

Disjunction under *if*

Outline: I argue that disjunction under *if* behaves like disjunction under negation. Accordingly, conditional antecedents license downward inferences. Failures of Antecedent Strengthening and related inferences are due to conditionals being subject to a covert *ceteris paribus* clause subsequent to the antecedent. *Or* retains its standard meaning as a propositional operator.

1 The datum

- Constituent disjunction under *if* is equivalent to sentential conjunction:
 - (1) a. If his mother sings or dances at the party, Nico will feel embarrassed.
 - b. If his mother sings at the party Nico will feel embarrassed and if his mother dances at the party Nico will feel embarrassed.
- Constituent disjunction is also equivalent to sentential conjunction in other contexts:
- Disjunction under negation (one of De Morgan's Laws):
 - (2) a. They didn't have decaf or tea.
 - b. They didn't have decaf and they didn't have tea.
- Disjunction in the restriction of a universal quantifier (Anti-additivity, Zwarts 1998):
 - (3) a. Every librarian who walks or bikes to work is healthy.
 - b. Every librarian who walks to work is healthy and every librarian who bikes to work is healthy.

- Disjunction under existential modals (Paradox of Free Choice, Von Wright 1969):
 - (4)
 - a. You may have cake or ice cream.
 - b. You may have cake and you may have ice cream.
 - (5)
 - a. He may be in New York or Boston.
 - b. He may be in New York and he may be in Boston.

- Disjunction under generics has also been said to license a conjunctive inference. Nickels (2011) says that *Elephants live in Africa or Asia* can be taken to mean that elephants live in Africa and that they live Asia but notes that a conjunctive inference is limited and not available in examples like *Elephants live in Africa or give birth to live young*. I will set it aside.

- The conjunctive inferences licensed by *or* are not present on a ‘discourse-level’ interpretation of *or*:
 - (6)
 - a. If his mother sings or dances at the party—I can’t remember which/I won’t tell you which—Nico will feel embarrassed.
 - b. They didn’t have decaf or tea—I can’t remember which/I won’t tell you which.
 - c. Every librarian who walks or bikes to work—I can’t remember which/I won’t tell you which—is healthy.
 - d. You may have cake or ice cream—I can’t remember which/I won’t tell you which.

- A great deal of attention has been given to the Paradox of Free Choice (e.g. Von Wright 1969, Kamp 1972, Aloni and van Rooij 2004, Geurts 2005, Alonso-Ovalle 2006, Aloni 2007, Chierchia 2006, Fox 2007, van Rooij 2010, Franke 2011). Various of these analyses are inspired by Kratzer and Shimoyama’s (2002) ‘exhaustification over disjuncts’ proposal. On this analysis *or* does not have its customary meaning but the disjuncts are accessed directly (cf. Sauerland 2004).¹

¹ The analysis assumes that when a cooperative speaker hears ‘You may have A or B’, she reasons in a Gricean manner that this statement is true according to the speaker and all its stronger alternatives must be ruled out. Crucially, the relevant alternatives are said to be the individual disjuncts ‘You may have A’ and ‘You may have B’ (rather than the conjunction ‘You may have A and B’). The hearer then asks “Why didn’t the speaker say ‘you may have A?’” She reasons that if it were because ‘You may have A’ is false, the speaker should have

- Alonso-Ovalle (2006, 2009) proposes to extend this type of analysis to disjunction under *or*.
- Asher and Bonevac (2005) analyze free choice permission in terms of a conditional with a disjunctive antecedent ('strong permission'). This means that 'You may have A or B' really has the logical form of 'if A or B there will be no sanction'. Whatever explains conditionals with disjunctive antecedents would on this approach also explain free choice permission.
- I think we should draw a parallel between disjunction under *if* and disjunction under *not* (and *every*), and set the Paradox of Free Choice aside.

2 A natural class: *if or* patterns with *not or*

Descriptive observation:
Disjunction under *if* patterns with disjunction under *not* and *every*, not with disjunction under *may*.

- NPI licensing:
Whereas *not (or)*, *if (or)* and *every (or)* license NPIs, *may (or)* does not:
- (7)
- a. Sue didn't hear anything (or remember anything).
 - b. If Sue hears anything (or remembers anything), she will write it down.
 - c. Everyone who hears (or remembers) anything suspicious should report it to the police.

said 'You may have B'. Since that does not explain why the speaker said 'You may have A or B', Kratzer and Shimoyama further propose to apply the neo-Gricean reasoning recursively to the disjunctive alternatives themselves ('You may have A', 'You may have B'). They argue that the hearer infers that reason the speaker did not say 'You may have A' is that it would have implied 'You may have A and you may not have B', by exhaustiveness. Similar reasoning applies to the alternative 'you may have B'. The hearer concludes that the speaker meant to permit both A and B. Fox's (2007) analysis is essentially similar in that it exhaustifies over the individual disjuncts, except that it posits an exhaustivity operator to derive upper-bounded implicature (cf. Chierchia 2006), and, moreover, includes 'You may have A and B' among the alternatives that are excluded, rendering $\Diamond(A \vee B)$ equivalent to $\Diamond A \wedge \Diamond B \wedge \neg \Diamond(A \wedge B)$. However, *You may have cake or ice cream* does not seem to entail that you may not have both but rather just implicates it.

- d. *Sue may hear anything (or remember anything).
 - Scalar implicature:
With *not or*, *every or* and *if or*, no upper-bounding conversational implicature arises. With *may or*, in contrast, we do find such an implicature:
- (8)
- a. I didn't see Amy or Tim #In fact, I didn't see both Amy and Tim.
No scalar implicature
 - b. If I see Amy or Tim, I'll call. #In fact, if I see Amy, I'll call and if I see Tim, I'll call.
No scalar implicature
 - c. Even though it was only 11 in the morning, everyone who was getting a manicure or pedicure was offered wine. #In fact, everyone who was getting a manicure was offered wine and everyone who was getting a pedicure was offered wine.
No scalar implicature
 - d. You may have cake or ice cream. In fact, you may have both.
Scalar implicature: You may not have both cake and ice cream.
- NPIs can be assumed to be licensed in DE environments (e.g. Fauconnier 1975, Ladusaw 1979). Conversely, upper-bounding conversational scalar implicatures for *or* ('but not both') do not arise in DE environments (e.g. Gazdar 1979, Horn 1989, Chierchia 2006; Herburger 2012).

Monotonicity Hypothesis:
Just like disjunction under *not* and disjunction under *every*, disjunction under *if* finds itself in a DE environment. The conjunctive inference follows on the standard semantics of *or*.

- If weak modals are (like) existential quantifiers they do not create DE contexts. The absence of NPI licensing and presence of scalar implicature follows.
- The conjunctive inferences licensed by *or* under *may* are difficult to reconcile with a standard meaning of *may* and *or*. It is not for nothing that it is called the Paradox of Free Choice.

- Given the clear semantic differences, whatever explains *or* under *may*, it does not directly extend to *or* under *if*, just as it does not extend to *or* under *not* and under *every*.

3 A monotonic analysis of conditional antecedents

- That *if* parallels *not* in creating a DE context would follow on a strict conditional analysis, where antecedents translate as universal quantifiers.

(9) Strict Conditional (Lewis 1918):

If p then q is true iff all *p*-worlds are *q*-worlds.

- The conjunctive inference licensed by *or* under *if* would then derive as a matter of logic:

$$(10) [\forall w: p(w) \vee r(w)] q(w) \Leftrightarrow [[\forall w: p(w)] q(w)] \wedge [[\forall w: r(w)] q(w)]$$

- But the Strict Conditional analysis cannot explain failures of Antecedent Strengthening in (11):

- (11) a. If this match were struck, it would light.
 b. If this match were struck after having been soaked in water, it would light.

- This is remedied by the Variably Strict Conditional analysis:

(12) Variably Strict Conditional (Lewis 1973):

If p then q is true iff there is a close *p*-world that is a *q*-world and there is no closer *p*-world that is not a *q*-world.

- Since, however, on the Variably Strict analysis *if* clauses are not downward monotonic, the licensing of NPIs is not easy to explain (cf. e.g. Heim 1984, von Stechow 1999).
- *Or* under *if* is also a problem: As soon as the disjunct *his mother dances at the party* describes a world that is closer than those described by the other disjunct, *his mother sings at the party*, and Nico is embarrassed in the dancing worlds but not in the singing worlds (1a) is wrongly predicted to be true (e.g. Creary and Hill 1975, Fine 1975, Nute 1975).

- Adding an axiom to the theory is not only a brute force solution but amounts to validating Strengthening of the Antecedent (Fine 1975, Ellis et al. 1977).
- (13) Simplification of Disjunctive Antecedents (SDA):
 $((A \vee B) > C) \rightarrow ((A > B) \wedge (B > C))$
- By substitution of equivalents, A can be substituted for with the tautological $((A \wedge B) \vee (A \wedge \neg B))$. This renders $A > C$ and $((A \wedge B) \vee (A \wedge \neg B)) > C$ equivalent. But then, given SDA, $A > C$ should entail $(A \wedge B) > C$.
 - Later proposals aim to derive SDA pragmatically (Loewer 1976, Bennett 2003). But the inferences do not really show the hallmark of pragmatically generated inferences (e.g. Alonso-Ovalle 2006, Klinedinst 2009).
 - Other approaches aim to derive SDA semantically by setting up the assignment function such that the consequent in sentences like (1a) is evaluated relative to the closest worlds described by *each disjunct within* the antecedent (e.g. Nute 1980, Alonso-Ovalle 2006, 2009, van Rooij 2006, 2010).

4. The Conditionally Strict account

- We can both keep a standard account of *or* and explain failures of Antecedent Strengthening (and related inferences) if we assume a Conditionally Strict analysis (cf. also Schlenker 2004, Bhatt and Pancheva 2006; Morreau 1997).
- (14) Conditionally Strict Conditional (Schein 2003):
If p then Q-often q is true iff whatever possible *p*-eventualities there are are such that Q-many of them are, *ceteris paribus*, followed by (or related to) *q*-eventualities.
- ‘Q’ stands for the adverb of quantification. It may be overt (e.g. *usually*, *sometimes*, etc.) or covert (‘bare’ conditionals). When it is covert it typically has universal force, but under certain circumstances it can also have existential force (Herburger 2015, 2016).

- *If* now has meaning (cf. Gillies 2010) and (c)overt adverbs of quantification are interpreted *in-situ* rather than as being restricted by the *if*-clause (e.g. Kratzer 1986, 2012).

(15) If the puppy barks at night, Art often gets annoyed.

- (16) [$\iota E: \forall e (E(e) \leftrightarrow [\text{the } x: \text{Puppy}(x)] (\text{Bark}(e, x) \ \& \ \text{At-night}(e)))$] (a)
 [$\text{Many } e: E(e)$] [$\exists E: \exists e' (E'(e') \wedge \forall e' (E'(e') \rightarrow \text{Follow}(e', e)))$] (b)
 [$\iota E'': \forall e'' (E''(e'') \leftrightarrow (E'(e'') \wedge \text{Ceteris-paribus}(e'', e)))$] (c)
 [$\forall e''': E'''(e''')$] [$\text{Gets-annoyed}(\text{Art}, e''')$] (d)

(17) [$[\text{if}] = \lambda f_{\langle e, t \rangle} . \lambda g_{\langle E, t \rangle} . [\iota E: \forall e (E(e) \leftrightarrow f(e)=1)] g(E)=1$]

4.1 Lack of Antecedent Strengthening

- Strengthening the Antecedent in (11) is now blocked not in the interpretation of the antecedent but as the result of a tacit *ceteris paribus* clause that is outside and subsequent to the antecedent:

- (18) [$\iota E: \forall e (E(e) \leftrightarrow [\text{this } x: \text{Match}(x)] \text{Strike}(\text{you}, x))$] (a)
 [$\forall e: E(e)$] [$\exists E: \exists e' (E'(e') \wedge \forall e' (E'(e') \rightarrow \text{Follow}(e', e)))$] (b)
 [$\iota E'': \forall e'' (E''(e'') \leftrightarrow (E'(e'') \wedge \text{Ceteris-paribus}(e'', e)))$] (c)
 [$\forall e''': E'''(e''')$] [$\text{Light}(it, e''')$] (d)

‘Whatever possible eventualities there are of you striking this match (a)
 they are all followed by some eventualities (b)
 where those among them where things where *ceteris paribus* (c)
 are all eventualities where the match lights’ (d)

- A more detailed version of Schein’s (2003) *ceteris paribus* relation contains two parameters, one for the sentence, proposition, facts, or state of affair that is the ‘other’ that is fixed by the antecedent, and one for the context of utterance. The *ceteris paribus* predicate compares antecedent eventualities to those following them, demanding that all ‘other matters’ that are contextually relevant at the utterance situation remain the same.

(19) If $\Phi \Psi \Rightarrow$
 $[\forall E: \forall e (E(e) \leftrightarrow \Phi)] [Qe: E(e)] [\exists E': \exists e' E'(e') \wedge \forall e' (E'(e') \rightarrow e \leq e')]$
 $[\forall E'': \forall e'' (E''(e'') \leftrightarrow E'(e'')) \wedge [\forall x: \text{Relevant}(x, u) \wedge x \text{ is other than } [\Phi]]$
 $x \text{ is at } t(e) \text{ and at } t(e'') \text{ as at } u]]$
 $\forall e'': E''(e'')] \Psi$

- What are the relevant other matters that have to stay the same? It is contextually determined (as is the selection of criteria by which closeness is measured on the Stalnaker/Lewis analysis).
- But we can say a bit more: Generally, what has to stay the same is that the relevant other not contain an ‘independent interferer’, i.e. something that explains independently why an antecedent eventuality should not be followed by a consequent eventuality (cf. Pietroski and Rey 2005, Reutlinger et al. 2011).
- The lack of Antecedent Strengthening in (11) now follows because relevant other matters do not remain equal (i.e. interferer-free) when the match in question was dry to begin with but was subsequently soaked in water—water is independent interferer.
- The *ceteris paribus* won’t have the same effect in (11b), since there the antecedent explicitly requires the inclusion of soaked matches, and the contextually relevant matters that will have to remain interferer-free with respect to *that* (e.g. no blow-drying the match).

4.2 NPIs and *or* under *if*

- Since *if*-clauses now provide a DE context and adverbs are interpreted *in-situ* we predict that NPIs are licensed in *if*-clauses, and we moreover predict that they are licensed even when the adverb is upward monotonic in its first argument:

(20) If Doug sees anything interesting in the paper, he {sometimes, often, frequently} tells Sid about it.

- Because *if*-clauses now provide a DE context, we now derive the conjunctive inferences licensed by *or* in (1): (21) entails both (22a) and (22b) and is hence equivalent to their conjunction:

- (21) [$\iota E: \forall e (E(e) \leftrightarrow (\text{Dance}(\text{his mother}, e) \vee \text{Sing}(\text{his mother}, e)))$]
 $[\forall e: E(e)] [\exists E': \exists e' (E'(e') \wedge \forall e' (E'(e') \rightarrow \text{Follow}(e', e)))]$
 $[\iota E'': \forall e'' (E''(e'') \leftrightarrow (E'(e'') \wedge \text{Cet.-paribus}(e'', e)))] [\forall e''': E''(e'')]$
 Embarrassed(Nico, e'')
- (22) a. [$\iota E: \forall e (E(e) \leftrightarrow \text{Dance}(\text{his mother}, e))$]
 $[\forall e: E(e)] [\exists E': \exists e' (E'(e') \wedge \forall e' (E'(e') \rightarrow \text{Follow}(e', e)))]$
 $[\iota E'': \forall e'' (E''(e'') \leftrightarrow (E'(e'') \wedge \text{Cet.-paribus}(e'', e)))] [\forall e''': E''(e'')]$
 Embarrassed(Nico, e'')
- b. [$\iota E: \forall e (E(e) \leftrightarrow \text{Sing}(\text{his mother}, e))$]
 $[\forall e: E(e)] [\exists E': \exists e' (E'(e') \wedge \forall e' (E'(e') \rightarrow \text{Follow}(e', e)))]$
 $[\iota E'': \forall e'' (E''(e'') \leftrightarrow (E'(e'') \wedge \text{Cet.-paribus}(e'', e)))] [\forall e''': E''(e'')]$
 Embarrassed(Nico, e'')

- *Or* keeps its regular meaning as a propositional operator. The conjunctive inference it licenses in (1) falls out directly from the semantics of the *if*-clause, just as the conjunctive inference we find with *or* under negation in (2) and under *every* in (3) directly fall out from the semantics of negation and universal quantification.

5 Counterexamples to SDA

5.1 New cases

Prediction: Non-universal, non-negative adverbs/modals need not distribute over each disjunct.
If p or q the Q-often, ceteris paribus, q is equivalent to ‘The eventualities that are p or r are such that Q-many of them are followed by (related to), ceteris paribus, q eventualities.’

- When the conditional has universal or negative force, the Conditionally Strict analysis is equivalent to an SDA analysis. But when the conditional has less than universal force, the two come apart:

- (23) Nick’s scenario:
 Nick is contemplating taking one of four indistinguishable pills. Pills 1, 3, and 4 only contain a harmless vitamin supplement, but pill 2 contains lethal cyanide.

- a. If Nick takes pill 1 or pill 2 tonight, he will die.
 - b. If Nick takes pill 1 or pill 2 tonight, he may/might die. T
- (23a) is too strong a claim, since Nick has a fifty/fifty chance of survival/death, but, precisely because for the very same reason, (23b) is clearly true!
 - In (24a,b) the antecedents disjunctively describe eventualities which are *jointly* considered for the interpretation of the quantified consequent:

- (24) a. If you pick hearts or a queen, chances are you pick hearts.
 b. If someone is O+ or O-, they are usually O+.

- The truth conditions of (22) and (24a,b) show that the consequent is not interpreted relative to each disjunct, contra SDA:

- (25) a. If Nick takes pill 1 he might die and if he takes pill 2 he might die.
 b. If you pick hearts chances are you pick hearts and if you pick a queen chances are you pick hearts.
 c. If someone is O+ they are usually O+ and if someone is O- they are usually O+.

- The right truth conditions follow on the Conditionally Strict analysis:

- (26) $[\neg E: \forall e (E(e) \leftrightarrow (\text{Pick}(\text{you}, \text{hearts}, e) \vee \text{Pick}(\text{you}, \text{a queen}, e)))]$
 $[\text{Most } e: E(e)] [\exists E': \exists e' (E'(e') \wedge \forall e' (E'(e') \rightarrow \text{Follow}(e', e)))]$
 $[\neg E'': \forall e'' (E''(e'') \leftrightarrow (E'(e') \wedge \text{Cet.-paribus}(e'', e)))] [\forall e'': E''(e'')]$
 $\text{Pick}(\text{you}, \text{hearts}, e'')$

5.2 A wrinkle

- In some instances the consequent seems to be interpreted relative to each disjunct even under a non-universal operator (Alonso-Ovalle 2009):

- (27) If you had a good magic book or you had been a newborn baby, you might have bent that fork too. F

- (28) If you had a good magic book you might have bent that fork too and if you had been a newborn baby you might have bent that fork too.

- The fact that (27) is interpreted as in (28) need not be attributed to disjunction directly (Alonso-Ovalle 2009) but can be explained pragmatically.
 - Consequents are interpreted relative to a contextually implicit background theory established by their antecedent. Disjunctive antecedents whose disjuncts are clearly disparate with respect to their background theories force the consequent to be interpreted relative to the background theories established by each disjunct (Barry Schein, p.c.)
- (29) If you blaspheme YHWH, Pater Noster, or Allah, then (Jewish-ly in the first case, Catholically in the second case, and Islamica-ly in the third case) you are damned. (Barry Schein, p.c.)
- Since no background theory ties together having a good magic book, being a baby and bending a fork, there is no single theory in (28) that allows us to compute an aggregate probability over a distribution of what according to that theory are the possible independent outcomes. The modal assertion must therefore hold relative to each background theory separately; (28) is rejected as false because one cannot assent to the modal assertion about fork bending relative to the theory involving babyhood.

5.3 Known counterexamples

- There are also well-known exceptions to SDA. (30a) suggests that the possibility of Spain fighting on the Allied side should be discarded (Lycan 2001). This fits with what we know independently:
- (30) a. If Spain had fought on the Axis side or on the Allied side, Spain would have fought on the Axis side. (McKay and van Inwagen 1977)
- b. If the US devoted more than half of its national budget to defense or to education, it would devote more than half of its national budget to defense. (Nute 1984)
- (31) a. If John had married Jean or Joan, he would have married Joan.
- b. If Jones signs with the Lakers or the Clippers, he'll sign with the Clippers.

- Why should it be possible to read conditionals of the form ‘if A or B, A’ in this manner? I think these examples are elliptical along the lines of ‘if confronted with the (incompatible) choices of A or B, the choice that is (to be) realized is A.’
- (30a) is interpreted as meaning ‘If Spain had been confronted to with the choice of fighting on either the Allied side or the Axis side in WWII, it would have, all things being equal, chosen to fight on side of the Axis’.
- The pattern can be replicated in (32a). To the extent (32a) is coherent it is interpreted as in (32b):

- (32) a. If the answer is 17 or 24, it is 24.
 b. If you the choices for an answer are 17 or 24, the right choice is 24.

- ‘If A or B then A’ is not very natural in German. Maybe there is some idiomaticity involved in English that lets the construction be elliptical.

- (33) Hätte John Jean oder Joan #geheiratet/ heiraten können,
 Had John Jean or Joan married/ marry can
- dann hätte er Joan geheiratet
 then would he Joan married

Conclusion:

Whatever the right analysis of the Free Choice Paradox, *or* under *if* is the familiar disjunction and behaves like the familiar *or* under *not*: it is a propositional operator expressing disjunction. Conditional antecedents are downward monotonic and the non-monotonic behavior of conditionals as a whole is due to a *ceteris paribus* condition outside and subsequent to the antecedent.

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