**Disjunction: dynamics & alternatives**
**March 25, 2015**

# 1 Today

- We shift our gaze from indefinites, indeterminates, and focus — to disjunction. We'll see a number of empirical properties of natural language (well, English) disjunction that aren't readily accounted for on a classical picture — i.e. one in which *or* denotes the boolean $\vee$.
- We'll also explore the varied sorts of accounts that have been offered as explanation for these facts.
- Though there will be some differences between the theories we look at, I will suggest that these are relatively superficial.
- In particular, we will see that each of them can be thought of as an *alternatives-oriented* semantics. In some cases, the connection will be quite direct. In others, less so (though still, I'll suggest, very real). Thus, the theme is a familiar one. We get evidence from a variety of domains for alternatives as an important part of the theoretical picture.
- Yet the different perspectives taken in these varied domains (due in part to the different natures of the phenomena under investigation) will make it not obvious whether these accounts can give rise to a unified picture — again, a by-now familiar state of affairs. This will set the stage for the next few weeks, in which we start to construct such a unified theory, and measure it against the (ahem) alternatives.

# 2 The dynamics of disjunction

- Disjunctions can serve up an antecedent for a donkey pronoun (Rooth & Partee 1982; Stone 1992):

(1) Whenever Mary sees John$_i$ or Bill$_i$, she waves to him$_i$.

(2) If a farmer owns a donkey$_i$ or a horse$_i$, he beats it$_i$.

- Though Stone does not discusss cross-sentential anaphora directly,[1] it has been argued that cases of cross-sentential anaphora to a disjunction exist (e.g. Schlenker 2011a,b):

(3) ?Mary will bake a strudel$_i$, or John will buy a pie$_i$. I'll devour it$_i$.

(4) ?I saw either Bill$_i$ or Sam$_i$ yesterday at the grocery store. He$_i$ was buying grapes.

It is an interesting question why cross-sentential anaphora to disjuncts is more marked than donkey anaphora to disjuncts with subordinating connectives like *if* or *when*. To my knowledge, nobody has given a story for why this should be the case.

- As Stone 1992 emphasizes, the disjoined thing needn't be the direct antecedent of the donkey pronoun (in fact, the Schlenker sentences above already bear this out, but it'll be useful to look at some more obviously copacetic cases):

(5) Whenever Mary$_i$ sees John$_j$, or Sue$_i$ sees Bill$_j$, she$_i$ waves to him$_j$.

(6) Whenver I write to a semanticist$_i$ or talk to a phonologist$_i$, I ask about her$_i$ work.

- Stone's data can actually be accounted for using the tools we developed in the last class. Here is a meaning for disjunction which captures all the cases we need:

$$[\![\text{X or Y}]\!] \coloneqq \lambda\kappa.\,\lambda s.\,[\![\text{X}]\!](\kappa)(s) \cup [\![\text{Y}]\!](\kappa)(s) \tag{1}$$

- The effect of this lexical entry — ignoring $\kappa$, which you can think of as "whatever else we need to make a sentence", roughly[2] — is to *combine* the update encoded by X with the update encoded by Y, and return a state that represents a composite update, one which is in a sense **intermediate** between the updates encoded by each of the disjuncts.
- To illustrate, it's easiest to start with disjoined sentences. Recall that on our compositionalization of Dekker 1994 (Week 8), a sentence of the form

[1] He comes close, but the cases he considers are all arguably cases of *subordination*.

[2] More, specifically, the purpose of $\kappa$ is to *generalize* the disjunction in order to allow things of arbitary types to be disjoined. So for example, the lexical entry given here works for sentences, names, VPs, and so on (cf. Partee & Rooth 1983; Barker 2002; Charlow 2014).

$x$ *left* denotes the following update (given some incoming state $s$):

$$s[x \text{ left}] = \begin{cases} \{e \cdot x : e \in s\} \text{ if } x \text{ left} \\ \varnothing \text{ otherwise} \end{cases} \tag{2}$$

Given our proposal for disjunction, this in turn means that if we disjoin e.g. $x$ *left* with $y$ *ran*, we will end up with the following, assuming that $x$ left and $y$ ran (notice that $\kappa$ is in a sense "idle" here):

$$\begin{aligned} &\{e \cdot x : e \in s\} \cup \{e \cdot y : e \in s\} \\ &= \{e \cdot v : e \in s \wedge v \in \{x, y\}\} \end{aligned}$$

- The generalized nature of the disjunction allows us to disjoin two proper names, as well:

$$\begin{aligned} [\![\text{John or Bill}]\!] &= \lambda P.\, \lambda s.\, [\![\text{John}]\!](P)(s) \cup [\![\text{Bill}]\!](P)(s) \\ &= \lambda P.\, \lambda s.\, P(\textsc{j})(s \cdot \textsc{j}) \cup P(\textsc{b})(s \cdot \textsc{b}) \\ &= \lambda P.\, \lambda s.\, \bigcup\{P(x)(s \cdot x) : x \in \{\textsc{j}, \textsc{b}\}\} \end{aligned} \tag{3}$$

  The result is precisely the same as if you'd uttered the (awkward) indefinite phrase *somebody who's John or Bill*.

- Finally, we can disjoin things like VPs, as well. The result, as before, is that the sentence as a whole will generate discourse referents that are, in some sense, intermediate between the discourse referents generated in each of the disjuncts (in addition to any generated by the subject).

- Stone 1992 argues that his data tends to favor a situations-based view of donkey anaphora. The argument is a little abstruse, but the basic idea is that dynamic semantics ('DRT' for Stone) is too flat-footed to construct the requisite drefs on the fly.

- In fact, as the toy analysis given above shows, the argument against dynamic semantics presented by such cases is not so cut-and-dry (though it has been fairly frequently thought to be such over the years, cf. e.g. Elbourne 2005; Barker & Shan 2008).

- In any case, it is certainly worth considering how we might construct an alternatives+situations account of this stuff.



# 3 Disjunctions and choice-offering

- Main goal: account of modal/*or* interactions. Basic data:

  (7) You may post the letter or burn it.

  (8) You must post the letter or burn it.

- Intuitively, both sentences give you permission to post the letter, and permission to burn it (though neither explicitly gives you permission to do both). How does this come about?

- It cannot just be from the classical meaning of the connectives, coupled with a standard accessibility-relation semantics for the modal. Consider the following:

$$\begin{aligned} &\exists w \in \textsc{acc}.\, \textsc{post}(w) \vee \textsc{burn}(w) \\ &\forall w \in \textsc{acc}.\, \textsc{post}(w) \vee \textsc{burn}(w) \end{aligned} \tag{4}$$

  The problem: neither of these truth-conditions guarantees that each of the things is permitted! Notice e.g. that every POST-world is classically a POST-or-BURN world.

- Thought: it's an implicature. Very easy to see how this goes for the strong modal *must*. Via a fairly vanilla implicature algorithm à la Sauerland 2004, you derive (roughly) the following implicature, which entails (in conjunction with the asserted content that at least posting or burning is required) that both posting and burning are permitted:

$$\begin{aligned} &\neg\forall w \in \textsc{acc}.\, \textsc{post}(w) \wedge \\ &\neg\forall w \in \textsc{acc}.\, \textsc{burn}(w) \wedge \\ &\neg\forall w \in \textsc{acc}.\, \textsc{post}(w) \wedge \textsc{burn}(w) \end{aligned}$$

  However, it is less obvious how this might carry over to the cases with weak modals such as *may*. (Though this has been done! See work by Fox, Chierchia, and others...)

- Simons goes another direction, following a rich tradition of analyzing free-choice effects like these in terms of alternatives introduced by the disjunction (see also Kratzer & Shimoyama 2002; Alonso-Ovalle 2006).

- The basic shape of the account:

$$[\![\text{may } [\phi \text{ or } \psi]]\!] = \exists S \subseteq \textsc{acc}.\, S \text{ is divided up into } \phi \text{ and } \psi \text{ worlds} \quad (5)$$

- Equivalently, modulo some details I'd like to abstract away from today (cf. also Aloni 2007 for a related proposal):

$$[\![\text{may } [\phi \text{ or } \psi]]\!] = \forall p \in \{[\![\phi]\!], [\![\psi]\!]\}.\, \exists w \in \textsc{acc}.\, p(w) \quad (6)$$

- The basic idea, then, might be thought of in terms of *alternative semantics*: disjunctions introduce alternatives, which expand up the tree via something like point-wise functional application (Simons's apparatus is actually much more involved... more in a second) until they meet a closure operator (here, the weak modal).

- I want to focus a bit on the compositional implementation, as well how this all relates to three of our desiderata: exceptional scope, abstraction, and selectivity. Let's begin with a quote (from Simons 2005:311):

> [I]t seems clear that once we admit sets of denotations as possible semantic values, [Hamblin application] is unavoidable.

- Notice now that disjunctions seem to take exceptional scope, exactly as the Hamblin picture would have it. E.g. the following admits a wide-scope-disjunction reading (e.g. Rooth & Partee 1982; Schlenker 2006; Brasoveanu & Farkas 2011):

(9) John thinks Bill said Mary was drinking or playing video games.

- In addition, (10) and (11) are ambiguous. Notice that this relates to selectivity. Does the modal capture all the alternatives, or only some? (Moreover, Simons suggests that certain combinations are simply impossible. We can discuss this if you wish.)

(10) Jane may sing or dance or read.

(11) Jane or Harriet may sing or dance.

- Simons 2005 suggests that we needn't fix a single answer. Sometimes the modal captures all the alternatives in its scope; other times it does not. She achieves this by allowing the interpretation function to sometimes generate higher-order alternative sets. NB: on this perspective, $[\![\cdot]\!]$ is no longer a function, but a *relation*.



- The consequences of abstraction (or lack thereof) *vis à vis* alternatives are left as an exercise ;).

## 4 Disjunction as inquisitive

- Groenendijk & Roelofsen 2009 proposes a kind of *inquisitive semantics*, in which sentence meanings are identified with *sets of possibilities*, i.e. sets of propositions.

- A **state** is a set of worlds. We begin by recursively characterizing when states **support** formulas:[3]

  - $\sigma \vDash p$ iff $\forall w \in \sigma.\, p(w)$ [for all **atomic** $p$]
  - $\sigma \vDash \neg\phi$ iff $\neg\exists w \in \phi.\, \{w\} \vDash \phi$
  - $\sigma \vDash \phi \vee \psi$ iff $\sigma \vDash \phi$ or $\sigma \vDash \psi$
  - $\sigma \vDash \phi \wedge \psi$ iff $\sigma \vDash \phi$ and $\sigma \vDash \psi$

  Everything here is fairly standard and classical, *with the exception of the clause for disjunction*. Compare a classical clause for disjunction:

$$\sigma \vDash \phi \vee \psi \text{ iff } \forall w \in \sigma.\, \{w\} \vDash \phi \text{ or } \{w\} \vDash \psi$$

- The meaning of a formula is given in terms of its **possibilities**. Definition of possibilities for $\phi$, which Groenendijk & Roelofsen write $\lfloor\phi\rfloor$: the set of all the *maximal* states that support $\phi$.

$$\lfloor\phi\rfloor \coloneqq \{\sigma \mid \sigma \vDash \phi \wedge \neg\exists\tau \supset \sigma.\, \tau \vDash \phi\} \quad (7)$$

- Note on terminology to head off any confusion: what Groenendijk & Roelofsen 2009 term *states* are the sorts of things we'd term *propositions*. What they term *propositions* are the sorts of things we'd term *sets of propositions*, or perhaps *questions*.

- Identifying the meaning of a formula with a set of possibilities is obviously no longer the classical picture.

[3] I leave out implication, but as is standard, you can define it in terms of $\wedge$ and $\neg$.

- For a simple disjunction of atomic formulae $p$ and $q$, we end up with the set of two propositions, the $p$-worlds, and the $q$-worlds!

$$\lfloor p \vee q \rfloor = \{[\![p]\!], [\![q]\!]\} \tag{8}$$

- Notice that the members of this set are the maximal states that support $p \vee q$. In particular, the state $\sigma$ which contains *all* the $p$ or $q$ worlds (as would be given by a classical semantics for disjunction), would in general both fail to support $p$ (since there would in general be worlds in $\sigma$ where only $q$ held), as well as fail to support $q$ (since there would in general be worlds in $\sigma$ where only $p$ held).

- For a negation of a disjunction, we end up with the maximal set of neither-$p$-nor-$q$ worlds:

$$\lfloor \neg(p \vee q) \rfloor = \{\{w : \neg p(w) \text{ and } \neg q(w)\}\} \tag{9}$$

- If we go back and negate *this* we end up with a flattened meaning with the same truth-conditions as disjunction, but less internal structure:

$$\lfloor \neg\neg(p \vee q) \rfloor = \{\{w : p(w) \text{ or } q(w)\}\} \tag{10}$$

  This should remind you of closure! Indeed, Groenendijk & Roelofsen define something they call *inquisitive closure* in terms of double-negation:

$$!\phi \coloneqq \neg\neg\phi \tag{11}$$

  You can think of $\lfloor \phi \rfloor$ as akin to the existential closure operation of alternative semantics (e.g. Kratzer & Shimoyama 2002).

- Notice that there is no *type-theoretic* distinction between garden-variety meanings and question-y meanings. Everything is just a set of possibilities (i.e. maximal states). Consider the following formulae:
  - Polar questions can be modeled as as polar disjunctions: $\phi \coloneqq \phi \vee \neg\phi$
  - Conditional questions such as *if John comes, will Bill?*: $\phi \rightarrow ?\psi$
  - Alternative questions: $?(\phi \vee \psi)$ — i.e. $(\phi \vee \psi) \vee \neg(\phi \vee \psi)$
  - Questions can be directly conjoined: $?\phi \wedge ?\psi$

- Meanings can be discriminated along other lines. In particular, meanings can be *informative* (that is, they eliminate some possibilities) and *inquisitive* (that is, more than one state is among their possibilities):
  - **Assertions** are informative but not inquisitive.
  - **Questions** are inquisitive but not informative.
  - **Hybrids** are both inquisitive *and* inquisitive.

- What exactly does this give us a handle on? Does it offer anything as pertains to linguistic phenomena that Kratzer & Shimoyama 2002 and Alonso-Ovalle 2006 — or, indeed, Karttunen 1977 —do not?

- Put a different way: to the extent that inquisitive semantics is supposed to be a theory of natural language (or, at least, a *framework* for doing formal-semantic analysis of natural language), we'd like an inquisitive-friendly characterization of the interpretation function $[\![\cdot]\!]$.

- But is there any reason to believe such an interpretation function would be fundamentally different from the $[\![\cdot]\!]$ posited by alternative-semanticists?

- NB: this is, emphatically, *not* to say that inquisitive semantics has nothing to teach us that we couldn't already have gleaned from alternative semantics. Rather, we should understand it as a logical tool — a framework, if you will — for exploring logical and mathematical notions of information and information exchange. Certainly these things are worthy of study; I am merely expressing a bit of skepticism that they will directly contribute to the research questions we're posing in this seminar.

- NB: the requirement that a possibility for $\phi$ be a *maximal* $\phi$-supporting state has been dropped in some recent work (e.g. Roelofsen 2013; Ciardelli & Roelofsen to appear). The reasons for this needn't concern us, but we can note that this does give a somewhat different picture from "classical" inquisitive semantics, as well as from alternative semantics.

## 5 Taking stock

- So, we have seen a variety of arguments for adopting some non-classical account of disjunction.

- The arguments came from different directions. We saw evidence that...
  - Disjunctions should allow us to introduce "disjunctive" — i.e. in some sense *indefinite* — discourse referents.
  - Disjunctions introduce alternatives which interact with operators like modals in a particular way (to generate free-choice effects).

  - Thinking about disjunctions in terms of alternatives is a fruitful way to conceptualize meaning in general (echoing the alternative-semantic perspective on meaning, though perhaps without a commitment to the notion that alternatives are made to be consumed by closure operators).

- I think that what differentiates these perspectives is of less importance than what unifies them. Specifically, it's hard to ignore that each of these treatments has it that the effect of a disjunction is in some sense to introduce *sets* or *alternatives* into the semantic computation.

- What this suggests is that each of these treatments is trying to model different aspects/manifestations of the a single underlying feature of disjunction. Yet it is not (yet) clear how to achieve this unified perspective.

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