Chomsky is wrong.*
> (Farkas 1981)
>
> *Everybody told several stories that involved some member of the Royal family.*
> (Farkas 1981)
>
> *Each teacher overheard the rumor that a student of hers had been called before the dean.*
> (Partee & Rooth 1982, fn. 6, attributed to Irene Heim)
>
> *Each writer overheard the rumor that she didn't write a book she wrote.*
> (Kratzer, in conversations in the 1980s)
>
> *At least one person an AIDS victim works with is usually misinformed about the disease.* (Rooth 1995(1991))
>
> *Every professor will rejoice if a student of his cheats on the exam*.
> (Ruys 1992)
>
> *Most linguists have looked at every analysis that deals with some problem*.
> (Ruys 1992)
>
> *Every professor got a headache whenever a student he hated was in class*. (Abusch 1994)
>
> *In every town, every girl that a boy was in love with married an Albanian.*
> (Cresti 1995)
>
> *Usually, every penny a shoesalesman earns goes for paying bills.*
> (Cresti 1995)

To see how some of these examples are constructed look at this one:

> *Most linguists have looked at every analysis that deals with some problem.*

Note that narrow scope here would lead to a trivialized reading of the relative clause: after all, every analysis does deal with some problem or other. Try parallel examples:

> *Most carpenters admire every table made out of some material.*
>
> *Most literature professors dislike every novel that some author wrote.*

Facilitating factors for intermediate readings are the presence of bound variable pronouns and the type of indefinite.

> *Every professor rewarded every student who had read a book he had recommended.*
> *Every professor rewarded every student who had read a book.*

"Very weak" indefinites show no pseudo-scope:

> *Most linguists have looked at every analysis that contains a problem.*

Modified numerals do not give rise to pseudo-scope:

> *Every professor rewarded every student who had read exactly two books he had recommended.*

2. Problems with Free QR

Reinhart shows that we don't really want to allow island-violating QR to explain wide-scope indefinites. Her argument rests on a case of a plural indefinite taking wide scope:

> *If three relatives of mine die, I will inherit a house.*

This has a reading where it asserts that there is a particular group of three relatives such that if they all die, I will inherit a house. The problem Reinhart notes is that if we QR'd the quantifier *three relatives of mine* out of the *if*-clause, we would predict a distributive reading: There are three relatives for each of whom it holds that if he or she dies, I inherit a house.

What about allowing free QR for an existential quantifier over groups and leaving the distributor operator behind? [This option is not entirely weird. McCawley argues that there are two quantifiers at work in distributive indefinites. Does Cresti talk about this?]

3. Problems with Unselective Binding

But leaving the indefinite in situ and binding it at a distance is also not possible. We would get meanings that are far too weak. This problem was first noted by Heim (1982: 148f).

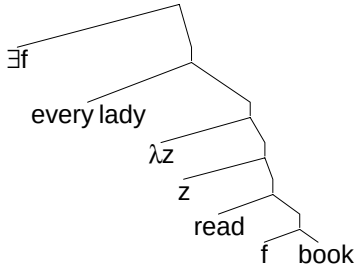
> *If a cat likes a friend of mine, I always give it to him.*
> $\exists_x$ always$_y$ [if cat$_y$ & friend of mine$_x$ & $_y$likes$_x$ then I give y to x]

Any x that is not a friend of mine verifies this claim. Heim's solution: free QR. But we saw that we should go that way. So, we are stuck in a dilemma.

4. Reinhart: Choice Functions

Solution: allow existential quantification over choice functions to mimic wide scope.

Simple case: *Every lady read some book*



Here, f is supposed to be a choice function. For all sets P, f(P) ∈ P.

What is asserted here is that there is a way of picking things from sets, such that every lady read the thing picked from the set of books.

Truth-conditions are stronger now:

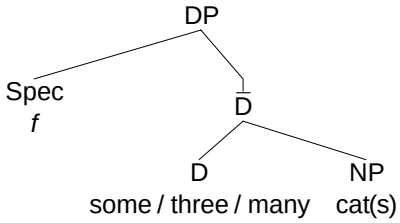
∃***f*** *(if we invite* ***f****(philosopher), then Max will be offended)*

Since **f**(philosopher) has to be a philosopher, Donald Duck will not trivially satisfy this claim.

Intermediate scope available:

*(Most linguists)$_X$ (∃**f**) (every analysis that solves* ***f****(problem))$_Y$ (x looked at y)*

Internal NP-Structure:



Existential Closure applies to bind the function variable.

5. A Simplification (Kratzer)

Reinhart's mechanism of free existential closure (introduced to capture intermediate scope) is redundant, under certain natural assumptions.

First, note that it is (almost) redundant when the indefinite NP contains a bound variable bound by the c-commanding universal quantifier:

Every professor will rejoice if a student of his cheats on the exam.

Reinhart's LF: (every professor)$_X$ $\exists$**f** (if **f**(student(x)) cheats, x will rejoice)

This is in fact equivalent to the following LF with no intermediate scope for $\exists$:

$\exists$**f** (every professor)$_X$ (if **f**(student(x)) cheats, x will rejoice)

So, if we claim that in all of the relevant intermediate scope examples the indefinite contains bound variables bound to the c-commanding quantifiers, we do not need intermediate existential closure. Need to claim implicit variables for some cases.

Data (discussed by Kratzer) seem to show that intermediate scopes are facilitated by bound variable pronouns, or other anaphoric expressions, including plausibly specificity markers.

a. *Every professor$_i$ rewarded every student who read some book he$_i$ had reviewed for the New York Times.*
b. *Every professor$_i$ rewarded every student who read some book I had reviewed for the New York Times.*

a. *Each teacher$_i$ overheard the rumor that some student of his$_i$ had been called before the dean.*
b. *Each teacher$_i$ overheard the rumor that some student of mine had been called before the dean.*

a. *Every professor$_i$ got a headache whenever some student he$_i$ hated was in class.*
b. *Every professor$_i$ got a headache whenever some student Mary hated was in class.*

Every professor rewarded every student who read a certain book from the canon.

Ruys:

a. *Every professor will rejoice if a certain student of his cheats on the exam.*
b. *Every professor will rejoice if a different student cheats on the exam.*
c. *Every student will rejoice if another student cheats on the exam.*

A Problem. A bound variable within the nominal predicate that serves as the argument of the choice function only gives rise to clean intermediate scope effects if for every value of that variable we get a different set. If two professors have exactly the same students, we would not get a true intermediate reading for

Every professor will rejoice if a student of his cheats on the exam.

If {x: x is a student of professor y} = {x: x is a student of professor z}, then the choice function will choose the same student for professors y and z. This would seem to be the wrong prediction.[6]

Kratzer's way-out: Give the choice function an additional covert argument bound to the professor. But then she has to tell a story about why the overt bound pronoun in the nominal predicate facilitates positing an additional covert bound pronoun argument for the function variable.

Winter proposes to go intensional at this point.

Is this the problem that made Engdahl switch from choice functions to range-restricted skolem functions?

To justify the implict arguments given to the choice function, Kratzer appeals to the Mitchell/Partee work on implicit anaphors (Mitchell 1986; Partee 1989; Partee 1991). See also Hintikka (1986). The choice-function variables are now not pure choice-functions anymore, but a kind of Skolem-function.

The move to choice-functions with implicit arguments is useful for the analysis of cases like the following. Reinhart has a mechanism to force choice functions to take values in the extension of the predicate in the world that is the current evaluation point at the site of existential closure. This gives equivalence with wide scope in a sentence like

If we invited some philosopher, Max would be offended.

Kratzer's system in theory allows a further reading (also available to Reinhart if we she modified her mechanism) with a wide scope choice function but with a locally bound world variable:

$\exists f \ \forall w$ (we invite$_w$ f(philosopher$_w$)): (Max will be offended$_w$).

There is a salient choice function that (at least) for every world yields a philosopher in that world such that Max will be offended if we invite the philosopher selected. For example, the reading would be one where we know that Max will be offended if we invite the chairperson of the APA whoever that may be. Can we establish that there is such a reading?

[6]This observation is attributed by Kratzer to myself and Paolo Casalegno. In fact, when I reported this problem to Kratzer, I was merely conveying an observation made by Orin Percus in a discussion in my MIT seminar on context-dependency in the fall of 1995.

The Nature of the Salience Presupposition Associated with Choice Functions

The interpretation of the free function variable needs to be discussed. It is supposed to be salient, but only salient to the speaker. This is in contrast to other deictic expressions. What is going on? My feeling is that these are presuppositional items that are "ear-marked" for accommodation. The closest analogue I can think of are non-restrictive relative clauses.

The Naturalness of Choice Functions

How "natural" does the function have to be? For true intermediate scope, it would have to allow any pairing!

Hintikka (1986 *LI* Paper on *a certain*):

> *Everyone of these young men hopes to marry a certain woman.*

"The function codifying young men's choices of their prospective spouses is a notoriously unpredictable one. Hence, the functional interpretation is expectedly unnatural in this case."

6. Matthewson's Argument for Choice-Functions

Matthewson carefully demonstrates that in St'át'imcets, quantifiers cannot be read distributively.

wa7	xwey-s-twítas	[ta	smúlhats-a]	[tákem	i	sqáyqeycw-a]
PROG	love-CAUS-3PL.ERG	[DET	woman-DET]	[all	PL.DET	man(PL)-DET]

'All the men love a woman.'

Rejected in context: Each man loves a different woman.

"There's just one lady. Can't mean a different one each. It sounds like you're talking about that one lady."

[tákem	i	sqáyqeycw-a]	wa7	xwey-s-twítas	[ta	smúlhats-a]
[all	PL.DET	man(PL)-DET]	PROG	love-CAUS-3PL.ERG	[DET	woman-DET]

'All the men love a woman.'

Rejected in context: Each man loves a different woman.

"Still means there's just one lady."

wa7 mitsaq-mín-as [ta twíw't-a] [i n7án'was-a smelhmúlhats]
PROG sit-APPL-3ERG [DET child-DET] [DET.PL two(HUM)-DET woman(PL)]
'A child is sitting on two women'

Accepted in context: There is one child, who is sitting on two women's laps.
Rejected in context: A different child is sitting on each woman's lap.

"Wow! The young boy is sitting on two women's laps. Adventurous! At the same time, he's trying to sit on both."

[kalhás i skúl-a] [az'-en-ítas [i q'ém'p-a latám]
[three DET.PL school-DET] buy-TR-3PL.ERG [DET.PL ten-DET table]
'Three schools bought ten tables.'

Accepted in context: 3 schools banded together and bought a total of 10 tables.
Accepted in context: 3 schools separately bought tables, the total number of tables bought was 10.
Rejected in context: Each of 3 schools bought 10 tables. 30 tables were bought.
Rejected in context: Each of 10 tables was bought by 3 schools. 30 schools were involved.

Matthewson argues that the only analysis that can capture the facts is one that employs choice-functions. The relevant St'át'imcets quantifiers are in fact indefinites with a choice-function variable.

Prediction of the modified Kratzer-approach: bound variable pronouns should induce narrow scope and distributivity.

wa7 xwey-s-twítas [i nkekalhás-a smelhmem'lhats
PROG love-CAUS-3PL.ERG [DET.PL three(HUM)-DET woman(DIMIN.PL)

i zwat-en-**ítas**-a] [i n7án'was-a twew'w'et]
DET.PL know-TR-**3PL.ERG**-DET] [DET.PL two(HUM)-DET boy]

'Two boys love three girls that they know'

Accepted in context: Two boys each love three different girls.

"It can be six girls. It's their own three girls."

III. Choice-Functions and Domain Restriction

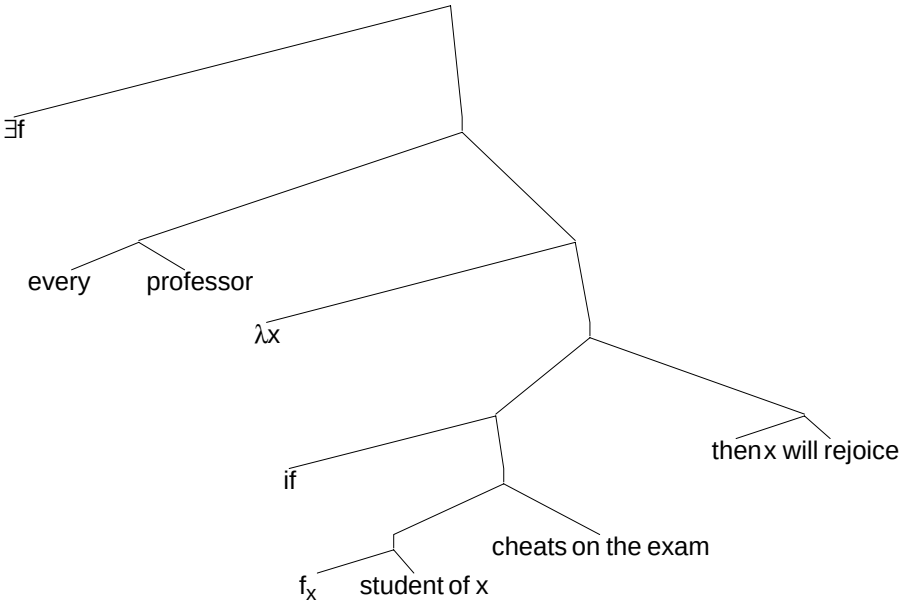
The question I want to explore now in this third part is whether there is any interesting connection between the domain restriction techniques we discussed in the first part and the choice-functions we discussed in the second part.

Let us look at a pair of examples:

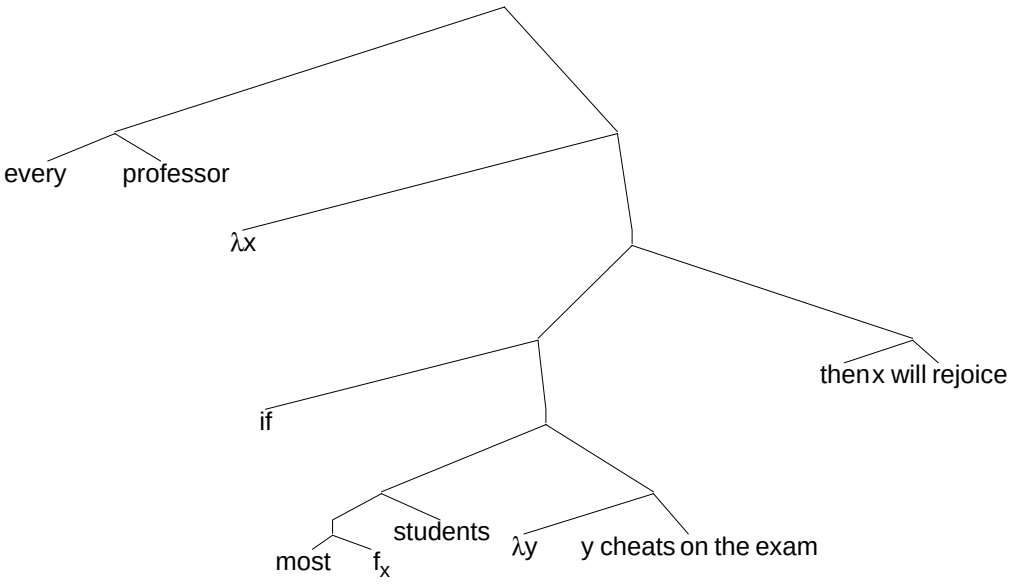
Every professor will rejoice if a student of his cheats on the exam.

Every professor will rejoice if most students stay awake.

The first sentence has an intermediate scope reading. The second sentence seems to have a reading where the students who have to stay awake to make the individual professors happy are different ones for the different professors, perhaps those students in the professor's classes. We can treat this by adding a complex domain variable. We get the following logical structures:



We have a choice-function with two arguments (the professor, and the set of students of the professor) that chooses an element of the second argument.



In the second case, according to what we have done so far, f_x denotes (let's say) the set of students who take one of the professor's courses. This set of students is then (quite vacuously) intersected with the set of students in the world.

These operations look awfully similar. Can we unify them? Can we use one operation for both purposes? Are the phenomena that these mechanisms were chosen for really instances of the same phenomenon?

NOTE: In St'át'imcets, the class of determiners that is argued by Matthewson to trigger choice functions also occurs in universally quantified NPs. Their structure is something like *every/all DET girl*.

I would like to explore the idea that what we have uniformly are functions (possibly with implicit arguments) that choose a subset from a set. These are therefore "class selection functions".[7]

Class-selection functions are not completely unknown in research on natural language semantics. They have been used in the semantics of counterfactual conditionals (Lewis 1973a; Lewis 1973b; Nute 1975; Nute 1980; Nute 1984). Here's the idea:

[7]There are (at least in principle) other options for unification. (i) One could "choose" an element from a set by intersecting that set with the singleton set containing that element. This idea has been explored a little by Uli Sauerland. (ii) One could effect domain restriction by applying a choice function to the power set of the original set.

if p, then q expresses the following proposition:

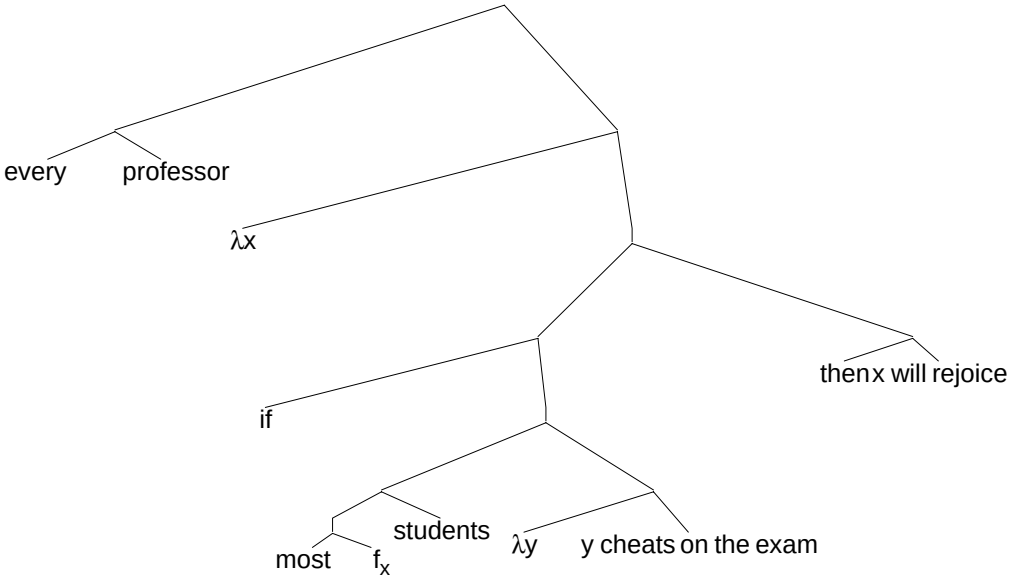
$\lambda w \left(\forall w' : w' \in f_w(p) \rightarrow w' \in q \right)$

This proposition is true of a world w iff all worlds selected by f_w from the *p*-worlds are *q*-worlds.

One can imagine that f_w selects those *p*-worlds that are most similar to w. This would give a fairly standard semantics for counterfactual conditionals. The same logical form may also work for other kinds of conditionals. If f_w selects those *p*-worlds that are compatible with eveyrthing that is known in w, we get an epistemic conditional.

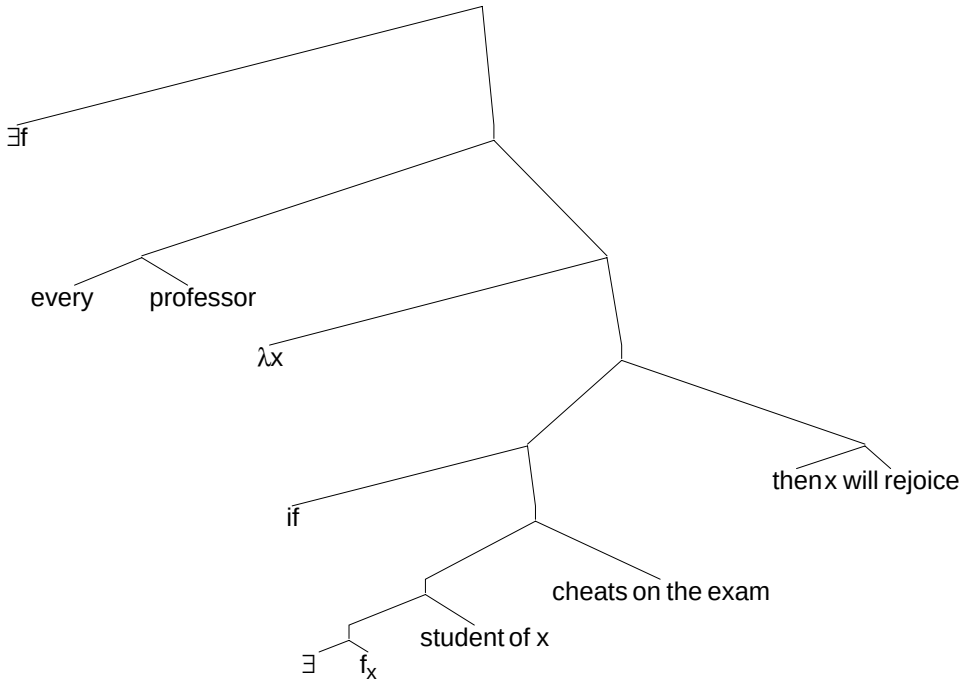
Now, how can we use class-selection functions to achieve the effects needed for the interpretation of indefinites and for domain restriction?

Take domain restriction first. Using class selection functions here is quite simple. We could use the same LF in fact as we used before:



But now, we do not interpret f_x as denoting a set of individuals (dependent on x), but as denoting a function from sets to subsets. This class selection function will pick out from the set of students that subset of students who are in the relevant relation to x.

To apply the class selection method to the interpretation of indefinites, we have to reintroduce an existential quantifier to apply to the selected subset. The LF looks slightly different now:



Here, the function f_x picks out from the set of students of x the subset that x is somewhat malevolent towards. This will not yet give the right reading, since we want a particular such problem not a set of such problems. So, here the function has to select a singleton subset for each x. I take it that this is signalled by the singular morphology in this case.

The claim that emerges is that indefinites are not special at all. Their apparent wide-scope and intermediate scope readings are simply readings where domain restriction (in dependence possibly of higher operators) has rendered the existential force of the quantifier moot.

Existential Closure vs. Contextual Value

There are some important differences perhaps. For indefinites, we may want to existentially close off the choice-function variable. Kratzer doesn't do that, but Matthewson argues that there is no trace of specificity with the relevant St'át'imcets determiners. But for other quantifiers and for conditionals, we want the class selection function to be given a contextually determined value, instead of making an existence claim about class selection functions.

To see this, try to spot the problem with the following analysis found in Matthewson:

[tákem i sqáyqeycw-a] wa7 xwey-s-twítas [ta smúlhats-a]
[all PL.DET man(PL)-DET] PROG love-CAUS-3PL.ERG [DET woman-DET]
'All the men love a woman.'

$$\exists f\, \exists g\, \forall x \left[x \in f\left(\left\{ X \mid \text{men}(X) \right\} \right) \rightarrow x \text{ loves } g(\text{woman}) \right]$$

Here, *f* is meant to pick a subset of the set of men. (Matthewson does not use a class selection function but assumes that the argument of the choice-function is a set of plural individuals made up entirely of men). The universal quantifier then applies to this subset of men. It is asserted that there exists an f such that all men chosen by *f* love the woman chosen by *g*.

This is much too weak to capture the truth-conditions of this sentence. Presumably it doesn't make a true claim just because there are two men who love the woman even though other relevant men don't. But of course there is a function which chooses just the right men. The universal force of the sentence would seriously misfire.

This problem can only be avoided if the value of the function variable is not subject to existential closure but is left to be contextually determined.

What we seem to have is this: the class selection function involved in the interpretation of indefinites is existentially closed, while the class selection function involved in the interpretation of other quantifiers is contextually valued.

Another Problem

Choice functions choose a particular element from sets. For different sets, they can choose different elements. In fact, even for sets that are very similar but not identical, they can choose different elements. For example, a function may choose *John* from the set of students but *Mary* from the set of linguistics students (even if John is also in the set of linguistics students).

This creates a potential problem for Kratzer's approach. The following looks like a valid inference:

> *Every professor will rejoice if an American student of his cheats on the exam.*
> *Therefore:*
> *Every professor will rejoice if a student of his cheats on the exam.*

But this inference will be far from valid for arbitrary choice functions. Here are the LFs:

> (every professor)$_X$ (if $\mathbf{f}_X$ ({x: American(x) & student(x)}) cheats, x will rejoice)
> (every professor)$_X$ (if $\mathbf{f}_X$ ({x: student(x)}) cheats, x will rejoice)

Since f_X will in general be able to pick different students from the two different sets, the inference will not be valid.

The problem does not arise if we have existential closure over choice functions. If there is some way of picking from American students to make the first sentence true, then there will be some way (not necessarily given by the same choice function) to pick from the set of students to make the second sentence true.

There is another possibility. We could stipulate that the choice functions or class selection functions available to natural language have a formal property that would make the inference above valid after all. Here is such a property:

> A class selection function *f* (a function from sets to sets, which always selects a subset of the input set) is intersective if there is a set A such that for all sets X in the domain of *f*: $f(X) = A \leftrightarrow X$.

If we use class selection functions for indefinites as well, we could solve the problem just discussed by stipulating that the class selection function has to be intersective. If f_X is intersective than any student chosen from the set of American students also has to be chosen from the superset of students. What is allowed is for f_X to pick additional students from the larger set, but it can't leave out any of the ones picked from the smaller set.

Some Remarks on Salience

???

You have to help me here.

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