

# Examining domain adverbs semantically \*

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## I Introduction

- What is the semantics of “domain” adverbs?
  - (1) Linguistically, this example is interesting. (Bellert 1977, (37))
  - (2) Physically, the climb had become more difficult. (Ernst 2004, (2b))
  - (3) Financially, he’s an octopus, with tentacles everywhere. (Ernst 2002)
  - (4) Legally, Alfonso was driving (even though he was actually asleep with his head pulling the steering wheel to the right).
  - (5) Philosophically, what does it mean to be the author of a FAQ about oneself?<sup>1</sup>
  - (6) Legally, was Alfonso the one who was driving?
  - (7) Technically, this is not spam but.... it sure looks like it to me.<sup>2</sup>
  - (8) “This suggests that, socio-economically, obesity is not as stigmatizing for men as it is for women.”<sup>3</sup>
  - (9) Politically, California is irrelevant.<sup>4</sup>
  - (10) The criticism that our efforts are undermanned are (*sic*) on target, but politically you can’t talk about putting in more troops because that will require activating more reserves.<sup>5</sup>
- I will look at clause-initial “definitional” cases, exemplified by (4) but not by, e.g., (8). In Ernst 2002’s terminology, this is a subset of the SPECIFY readings.
- Two alternative treatments: Domain adverbs (DAs) as modal operators (quantifiers over possible worlds), and as operators that switch models
- I consider the effect of DAs on two kinds of things within their scope: non-modal predicates (Ns, Vs, As), and modals.

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<sup>1</sup><http://pwp.detritus.net/news/1999/07.html>

<sup>2</sup><http://www.webmasterworld.com/forum5/186.htm>

<sup>3</sup>quoted in <http://www.cbsnews.com/stories/2004/03/03/health/main603825.shtml>

<sup>4</sup><http://veganmegan.proboards25.com/index.cgi?board=news&action=display&num=1078508691>

<sup>5</sup><http://www.emory.edu/central/NEWS/Releases/rebuilding1050930193.html>

## 1.1 Things I won't consider

- (11) Legally, Alfonso is a midget. (I'll ignore the following readings:)
- a. The law allows Alfonso to be a midget.
  - b. In terms of his ability to handle legal things, Alfonso is of lesser stature than others. (Ernst: SHIFT reading.)
- (12) His knee will have to be surgically replaced. (MEANS-DOMAIN readings, (Ernst 2004, 6a), (see Moltmann 1997, esp. 3.1.2.2 and 6.2))<sup>6</sup>
- (13) Joana was speaking legally.
- While I believe that different sorts of domain readings (beyond the definitional ones here) should be given a unified analysis, I won't talk about that here.

## 2 Starting point

- Two analyses due to Ernst: they contain the minimum amount of semantics necessary for a syntactic account, and leave much unspecified.
  - Ernst 2002: adverb binds a contextual variable restricting the eventuality<sup>7</sup>
- (1) Linguistically, this example is interesting.
- (1')  $(\exists c^* . CR(c^* , linguistic) \wedge (\exists e \in D_\nu . Interesting(e) \wedge Th(e, example) \wedge UNDER(e, c^*)))$
- Ernst 2004: “ ‘IN-X-DOMAIN’ [...] is to be interpreted as ‘some contextually salient entity within [...] is in the X domain’ ”
- (1'')  $IN-LING-DOM[\exists e \in D_\nu . Interesting(e) \wedge Th(e, examples)]$
- Both of these leave semantic questions unanswered, and the answers are crucial for deriving truth conditions of the sentences. These are the questions I hope to address here:
- (14) a. What is a domain? (in particular, a “definitional” domain)
- b. What does it mean for something to be in some domain?

## 3 Analysis

### 3.1 Examples with simple predicates

- DAs often “affect” predicates in their scope.

<sup>6</sup>In fact, Moltmann's “dimensional” account, a development of the account in Bartsch 1986, may cover many of the other cases.

<sup>7</sup>In all that follows, I've translated Ernst's linearized DRT notation into a style that I am more comfortable with. Accidental misrepresentations of Ernst's semantics are due to me. For all my formulas, I will use a Heim and Kratzer (1998)-style notation for the lambda calculus, with some additions.  $D_\nu$  is the domain of events, kept separate from other things for simplicity.  $D_s$  is the domain of possible worlds.

- (15) Legally, the house is red. (even though it looks awfully pink to us)
- (16) Legally, Joana was driving the car.
- (17) Botanically, tomatoes are a fruit. (even though commonly, they are vegetables)
- (18) You charge that SOB every last penny he's got, since statistically he is incredibly likely to be a selfindulging egocentric moron.<sup>8</sup>

- DAs can (it seems) affect other things in their scope.

- (19) Legally, a nonprofit organization is one that does not declare a profit and instead utilizes all revenue available after normal operating expenses in service to the public interest.<sup>9</sup>
- (20) Economically, a library is like a school, not a bookstore.<sup>10</sup>
- (21) Legally, a monopoly or "trust" exists when an individual or firm can explicitly force competitors out of business by slashing prices, buying up and hoarding supplies, bribery or intimidation.<sup>11</sup>
- (22) (Alfonso has just been arrested. The police department keeps someone around who is a lawyer in name only: he passed the bar 40 years ago, doesn't practice beyond what the PD has him do, and doesn't remember anything much from law school. The PD provides only this guy as Alfonso's lawyer.)
- Legally, a lawyer spoke to Alfonso.
  - Legally, Alfonso spoke to a lawyer.
- (23) Botanically, a fruit always develops from a flower and is composed of at least one ripened ovary. Botanically, a vegetable is any edible part of a plant other than the flower.<sup>12</sup>

- Certain things it is very hard for DAs to affect. Consider (15) again, in a context where the law makes certain provisions as to what constitutes being a house. It is difficult/impossible to find a context of this kind (or any kind) where the DA mandates that we presuppose the existence of something that is defined as a house.<sup>13</sup>

- (15) Legally, the house is red.

- When under the scope of a domain adverb, many predicates seem to have different extensions than when not.

### 3.2 Two analyses

- Different views of the same worlds:** The world doesn't change, but how we split up the world (i.e. how we define 'redness' changes).
- Different worlds with the same views:** The world changes, and in other worlds things are split up differently differently (the extension of red in those worlds is not like in our world).

<sup>8</sup>regarding ethical software pricing: <http://discuss.fogcreek.com/joelonsoftware/default.asp?cmd=show&ixPost=129972>

<sup>9</sup><http://nonprofit.about.com/library/weekly/aa120402.htm>

<sup>10</sup><http://www.kcoyle.net/letter.html>

<sup>11</sup><http://www.thisnation.com/question/027.html>

<sup>12</sup><http://www.hcs.ohio-state.edu/mg/manual/botany.htm>

<sup>13</sup>We can get this reading with some special (paralinguistic?) intonation - this needs to be fairly pronounced and is of a particular kind that usually seems to carry irony.

- Two examples to illustrate the differences.
- (24) **Legal Timberland:** (from California Title 5 section 51104 item f) “*Timberland*” means privately owned land, or land acquired for state forest purposes, which is devoted to and used for growing and harvesting timber, or for growing and harvesting timber and compatible uses, and which is capable of growing an average annual volume of wood fiber of at least 15 cubic feet per acre.
- (25) **Conventional Timberland:** For me at least, timberland is just any land with a fair amount of trees on it, where lumbering happens. Vaguer than (24).
- For simplicity, assume that the law consists only of the provision I outlined above, and that there is only one piece of land in any world.
- (26) That land is/isn’t timberland.
- (27) Legally, that land is/isn’t timberland.

### Example: different views of the same worlds

- We shift the model on which we evaluate predicates.
- there are only four worlds, each with a counterpart of the piece of land under discussion: (LT = Legal Timberland by (24), CT = Conventional Timberland by (25))

	LT	CT
$w_1$ : the land is owned by the government, used for lumbering, and not acquired for state forest purposes.	-	+
$w_2$ : the land satisfies the description in (24), and is used solely for lumbering.	+	+
$w_3$ : the land satisfies the description in (24), even though only an occasional tree is cut down, and the owners intend only to ever use it for “compatible uses” (say, for management of a watershed, which is allowed in 51104 (h)).	+	-
$w_4$ : the land is a treeless meadow.	-	-

- When not under the scope of a domain adverb,  $\llbracket \text{timberland} \rrbracket$  picks out the counterparts of the land in  $w_1$  and  $w_2$ . The intension of  $\llbracket \text{that land is timberland} \rrbracket$  is  $\{w_1, w_2\}$ .  
We would include  $w_1$ , because no matter what the law says, timberland is timberland. We would not include  $w_3$  because it’s obvious that the law only considers it timberland as a technicality - it’s not really timberland.
- “Legally”, when in sentence initial position, involves us replacing our conventional notion of “timberland” with something different. When interpreted under the scope of this DA (ignoring how it works)  $\llbracket \text{timberland} \rrbracket$  picks out the counterparts of the land in  $w_2$  and  $w_3$ . The intension of  $\llbracket \text{that land is timberland} \rrbracket$  in this scope is  $\{w_2, w_3\}$ .
- We consider the truth of the sentence in the usual evaluation world, but with *changed intensions* in the scope of the DA.
- This accords with the intuition that the domain adverb does something like change the meaning of the word.

**Example: different worlds with the same views**

- The domain adverb forces us to only consider worlds in which the extensions of relevant predicates coincide with the extensions specified in the law. In particular, we consider the closest of these worlds to the evaluation world.
- There are eight worlds:  
(CT: whether the land matches description of conventional timberland in (25), LT: whether it matches description of legal timberland in (24))

	LT	CT
$w'_1$ : like $w_1$ , and the land is not in <b>timberland</b> .	-	+
$w'_2$ : like $w_2$ , and the land is not in <b>timberland</b> .	+	+
$w'_3$ : like $w_3$ , and the land is not in <b>timberland</b> .	+	-
$w'_4$ : like $w_4$ , and the land is not in <b>timberland</b> .	-	-
$w''_1$ : like $w_1$ , and the land is in <b>timberland</b> .	-	+
$w''_2$ : like $w_2$ , and the land is in <b>timberland</b> .	+	+
$w''_3$ : like $w_3$ , and the land is in <b>timberland</b> .	+	-
$w''_4$ : like $w_4$ , and the land is in <b>timberland</b> .	-	-

- Unlike the different views analysis, all possible values for **timberland** appear in some world, and the extensions are fixed from the start.
- **timberland** picks out the counterparts of the land in  $w'_1, w'_2, w'_3, w'_4$ .
- We quantify over possible worlds, and only look at worlds in which the things that count as timberland match the “definition” of timberland that we’re using.
  - For the conventional definition of timberland: worlds in which the extension of timberland coincides (roughly) with the extension of “place with lots of trees” and “place where trees get cut down”.
  - Worlds in which the conventional definition is satisfied:  $\{w'_3, w'_4, w''_1, w''_2\}$ .
  - Worlds in which the legal definition is satisfied:  $\{w'_1, w'_4, w''_2, w''_3\}$ .
  - Given a domain  $x$ : for all worlds in which the  $x$  definition is satisfied, and everything else is like the evaluation world, that land is timberland in those worlds.
  - “everything else is like the evaluation world”: roughly, we take the closest world where the definition is satisfied.
  - This treats DAs as modal operators.
  - The intension of **that land is timberland** is sensitive to the definition(s) being used. Under conventional definition, it is  $\{w'_1, w'_2, w''_1, w''_2\}$ . Under legal definition, it is  $\{w'_2, w'_3, w''_2, w''_3\}$ .
  - For the conventional meaning: the closest clause causes us, if the evaluation world is  $w'_1$ , to not look at that world, but at the closest world where the definition is satisfied. This is  $w''_1$ , which holds the facts constant except for the extension of timberland.
  - We should usually not consider  $w_3$  (or  $w_4$ ) unless some operator gets us there. The context might be enough; consider an environmentalist protesting the clearcutting of the land in  $w_1$ :

(28) You can't do that! That's not timberland!

### 3.3 First passes

- ‘Legally’ makes items be defined in the same way the law defines them. ‘Technically’ sharpens the extensions, removing some of the vagueness.
- A domain is (contingently) a set of propositions characterizing how things are “divided up” in some domain.
  - A legal domain (for some body of law in some world) is the set of propositions laying out not what that law allows/disallows, but the ways in which it defines things. It would contain propositions that say things like (24).
  - An economic domain is the set of propositions that make up how economics would (naively) define things. Many of the terms here would only be vaguely defined conventionally, if at all. Some are in common; for instance, one classical theory (apparently) says that “land” is “The entire material universe exclusive of people and their products.”<sup>14</sup> I don’t think this works at all, conventionally; I would never have thought that trees (in virgin forest) are land. (the cited page mentions that in cultivated forest they are not.)
  - A technical domain is one where attention is paid to the technicalities. This is a little hard to characterize in propositions - I’ll leave this in the background.
- Does this object look familiar? Yes - a set of propositions in world is the same kind of thing as a *conversational background* in the terms of Kratzer 1981, 1991 - something of type  $\langle s \langle \langle st \rangle t \rangle \rangle$ . They aren’t much different from her circumstantial backgrounds; here they’re also limited by the meaning of certain lexical items.

### Different worlds theory

- An analogy with elements under the scope of e.g. ‘believe’ (though this is just an analogy, I don’t think it goes very far): Someone can have different beliefs about e.g. what constitutes being red.
 

(29) Alfonso believes that the land is timberland.
- Roughly: Alfonso believes himself to be in some world  $w$  such that the land is in the extension of “timberland” in  $w$ . This world may be at variance with the actual world, and with many other worlds. It may be at variance with what anyone else believes about timberland and that land.
- Since extensions of this kind may be contingent in this way, perhaps we can apply it to domain adverbs, where extensions also seem to change.
- Domain adverbs are modal operators (necessity) that assert truth of their clause in possible worlds defined according to the domain. The domain comes from the lexical content of the adverb itself.
- Where do the conversational backgrounds come from? I will say from the context, and the speaker presupposes that they are shared.
- I won’t spell out the ordering semantics here; see Kratzer 1981, 1991; Lewis 1981 among others for more details.

<sup>14</sup><http://www.henrygeorge.org/def2.htm#defn>

- (30) For any context  $c$  which contains a conversational background  $b_c$  that is “definitional” and “legal”, and a (realistic) ordering source  $o_c$ ,  $\llbracket \text{legally} \rrbracket^{g,w,c} = \lambda p \in D_{\langle st \rangle} . (\forall w' \text{ in } D_s : w' \in \cap b_c(w) \wedge \text{there is no closer } w'' \in \cap b_c(w) \text{ to } w \text{ according to } o_c] p(w'))$ , and for other contexts  $c$ ,  $\llbracket \text{legally} \rrbracket^{g,w,c}$  is not defined.
- What is a “definitional” c.b.? I don’t have a good answer, but it’s more like epistemic/doxastic than deontic. Perhaps it doesn’t differ from the actual world in matters of physical fact?
  - In the ideals (sets of completely-conforming worlds) picked out by these backgrounds, the extensions of predicates may differ from what they are in the actual world. The legal ideal might include the land in timberland, whereas we would not.
  - **Very important** (and slightly mysterious): What is different in these worlds is *not* the denotation of e.g. “timberland”. The denotation of “timberland” is already relative to a world ( $\llbracket \text{timberland} \rrbracket^{g,w,c} = \lambda x . x \text{ is timberland in } w$ ). What is different, in effect, is the set of propositions against which we determine timberlandness.
  - given a context  $c$  with a legal epistemic c.b.  $b_c$ ,  $\llbracket \text{legally the land is timberland} \rrbracket^{g,w,c} = 1$  iff  $(\lambda x [\forall w' \in D_s : w' \in \cap b_c(w)] (x \text{ is timberland in } w')) (x . x \text{ is land in } w)$   
(*q: what to do with definite here? I've treated it as if it QR'd for now*)
  - I’ll dodge the issue (for now) of whether anything is asserted to be true in the actual world.
  - Some domains may inherit much from the actual world which they don’t discuss: e.g. ‘statistically’ doesn’t seem to affect many predicates.
  - Why necessity? For this kind of example, it’s not clear to me that this is right or how I’d tell if it weren’t. But, we want some kind of certainty that the house is really “red” before taking legal action.
  - A side note: This approach appears to work out nicely for DAs in questions (e.g. 5,6) with the Groenendijk and Stokhof 1997 approach.

### Different views theory

- There are doubtless many technical tricks that could be employed here in changing how the interpretation function works. It seems to need to be relativized somehow.
- What I’ll do is relativize it to a conversational background, which is of the same makeup discussed earlier. Call it  $b$ , it’ll be a parameter like the evaluation world, assignment function, and context:  $\llbracket \rrbracket^{g,w,c,b}$ .
- By default, this value is assigned to consist of “conventional” meaning. It might actually be definitional propositions assumed to be shared by the speaker and hearer(s). (i.e. one doesn’t normally use terminology or shades of meaning one doesn’t think any of the hearers will get)
- predicates are interpreted relative to such a thing, as well as an evaluation world.  $\llbracket \text{timberland} \rrbracket^{g,w,c,b} = \lambda x \in D_e . (x \text{ is timberland in } w)$  follows from  $b(w)$ .
  - One way to capture “follows from” uses Kratzer’s possible worlds definition, but this requires there be more worlds than I set up. This amounts to every predicate having an implicit modal force.

- The real intuition: what we really do here is **switch models** when under the scope of such an operator. The *b* argument is like a set of meaning postulates.
  - This means *b* needs to consist of formulas, not propositions (which have already been interpreted on a particular model).
  - Furthermore, meaning postulates pick out a class of models, not a particular model. Intuitively, we want to evaluate the sentence on a particular model (or models) that is as “close” to the current one as possible. (Very similar kind of ordering to the modal kind!)
- Consequences of embedding:
    - (31) The Guild believes that legally, the check off provisions remain in effect...<sup>15</sup>
    - (32) Dr. Holder believes that, technically, there is no cure for addictions.<sup>16</sup>
  - *b* is contingent. This means we need to be able to get at some of a person’s beliefs (about the law) as an (uninterpreted) formula, something which we don’t typically work with directly.

### 3.4 Examples with modals

- (33) Legally, the house can be red
- (34) Legally, banks must report interest to the IRS and taxpayers must include it as income.<sup>17</sup>
- (35) Yvette wants to do things, but physically she can’t.<sup>18</sup>
- (36) Biologically, man must eat in order to live...<sup>19</sup>
- (37) Technically, you can’t actually buy an index.<sup>20</sup>
- (38) Even though technically the IRS can ask that returns for all previous years be filed (no matter the number), it will normally be satisfied if back returns for the preceding six years are filed.<sup>21</sup>
- (39) Legally, that land might be timberland.
  - Prominent reading of (33): according to the law, houses are permitted to be red.
  - The domain adverb has *the same* effect as the in-view-of phrases which Kratzer uses to force certain kinds of conversational backgrounds.
- (40) a. In view of what the law provides, Jockl must go to jail. (from Kratzer (1991))
  - b. In view of what their tribal duties are, the Maori children must learn the names of their ancestors. (from Kratzer (1977))
- (41) Legally, Jockl must go to jail.
  - Does the domain adverb in (33) have the same effect on “red” or “drive” as it had in a sentence without modals?

<sup>15</sup>About the status of a contract between the Providence Newspaper Guild and the Providence Journal; <http://www.riguild.org/glxi20.htm>

<sup>16</sup><http://www.acacd.com/art4.htm>

<sup>17</sup><http://www.snopes.com/inboxer/scams/irsform.htm>

<sup>18</sup>about someone with “Chronic Fatigue Syndrome”. <http://www.afme.org.uk/allaboutme.asp?id=15>

<sup>19</sup><http://www.newark-church.com/html/trust.html>

<sup>20</sup><http://simulator.investopedia.com/help/index.aspx>

<sup>21</sup>via Google cache, <http://www.a.ca.ch/nonfiler.htm>

(42) Legally, John is driving

(43) Legally, John can drive

- It is entirely possible that from a legal viewpoint, John is not allowed to do all the things that the law calls driving. He also is not allowed to do anything the law doesn't call driving, but might be considered driving commonly.
- Though the DA forces a deontic reading for "can" in (43), I have suggested above that the modal flavor involved in the DA itself is not deontic. This distinction is not always so clear, however.

(44) Physically, John can drive (though he doesn't know how)

#### 4 Putting the pieces together

(45) **Effects to be accounted for:**

- Effect 1: A domain adverb in front of a simple sentence gives us (somehow) shifted extensions of predicates in that sentence.
- Effect 2: A domain adverb in front of a modal sentence forces the conversational background (= ordering source) used to interpret that modal to be of roughly the kind picked out by the adverb.

- *Can we make these two effects a natural class?*
- How do current approaches relate in-view-of phrases and modals? One approach is to simply do what I've done for the domain adverbs - have the c.b. in the context and picked up by the modal. Another approach is to treat them as bound variables in the syntax at LF.

(46) Four approaches to domain adverbs and modals:

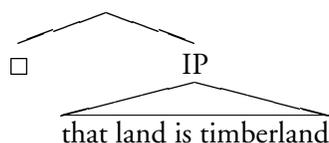
- DAs have different effects on modals and predicates. These should simply be explained in different ways.
- The appearance of a direct effect of a DA on a modal or a predicate is an illusion, and one or the other (probably the effect on the predicate) is mediated by something invisible. Perhaps non-modal sentences have a default modal force? (+ different worlds)
- Make other predicates look like modals:
  - Contextual index:  
When interpreting a predicate, have a predicate not be sensitive to evaluation world directly, but have it pick out from the context a variable of type  $\langle s \langle \langle st \rangle t \rangle \rangle$  (a c.b./domain), and have it use that to determine its extension in the eval. world. Normally, this would be the set of typical beliefs about what things are, but DAs could shift this (and so could modals). (+ different views)
  - Bound variable:  
Have the DA bind a variable of type  $\langle s \langle \langle st \rangle t \rangle \rangle$ , again a c.b./domain, inside the predicates that it affects. Give a story of why modals block this (maybe they also bind such variables).

## D. Make modals look like other predicates:

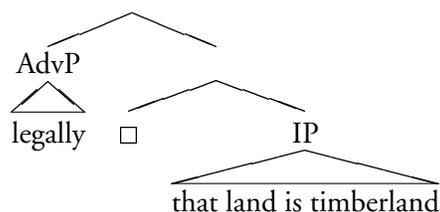
Instead of sensitive to a c.b. in the context/bound in them, make modals (more) sensitive to evaluation world/model, and explain why their extension is shifted by a DA. In the “different worlds” approach, modals are another kind of contingent predicate. In the “different views” approach, I’m not sure what to say.

- I’ll sketch the B approach.
- What would the default modal force be, and what kind of c.b. would it use?
- Heim had non-modal sentences work out (more or less) as necessity w.r.t. the context set.
- When a DA is present, we get a c.b. that shifts extensions according to legal, economic, etc. notions of how the world works. If what I have been implicitly treating as the unshifted extension must also be evaluated according to some c.b., this must be the background that talks about our normal notion of how the world works.
- The (default) context set would also contain only worlds picked out by conventional definitional propositions.
- The modal force should be necessity, the same as when a DA is present. When we make a (non-modal) assertion, it should be true only in “definitional” worlds (of which the context set is a subset).
- There is an implicit modal operator in non-modal sentences.
- DAs don’t supply the modal force; they simply fill in (i.e. restrict) the background used by whatever modal force is present in the sentence.

(47)



(48)



## 4.1 Conclusions

- Domain adverbs have a viable treatment as modal operators, and possibly as model shifters.
- What are the answers to the initial questions? (different worlds approach)
  - A **domain** is a function from worlds to sets of propositions. It picks out propositions that describe the aggregated “beliefs” of that domain.
  - When something is **in a domain**, it is necessarily true/exists in view of the domain.
- What are the answers to the initial questions? (different views approach)
  - A **domain** is a function from worlds to sets of formulas of the logic being used. These formula are used as meaning postulates to restrict the class of models under which interpretation of sentences happens.

- When something is **in a domain**, it is true on the appropriate model closest to the actual world.
- What would either of these buy us?
  - Truth-conditional understanding of some aspects of domain adverbs.
  - (Different worlds) An understanding based on a reasonably well-studied system (modality).
  - The beginnings of a general mechanism for interpreting adverbials which interact with modals.
  - A wedge analysis with which to look at other domain adverbs.
  - (Different worlds) A parallel with some non-domain adverbs (illegally, rudely, cleverly, immorally, the permissive reading of legally) which I have argued elsewhere are best treated as (deontic) modal operators. (Rawlins 2008)
- Unresolved:
  - How does this fit with Ernst's two analyses?
  - Can this be extended to non-definitional domain adverbs?
  - Can this be extended to domain adverbs used as manner adverbs?
  - I would like to explore in more detail the interaction with modals and questions.
  - Are there empirical ways of distinguishing the approaches I've outlined here?

## Bibliography

- Renate Bartsch. The construction of properties under perspectives. *Journal of Semantics*, 5(4):293–320, 1986.
- Irena Bellert. On semantic and distributional properties of sentential adverbs. *Linguistic Inquiry*, 8(2): 337–351, 1977.
- Thomas Ernst. *The Syntax of Adjuncts*. Cambridge University Press, 2002.
- Thomas Ernst. Domain adverbs and the syntax of adjuncts. In Jennifer R. Austin, Stefan Engelberg, and Gisa Rauh, editors, *Adverbials: the Interplay between Meaning, Context, and Syntactic Structure*. John Benjamins, 2004.
- Jeroen Groenendijk and Martin Stokhof. Questions. In J. van Benthem and A. ter Meulen, editors, *Handbook of Logic and Language*, pages 1055–1124. Elsevier/MIT Press, 1997.
- Irene Heim and Angelika Kratzer. *Semantics in Generative Grammar*. Blackwell, 1998.
- Angelika Kratzer. What ‘must’ and ‘can’ must and can mean. *Linguistics and Philosophy*, 1:337–355, 1977.
- Angelika Kratzer. The notional category of modality. In Hans-Jürgen Eikmeyer and Hannes Rieser, editors, *Words, Worlds, and Contexts: New Approaches in World Semantics*, pages 38–74. Walter de Gruyter, Berlin, 1981.
- Angelika Kratzer. Modality. In A. von Stechow and D. Wunderlich, editors, *Semantics: an International Handbook of Contemporary Research*, pages 639–650. Mouton de Gruyter, Berlin and New York, 1991.
- David Lewis. Ordering semantics and premise semantics for counterfactuals. *The Journal of Philosophical Logic*, 10:217–234, 1981.
- Friederike Moltmann. *Parts and Wholes in Semantics*. Oxford University Press, 1997.
- Kyle Rawlins. Unifying ‘illegally’. In Johannes Dölling, Tatjana Heyde-Zybatow, and Martin Schäfer, editors, *Event Structures in Linguistic Form and Interpretation*, Language, Context and Cognition, pages 81–102. Mouton de Gruyter, 2008.