Disjunctions of universal modals and conditionals

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Abstract. This paper is concerned with disjunctions of conditionals, such as *If Alice dances, Charlie will dance, or if Bob dances, Charlie will dance*, and disjunctions of universal modals, such as *You have to clean your room or you have to walk the dog.* We aim to provide a uniform account of their surprising behaviour. Our proposal combines two independently-attested features of disjunction. Firstly, disjunction's dynamic effect: the fact that the second disjunct of a disjunction is typically interpreted assuming the negation of (a subclause of) the first, and perhaps symmetrically, that the first is interpreted assuming (a subclause of) the second. Secondly, the fact that disjunctions often receive a conjunctive interpretation, familiar from free choice phenomena.

1 Introduction

Surprising things happen when disjunction joins universal modals and conditionals, as in (1) and (2).

(1) a. You must do clean your room or you must walk the dog.
  b. They keys must be in the drawer or John must have taken them.

(2) a. If Alice had come to the party, Charlie would have come. Or if Bob had come, Charlie would have come.
  b. If Alice had come to the party, Charlie would have come. Or if Alice had come, Darius would have come.

We study these two cases of disjunction in tandem since we believe that a uniform explanation underlies their surprising behaviour.

Disjunctions of universal modals such as *Must A or must B*, first discussed by Geurts (2005), behave in a way unexpected from a simple application of classical logic. Geurts observes that disjunctions of universal modals can be asserted even when both disjuncts are false: you must clean your room or you must walk the dog, but it is not true that you must clean your room (you may walk the dog and leave your room as it is), and it is not true that you must walk the dog (you may clean your room and keep the dog home). The keys must be in the drawer or John must have taken them, but it is not true that they must be in the drawer (for John might have taken them), and it is not true that John must have taken them (for they might be in the drawer). Naturally, this violates classical logic: if both disjuncts are false, classical logic tells us that the disjunction as a whole must be false too.

Instead of the meaning we would expect from classical logic, *Must A or must B* somehow winds up meaning something more akin to *Must*$(A \vee B)$. This is not how disjunctions of universal quantifiers usually behave.

(3) a. Everyone is in the kitchen or the garden.
b. $\not\equiv$ Everyone is in the kitchen or everyone is in the garden.

If some people are in the kitchen and the rest are in the garden, the first is true but the second false.[1] The problem becomes especially salient when we unpack the meaning of *must* according a standard semantics.

(4) a. You must clean the kitchen or you must walk the dog.
b. $\not\equiv$ In every normatively best world you clean the kitchen, or in every normatively best world you walk the dog.

The first goal of our paper is to account for this unexpected behaviour of disjunctions of universal modals.

> *Question 1.* What are the truth-conditions of disjunctions of universal modals? In particular, why are they assertable even when both disjunctions are false?

Turning to conditionals, disjunctions of conditionals exhibit an interesting contrast, noted by Woods (1997), Geurts (2005) and Khoo (2021a:357). When the antecedents are different, as in (2a), we readily perceive a conjunctive interpretation, with the sentence implying both disjuncts.

(2a) If Alice had come to the party, Charlie would have come. Or if Bob had come, Charlie would have come.
$\rightsquigarrow$ If Alice had come to the party, Charlie would have come.
$\rightsquigarrow$ If Bob had come, Charlie would have come.

However, when the antecedents are the same, as in (2b), we do not.

(2b) If Alice had come to the party, Charlie would have come. Or if Alice had come, Darius would have come.

[1] At least, the first *can* be true in this scenario; it also has a wide-scope reading on which it is equivalent to the second. This can be explained by the well-known scopal flexibility of disjunction, illustrated by (i) from Rooth and Partee (1982).

(i) Mary is looking for a maid or a cook.

As Rooth and Partee observe, this has a reading suggested by the continuation "... but I don't know which", where the disjunction takes wide-scope, interpreted as "Mary is looking for a maid or Mary is looking for a cook".

Nonetheless, while (3a) has both narrow and wide scope readings, (3b) only has the wide scope reading.

$\not\rightsquigarrow$ If Alice had come to the party, Charlie would have come.
$\not\rightsquigarrow$ If Bob had come, Charlie would have come.

Interestingly, the conjunctive interpretation can arise even when the antecedents are not the same. For instance, (5) has a conjunctive interpretation.

(5) If you had taken the morning train, you would have arrived before lunch. Or if you had taken the afternoon train, you would have arrived after lunch.

Under what circumstances does the conjunctive interpretation arise, and under what circumstances does it not? Answering this question is the second goal of this paper.

> *Question 2.* What determines whether a disjunction of conditionals receives a conjunctive or disjunctive interpretation?

1.1 Motivation from theories of wide scope free choice

The puzzling behaviour of disjunctions of universal modals becomes especially important in light of recent interest in wide scope free choice, the inference from $\Diamond A$ *or* $\Diamond B$ to $\Diamond A$ *and* $\Diamond B$ (Zimmermann 2000), illustrated in (6).

(6) a. He might be in Brixton or he might be in Victoria.
  (i) $\rightsquigarrow$ He might be in Brixton.
  (ii) $\rightsquigarrow$ He might be in Victoria.
 b. You may go to Brixton or you may go to Victoria.
  (i) $\rightsquigarrow$ You may go to Brixton.
  (ii) $\rightsquigarrow$ You may go to Victoria.

Disjunctions of necessity modals behave differently from disjunctions of possibility modals. *Must A or must B* does not imply *Must A and must B*.

(7) a. He must be in Brixton or he must be in Victoria.
  (i) $\not\rightsquigarrow$ He must be in Brixton.
  (ii) $\not\rightsquigarrow$ He must be in Victoria.
 b. He must go to Brixton or he must go to Victoria.
  (i) $\not\rightsquigarrow$ He must go to Brixton.
  (ii) $\not\rightsquigarrow$ He must go to Victoria.

A number of theories today (Zimmermann 2000, Geurts 2005, Aloni 2023) aim to account for wide scope free choice. It is important to check, however, that these theories do not inadvertently predict disjunctions of universal modals to also imply each of their disjuncts.

For example, Zimmermann (2000) and Geurts (2005) derive wide scope free choice by proposing that disjunctions denote conjunctions of possibilities: $A \vee B$ means $\Diamond A \wedge \Diamond B$, and thus $\Box A \vee \Box B$ is equivalent to $\Diamond\Box A \wedge \Diamond\Box B$. By a further principle—Zimmerman's Authority Principle, stating that the agent is an authority on what is permitted—this is equivalent to $\Box A \wedge \Box B$. This prediction, Geurts (2005:388) notes, "is clearly wrong". Geurts offers a solution, which we discuss and raise some problems for in section 7.

Aloni (2023) derives wide scope free choice assuming a very different semantics of disjunction, but along the way uses a constraint similar to the Authority Principle, which she calls *Indisputability*: all worlds in the speaker's epistemic state agree on which worlds are (deontically/epistemically/...) possible. If the speaker's accessibility relation is indisputable, Aloni predicts that $\Box A \vee \Box B$ implies $\Box A \wedge \Box B$. Aloni therefore risks making the same "clearly wrong" prediction as Zimmermann and Geurts.

When we examine disjunctions of epistemic modals, we see that one may explicitly affirm indisputability without *Must A or must B* meaning *Must A and must B*.

(8) I know exactly what you have to do.
You have to clean the kitchen or you have to walk the dog.
$\not\equiv$ You have to clean the kitchen and you have to walk the dog.

Do accounts of wide scope free choice such as Geurts' and Aloni's really predict the unwelcome inference from *Must A or must B* to *Must A and must B*? Or is there more to the interpretation of disjunctions of universal modals than meets the eye? In what follows we propose that there is: additional factors influence their interpretation which renders (8) unproblematic for accounts like Aloni's (although, we argue in section 7 that there are nonetheless problems with Geurts' solution).

1.2 Our analysis in a nutshell

Our account brings together two independently-motivated features of disjunction: its dynamic effect, and a conjunctive interpretation. By the dynamic effect of disjunction, we mean the fact that the second disjunct of a disjunction is typically interpreted assuming the negation of the first or the negation of a subclause of the first (and perhaps also symmetrically, the first disjunct is interpreted assuming the negation of the second or the negation of a subclause of the second).

The dynamic effect of disjunction and is familiar from dynamic semantics (Heim 1982, Veltman 1996, Chierchia 1995, Beaver 2001), the wider literature on presupposition projection (Schlenker 2008, 2009, Chemla 2009), and Klinedinst and Rothschild's (2012) concept of non-truth-tabular disjunction. It is also similar to the contribution of *else*, though there appear to be some differences between *or* and *or else* regarding which previous material can be negated (see Webber et al. 2003, Meyer 2016:6–9), which we discuss in section 3.

In addition, disjunction may receive a conjunctive interpretation, familiar from the literature on wide scope free choice (Zimmermann 2000, Meyer 2016, Aloni 2023) and non-truth-tabular disjunction. Section 4 presents some examples that cannot be explained by non-truth-tabular disjunction, though all our data can be accounted for as cases of wide-scope free choice.

On our proposal, then, disjunctions of universal modals *Must A or must B* as in (1) may have the following interpretations, with an asymmetric and symmetric dynamic effect, respectively.

(9) ASYMMETRIC DYNAMIC EFFECT + CONJUNCTIVE INTERPRETATION
  a. You must do clean your room and if you do not clean your room, you must walk the dog.
  b. They keys must be in the drawer and if they are not in the drawer, John must have taken them.

(10) SYMMETRIC DYNAMIC EFFECT + CONJUNCTIVE INTERPRETATION
  a. If you do not clean your room, you must do clean your room, and if you do not clean your room, you must walk the dog.
  b. If John has not taken the keys, they must be in the drawer, and if they are not in the drawer, John must have taken them.

We argue that both the asymmetric and symmetric readings are available, with the asymmetric reading giving priority to the first disjunct and the second true at more remote possibilities—what Schwager (2006) calls the *or else* effect. For example, the asymmetric reading allows us to predict the following contrast.

(11) a. You have to pay the bill, or you have to go to jail.
  b. ??You have to go to jail, or you have to pay the bill.

In contrast, on the symmetric reading, the options are viewed on a par, with neither having priority over the other. This is shown in examples like (12), where order seems not to matter.

(12) *To win the game, the die must land on multiple of three.*
  a. You have to roll a three or you have to roll a six.
  b. You have to roll a six or you have to roll a three.

Turning to conditionals, the very same combination of disjunction's dynamic effect and conjunctive interpretation account for the contrast in (2), repeated below.

(2) a. If Alice had come to the party, Charlie would have come. Or if Bob had come, Charlie would have come.
  b. If Alice had come to the party, Charlie would have come. Or if Alice had come, Darius would have come.

In principle there are a number of options for which clause is negated by the dynamic effect disjunction: the whole conditional(s), the antecedent(s) or the consequent(s). As we discuss in section 6.1, negating the whole conditional is possible, but not very interesting for our purposes since it is classically equivalent to an interpretation without any dynamic effect. This is due to the following equivalences, where $\to$ denotes the material conditional.

$$A \vee B \quad \equiv \quad A \vee (\neg A \to B) \quad \equiv \quad (\neg B \to A) \vee (\neg A \to B)$$

Putting aside the option of negating the whole conditional(s), we find that in (2a), negating the previous consequent is not an option since it would violate a general ban on triviality; the second conditional would assert, vacuously, that if Bob but not Charlie had come, Charlie would have come. However, negating the previous antecedent is perfectly possible. In contrast, in (2b) negating the antecedents is not an option since it would also violate a general ban on triviality; the second conditional would assert, vacuously, that if Alice but not Alice had come, Darius would have come. However, negating the previous consequents is an option.

Given an asymmetric dynamic effect, then, the sentences in (2) have interpretations which we may paraphrase as follows.

(13) a. If Alice had come to the party, Charlie would have come. And if Bob but not Alice had come, Charlie would have come.
b. If Alice had come to the party, Charlie would have come. And if Alice but not Charlie had come, Darius would have come.

And given a symmetric dynamic effect, they have interpretations which we may paraphrase as:

(14) a. If Alice but not Bob had come to the party, Charlie would have come. And if Bob but not Alice had come, Charlie would have come.
b. If Alice but not Darius had come to the party, Charlie would have come. And if Alice but not Charlie had come, Darius would have come.

The rest of the paper is structured as follows. Section 2 provides the primary data to be analysed, presenting a variety of examples of disjunctions of universal modals and conditionals. Section 3 presents our analysis of disjunctions of universal modals. In section 5 we motivate the need for a symmetric reading of disjunctions of universal modals (with each option viewed on a par) and develop two ways to derive the symmetric reading without deciding between them. Section 6 presents our analysis of disjunctions of conditionals.

2 Data

2.1 Disjunctions of universal modals

Epistemic *Must A or must B*. On 22 May 2024, Lee Pappas posted the following question on Philosophy StackExhange.[2]

> I have a question regarding disjunction and necessity. Is the following theorem provable in any system of modal logic, or is it not generally

[2] https://web.archive.org/web/20240605182200/https://philosophy.stackexchange.com/questions/113417/question-regarding-disjunction-and-necessity-in-modal-logic

> true?
>
> $$\vdash A \lor B \to \Box A \lor \Box B$$
>
> I was thinking about using the truth functional definition of OR to answer the question myself. I think it's true, but I don't know how to prove it.

Within eight minutes, the user Conifold comments, "It is trivially false, take $B = \neg A$." 'Trivial' might be a bit harsh, but Conifold is right: it is not generally true. (An hour later the user Bumble more charitably points out that it is in fact theorem of the modal logic `Ver`, which contains $\Box A$ as an axiom for every sentence A.)

Undeterred, four hours later Pappas posts an answer to his own question, featuring the following remark.

> To me it seems to be a consequence of the truth functional definition of OR. If 'A or B' is true then A must be true or B must be true.

He then attempts to offer a proof of this claim, the conclusion of which reads as follows.

> Thus, any modal logic in which does not have $\vdash A \lor B \to \Box A \lor \Box B$ is perforce inconsistent. So I followed my instinct, and used the truth functional definition of OR to answer the question.

Lee's answer received a score of −3. But there is something oddly compelling about his reasoning. In particular, the sentence

(15) If 'A or B' is true then A must be true or B must be true.

can sound quite plausible. Strikingly, however, each *must* claim in isolation is false. If A or B is true, it is not the case that A must be true—for A could be false while B is true—and it is the case that B must be true—for B could be false while A is true. But here we find Lee happy to assert the disjunction.

This interpretation of *must* also appears in more official writing. The textbook *Math in Society* by mathematics professor David Lippman teaches in a chapter on conditionals that:

(16) A conditional statement $[p \to q]$ and its contrapositive $[\neg q \to \neg p]$ are logically equivalent. The converse $[q \to p]$ and inverse $[\neg p \to \neg q]$ of a conditional statement are logically equivalent.

So far so good. The textbook continues:

(17) In other words, the original statement and the contrapositive must agree with each other; **they must both be true, or they must both be false**. Similarly, the converse and the inverse must agree with each other; **they must both be true, or they must both be false**.

> Be aware that symbolic logic cannot represent the English language perfectly.[3]

In a pleasing irony, the final sentence says what the previous sentences show. Formalising "they must both be true, or they must both be false" as $\Box T \vee \Box F$ does not represent the meaning of that English language sentence perfectly, for the same reasons as before. It is false that a conditional and its contrapositive must both be true—for they could both be false, and it is false that a conditional and its contrapositive must both be false—for they could both be true. Both disjuncts, $\Box T$ and $\Box F$, are false, yet here we read a mathematics professor, in a chapter on classical logic no less, asserting two such disjuntions.

We also find statements of epistemic *Must A or must B* out in the wider world, beyond the specialist confines of online forums and mathematics textbooks. In *The Golden Girls* (Season 5, Episode 4, 'Rose Fights Back'), when Rose loses her pension, she sees a woman searching through some garbage and wonders:

(18) What did she do to get herself into a fix like that? I thought, well, **she must be lazy. Or she must be pretty stupid** to let something like this happen to her. But the truth is she's me.[4]

Or in the song *I Must be the Devil*, The Box Tops sing:

(19) Oh God! **I must be the Devil, baby**
Or I must just be out of my head
Oh yes, I must be out of my head, now
Mmm, well, I just don't seem to know, no more?[5]

Deontic *Must A or must B* The above examples involve an epistemic interpretation of *must*. We see the same behaviour with deontic modals. In the film *Kill Your Darlings*, Allen Ginsberg submits a lurid essay as his final term paper at Columbia University. The film's Wikipedia page recounts:

(20) Ginsberg is faced with possible expulsion from Columbia. **Either he must be expelled or he must embrace establishment values.** He chooses the former.[6]

It is not true that Ginsberg must be expelled; he has the option to embrace establishment values and retract his essay. Nor is it true that he must embrace

[3] https://web.archive.org/web/20240414003343/https://math.libretexts.org/Bookshelves/Applied_Mathematics/Math_in_Society_(Lippman)/17%3A_Logic/17.06%3A_Section_6-

[4] https://web.archive.org/save/https://tvquot.es/the-golden-girls/quote/20o7s8f6/

[5] https://web.archive.org/web/20240711164602/https://genius.com/Box-tops-must-be-the-devil-lyrics

[6] https://web.archive.org/web/20230326030930/https://en.m.wikipedia.org/wiki/Kill_Your_Darlings_(2013_film)

establishment values; he can choose to stick by his principles and accept expulsion, which he does. Both disjuncts are false, but remarkably, the page's author asserts the disjunction.

(21) Either you must go to school or stay indoors here. (Tanith Lee, *Dark Dance* 1993)

Note the authors' use of *either* in these two examples, the significance of which we discuss this possibility in section 4.

These examples do not seem to communicate any preference for either option. Other cases suggest a more asymmetric interpretation, with the ideal option listed first and a less ideal backup mentioned second.

(22) *On information leaflet for Accutane, a medication that can cause birth defects.*
I understand that I must avoid sexual intercourse completely, or I must use 2 separate, effective forms of birth control (contraception) at the same time.[7]

(23) If you were born on or after September 2, 1971 and you are [...] age 9 through 16, you must successfully complete hunter education, OR you must be accompanied.[8]

(24) To be eligible for Medicaid, you must be a U.S. citizen. Or, you must be within one of the qualified categories of non-citizens.[9]

Interestingly, these examples all feature a pause between the two disjuncts—indicated by a comma or full stop—while the sentences with a symmetric interpretation do not. Meyer (2016:42) suggests that intonational breaks and a high boundary tone help disambiguiate between a conjunctive and disjunctive reading of *or else* sentences, with intonational breaks and a high boundary tone suggesting uncertainty, and therefore favouring a disjunctive reading. We will discuss these data in section **??**, once we have presented our analysis.

2.2 Data: disjunctions of conditionals

There is an extensive literature on conditionals with disjunctive antecedents; in particular, on simplification of disjunctive antencedents—the inference from *if A*

[7] https://web.archive.org/web/20230207215258/https://www.accessdata.fda.gov/drugsatfda_docs/label/2010/018662s060lbl.pdf

[8] https://web.archive.org/web/20240406004805/https://tpwd.texas.gov/education/hunter-education/faq

[9] https://web.archive.org/web/20230512112900/https://www.illinoislegalaid.org/legal-information/am-i-eligible-medicaid

or B, *C* to *if A, C and if B, C*.[10] More recently, Khoo (2021b) and Klinedinst (2024) consider the case of *if or if*-conditionals such as (25).[11]

(25) If you had taken the train or if you had taken the metro, you would have been on time.
  a. ⇝ If you had taken the train, you would have been on time.
  b. ⇝ If you had taken the metro, you would have been on time.

There has, however, been comparatively less discussion of disjunctions of whole conditionals, which we focus on in this paper.

Our first observation is that a conjunctive interpretation of disjunction is robust across the various forms conditionals can take—including the conditional conjunction. Each of the sentences below has a conjunctive reading, implying both conditionals.

(26) PRESENT (GENERIC)
If Jia takes the tofu she enjoys her meal,
or if she takes the dumplings she enjoys her meal.

(27) PRESENT + WILL (EPISODIC)
If Jia takes the tofu she will enjoy her meal,
or if she takes the dumplings she will enjoy her meal.

(28) PAST SIMPLE
If Jia took the tofu she would enjoy her meal,
or if she took the dumplings she would enjoy her meal.

(29) PAST PERFECT
If Jia has taken the tofu she would have enjoyed her meal,
or if she had taken the dumplings she would have enjoyed her meal.

(30) CONDITIONAL CONJUNCTION
Take the tofu and you'll enjoy your meal,
or take the dumplings and you'll enjoy your meal.

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[10] Among authors who argue for simplification's validity are Nute (1975), Ellis, Jackson, and Pargetter (1977), Warmbrōd (1981), Fine (2012), Starr (2014), and Willer (2018). Among those who argue it is invalid are Nute (1980), Bennett (2003), van Rooij (2006), Santorio (2018), and Lassiter (2018).

[11] Indeed, unlike with disjunctive antecedents, Starr (2014) observes that *if or if*-conditionals *obligatorily* entail their simplifications, as shown by specificational disjunctive antecedent conditionals such as (i). (For discussion of specificational conditionals see Loewer (1976), McKay and Inwagen (1977), Nute (1980), Bennett (2003), and Klinedinst (2007).)

(i) a. If John had taken the train or the metro, he would have taken the train.
  b. #If John had taken the train or if he had taken the metro, he would have taken the train.

The conjunctive inference is also cross-linguistically robust. Consider the following passage from the Book of Leviticus:

(31) And if a soul sin ... if he do not utter it, then he shall bear his iniquity.
Or if a soul touch any unclean thing ... he also shall be unclean, and guilty.
Or if he touch the uncleanness of man ... when he knoweth of it, then he shall be guilty. (Leviticus 5:1–3, King James Version, 1611).

This is most naturally read as a conjunction of conditionals. Cross-linguistically, a disjunction word links the clauses of Leviticus 5 in, for example, Mandarin Chinese *huò*[12], the original Hebrew *o*[13], Hungarian *vagy*[14], Icelandic *eða*[15], Māori *rānei*[16], Urdu *yâ*[17], Somali *ama*[18], Welsh *neu*[19], and Yoruba *tàbí*[20], suggesting that the conjunctive interpretation is a cross-linguistically robust phenomenon.

3 Analysis: Disjunctions of universal modals

Our account of disjunctions of universal modals follows a proposal by Meyer (2016) for *or else* sentences. Indeed, the following pair sound synonymous.

(32) a. You have to clean the kitchen or you have to walk the dog.
b. You have to clean the kitchen or else you have to walk the dog.

Meyer proposes that an *or else* sentence receives a conjunctive interpretation, which she derives as a free choice effect using the implicature approach to free choice (Kratzer and Shimoyama 2002, Fox 2007). The contribution of *else* is to negate previous material, such as the prejacent of a previous modal. The conjunctive interpretation and negation of the previous prejacent together derive the asymmetric reading.

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12 https://web.archive.org/web/20220425194146/https://www.biblegateway.com/passage/?search=Leviticus+5&version=CNVT
13 https://web.archive.org/web/20220425194625/https://www.biblegateway.com/passage/?search=Leviticus+5&version=WLC
14 https://web.archive.org/web/20220425194655/https://www.biblegateway.com/passage/?search=Leviticus+5&version=KAR
15 https://web.archive.org/web/20220425194740/https://www.biblegateway.com/passage/?search=Leviticus+5&version=ICELAND
16 http://web.archive.org/web/20201127071407/https://www.biblegateway.com/passage/?search=Leviticus+5&version=MAORI
17 https://web.archive.org/web/20220425195430/https://www.biblegateway.com/passage/?search=Leviticus+5&version=ERV-UR
18 https://web.archive.org/web/20220425195432/https://www.biblegateway.com/passage/?search=Leviticus+5&version=SOM
19 http://web.archive.org/web/20220425195453/https://www.biblegateway.com/passage/?search=Leviticus+5&version=BWM
20 https://web.archive.org/web/20220425195612/https://www.biblegateway.com/passage/?search=Leviticus+5&version=BYO

(33) You have to clean the kitchen. If you don't clean the kitchen, you have to walk the dog.

Meyer adopts Kratzer's (1991) analysis of modality, where worlds in the modal domain are ordered as closer to or further from a (denotic/epistemic/...) ideal. The first disjunct asserts that you clean the kitchen in all worlds that come closest to the ideal. Assuming that you do not clean the kitchen forces us to consider less ideal possibilities. The second disjunction asserts that in all of those in which you don't clean the kitchen, you walk the dog. This derives Schwager's *or else* effect, where the first option is given priority, and the second viewed as a backup plan.

The final ingredient of Meyer's account is to assume that there is a covert variant of *else*. This is necessary since the same interpretation can appear even without overt else, as in (32a). Our account will not take a stand on whether the dynamic effect of disjunction is part of the interpretation of disjunction itself or due to covert *else*. One potential issue with using covert *else* comes from differences between disjunctions with and without *else*. Meyer mentions the following example, due to Webber et al. (2003).

(34) a. If the light is red, stop, or go straight on.
$\not\equiv$ Go straight on if the light is not red.
$\equiv$ Go straight on if you don't stop.
b. If the light is red, stop, or else go straight on.
$\equiv$ Go straight on if the light is not red.
$\equiv$ Go straight on if you don't stop.

If the dynamic effect of disjunction were due to covert *else*, it would be unclear why a covert *else* could not appear in (34a) to make the disjunction's anaphoric possibilities the same as those in (34b). Meyer could respond that overt and covert *else* differ in their anaphoric possibilities. Though it is hard to explain why covert and overt elements with the same meaning should spontaneously differ along this highly specific dimension; namely, their anaphoric possibilities.

Since we do not assume that *else* is necessary for the dynamic effect, our account already has the flexibility to allow the dynamic effect of disjunction to differ from *else*, such as which anaphors they allow. Recall our proposal that the dynamic effect of disjunction allows the second disjunct to be interpreted assuming the negation of the first or a subclause of the first. The clause *the light is red* in (34a) is neither, so we correctly predict the anaphoric possibilities in (34). To account for (34b), we may simply assume that *else* is a pronomial element which can negate any salient clause.

Our account is also compatible with various ways of deriving a conjunctive interpretation of disjunction. Meyer assumes an implicature approach to free choice (Kratzer and Shimoyama 2002, Fox 2007). Recently, some striking differences in acquisition and processing have been discovered for free choice and implicatures, with the free choice inferences being acquired earlier and easier to process (Aloni 2023). Our account is also compatible with Aloni's account for free choice, which also has a mechanism to derive wide scope free choice. (Indeed, our account also solves an open problem for Aloni's account, the unwelcome prediction that $\Box A \vee \Box B$ implies $\Box A \wedge \Box B$ whenever the speaker is an authority on the the modal's accessibility relation.)

Putting aside these differences with Meyer's account, we follow her in assuming that the asymmetric reading is due to a conjunctive interpretation, with the *or else* effect derived using a Kratzerian ordering over possibilities.

Meyer only discusses an asymmetric reading for *or else* sentences. In (12) we saw an example of a disjunction of universal modals that intuitively had a symmetric reading, with each option viewed on a par. To my knowledge, no existing account derives the symmetric reading. We turn to this task now.

4 The role of *either*

In this section we briefly rule out an alternative explanation of our data, where two modals are pronounced, but these are somehow really one modal. Recall example (20) above, featuring wide scope *either*.

(20) Ginsberg is faced with possible expulsion from Columbia. Either he must be expelled or he must embrace establishment values. He chooses the former.

Following a generalisation by Larson (1985), *either* forces the disjunction to take wide scope. This challenges the idea that (20) could have the logical form $\Box(A \vee B)$, where a single *must*, doubly pronounced, takes scope over both disjuncts. For one might have been tempted to propose that the second *he must* is somehow elided, as in (35).

(35) He must be expelled or ~~he must~~ embrace establishment values.

Simons (2005) and Meyer and Sauerland (2016) propose a similar idea to account for wide scope free choice (Zimmermann 2000) via across-the-board movement (Postal 1978, Ross 1967, Williams 1978), as in (36). This proposal reduces wide scope free choice, $\Diamond A \vee \Diamond B$, to the more familiar case of narrow scope free choice, $\Diamond(A \vee B)$.

(36) He might be in London or ~~he might be~~ in Victoria.

The proposal has been criticised on similar grounds to those we have just discussed; namely, that *either* is compatible with a conjunctive reading. For example, Cremers et al. (2017) found experimental evidence that (37) can have a free choice inference, implying both disjuncts (especially when the speaker is presumed to know what Mary may eat).

(37) Either Mary can have a pizza or she can have a hamburger.
   a. $\rightsquigarrow$ Mary can have a pizza
   b. $\rightsquigarrow$ Mary can have a hamburger.

The same discussion has played out in parallel in the literature on conditionals. Khoo notes that *if or if*-conditionals *if A or if B, C* imply each of their simplifications, *if A, C* and *if B, C*, and offers an account of this fact.

(38) If John draws a hold coin or if he draws a silver coin, he will win.

Disjunctions of conditionals often receive a conjunctive interpretation.

(39) If John draws a gold coin he will win or if he draws a silver coin he will win.

Khoo considers the option that "one possible LF of [(39)] involves deletion of the doubled consequent clause at LF (resulting in it having the LF of an *if or if*-conditional)".[21]

$$\textit{if } A, C \textit{ or if } B, C \quad \Rightarrow \quad \textit{if } A \not{C} \textit{ or if } B, C$$

However, the same criticism of this strategy for disjunctions of universal modals applies here. Disjunctions of conditionals with *either* can also have a conjunctive interpretation. Woods (1997:63) offers the following examples.[22]

(40) a. Either he will stay in America if he is offered tenure or he will return to Europe if he isn't.
b. Either she left in disgust, if she found no one there, or she never came in the first place, if the letter changing the date never reached her.
c. Either he is in Rome, if he is in Italy, or he is in Bordeaux, if he is in France.

Assuming *either* fixes the scope of disjunction, with these examples what you see is what you get: they are disjunctions of conditionals, rather than *if or if*-conditionals.

[21] Khoo (2021a:n.23) notes that this strategy does not apply to conditionals where the consequents are not the same, such as (5) above, which may also receive a conjunctive interpretation.

[22] The fact that the consequent precedes the antecedent in each of these examples may suggest that they involve parenthetical *if*-clauses (see Meyer 2016:41). Note, however, that there are examples with *either* where the antecedent precedes the consequent that still receive a conjunctive interpretation.

(i) Either if Alice goes Charlie will go, or if Bob goes Charlie will go.

It is less plausible to argue that the *if*-clause here is parenthetical to material that comes after it. Moreover, this example does not appear to involve the intonational breaks characteristic of parentheticals (see Bolinger 1989, Dehé and Kavalova 2007, Meyer 2016:42).

5 The symmetric interpretation

The conjunctive interpretation predicts an asymmetry between the two disjuncts, discussed by Schwager (2006) as the *or else* effect. Adopting Kratzer's (1977) analysis of modality, where possibilities are ranked as closer or further from an ideal, the sentences in (9) state that the first disjunct is true at the most ideal (e.g. normatively best/most plausible) worlds. Given disjunction's dynamic effect and a conjunctive interpretation, the second option B cannot hold at the most ideal worlds, since the first disjunct holds at the most ideal worlds and its negation is assumed when interpreting the second disjunct. The only option is for B to hold at less ideal worlds.

(41) You must follow the rules or you must face the consequences.
   a. $\equiv$ You must follow the rules. If you do not follow the rules, you must face the consequences.
   b. $\not\equiv$?? You must face the consequences or you must follow the rules. $\equiv$?? You must face the consequences. If you do not face the consequences, you must follow the rules.

In other cases this asymmetry appears too strong. *Must A or must B* can be asserted even when both options are intuitively on a par, as in (42).

(42) *To win the game, the die must land on multiple of three.*
   You have to roll a three or you have to roll a six.

This sounds much better than when the first disjunct is asserted outright.

(43) ??You have to roll a three. If you don't roll a three, you have to roll a six.

Now that we have evidence that disjunctions of universal modals genuinely do have a symmetric interpretation, we would like understand what generates this reading. In the following sections we develop two ways to generate the symmetric interpretation, without deciding which one (or perhaps both) could be playing a role.

5.1 Option 1: the conjunctive interpretation does not arise

The symmetric use falls out automatically if we assume that the conjunctive interpretation is optional. The bare disjunctive meaning, incorporating disjunction's asymmetric dynamic effect, is $\Box A \vee \Box_{\neg A} B$, where $\Box_{\neg A}(B)$ denotes that B is true at every world in the modal domain where $\neg A$ is true.[23] This is equivalent to $\Box A \vee \Box(\neg A \rightarrow B)$, where $\rightarrow$ is the material conditional. Observe that this is just $\Box A \vee \Box(A \vee B)$. Since $\Box A$ entails $\Box(A \vee B)$, this is itself equivalent to

[23] We leave open how the modal domain is determined. Our proposal is compatible with any semantics of modals, provided it says that modal statements are evaluated at some domain—an uncontroversial claim.

$\Box(A \vee B)$.

$$\begin{aligned} & \Box A \vee \Box_{\neg A} B \\ \equiv\ & \Box A \vee \Box(\neg A \rightarrow B) \\ \equiv\ & \Box A \vee \Box(A \vee B) \\ \equiv\ & \Box(A \vee B) \end{aligned}$$

The resulting meaning is symmetric, and appears to be a reasonable prediction for (42): to win the game, you have to roll three or six.[24]

Above we have used the material conditional to represent the restriction supplied dynamic effect of disjunction. However, it is well-known that the material conditional does not represent how restriction works in natural language (Kratzer 1986, von Fintel 1998). For example, *Most cats hate milk* does not mean that most things are either not a cat or hate milk; *Usually, if it's the weekend I'm in my office* does not mean that usually is it not the weekend or I'm in my office.

Nonetheless, the equivalences above remain if we assume a more sophisticated treatment of restriction; for example, that sentences are evaluated at information states (Yalcin 2007, Aloni 2023) and that these information states can be restricted by dynamic effects of the connectives (Klinedinst and Rothschild 2012) or conditional antecedents (Yalcin 2007, Gillies 2010). Suppose that sentence A holds at an information state s (denoted $[\![A]\!]^s$) just in case A is true at every world in the information state, and thus, for example, $[\![A \vee B]\!]^s$ holds just in case every world in the information state makes A or B true. Where $|A|$ is the set of worlds where A is true, we have the following equivalences.

Assume, following Aloni (2023), that $\Box A$ is true at state s just in case for every world w in s, A is true at every world accessible from w.

(44) $\Box A$ is supported by s just in case for all $w \in s$, A is supported by $R[w]$.

[24] In deriving the equivalence of $\Box A \vee \Box_{\neg A} B$ and $\Box(A \vee B)$, the role of the first disjunct $\Box A$ may appear to be redundant. This is because the second disjunct $\Box_{\neg A}(B)$ is all by itself equivalent to $\Box(A \vee B)$. However, the first disjunct still makes a contribution to the meaning of the sentence. Firstly, it supplies the information that is negated by the second disjunct, preventing $\Box B$ from being asserted outright. That being said, various alternative choices for the first disjunct can supply the same restriction, such as A alone. However, $A \vee \Box_{\neg A} B$ is not equivalent to $\Box(A \vee B)$, the difference being that $\Box A$, but not A, entails $\Box(A \vee B)$.

One way in which $\Box A$ is stronger than A is that $\Box A$ presupposes $\Diamond A$—what is obligatory is permissible; what is certain is epistemically possible—while A does not. People act in forbidden ways all the time. Compare:

(i) a. John will bankrupt the company or the board must agree on a plan to stop him.
b. John must bankrupt the company or the board must agree on a plan to stop him.

Only (ib) implies that John is allowed to bankrupt the company.

$$\begin{array}{ll} & [\![A \vee B]\!]^s \\ \text{iff} & [\![A]\!]^s \text{ or } [\![B]\!]^{s\cap|\neg A|} \\ \text{iff} & [\![A]\!]^{s\cap|\neg B|} \text{ or } [\![B]\!]^{s\cap|\neg A|} \end{array}$$

$$\begin{array}{ll} & [\![A \vee B]\!]^s \\ \text{iff} & [\![A]\!]^s \text{ or } [\![B]\!]^{s\cap|\neg A|} \\ \text{iff} & [\![A]\!]^{s\cap|\neg B|} \text{ or } [\![B]\!]^{s\cap|\neg A|} \end{array}$$

Now that we have this route to the symmetric reading, let us discuss a few of its properties. Section 5.2 discusses possible differences between $\Box A \vee \Box_{\neg A}(B)$ and $\Box(A \vee B)$, and section 5.3 presents some motivation for an alternative route to the symmetric reading.

5.2 Differences between $\Box A \vee \Box_{\neg A}(B)$ and $\Box(A \vee B)$

As we have seen, under a disjunctive reading, $\Box A \vee \Box_{\neg A}(B)$ is equivalent to $\Box(A \vee B)$. There may nonetheless be some differences in meaning between $\Box A \vee \Box_{\neg A}(B)$ and $\Box(A \vee B)$. It is widely assumed that interpretative domains must be non-empty (von Fintel 1994, Aloni 2023). In this case the domain is the modal domain—a set of worlds—such as the set of worlds that best satisfy the rules (for denotic modals), or the most plausible worlds in virtue of the speaker's evidence (for epistemic modals). Given this widespread assumption of non-empty domains, one would expect $\Box A \vee \Box_{\neg A} B$, but not $\Box(A \vee B)$, to imply that the modal domain contains a $\neg A$-world.

The issue can be addressed more straightforwardly without the complication of a modal in the disjunction. Degano et al. (2023) tested the behaviour of disjunctions in which the first disjunct is known to be true, such as (45).

(45) *Context: it is certain that the mystery box contains a yellow ball.*
The mystery box contains a yellow ball or a blue ball.

Their experiment found that such sentences receive uniformly high ratings (mean acceptance 94.7%, 95% confidence interval of [92.4, 96.3]). Intuitively this sentence sounds worse when the dynamic effect of disjunction is made explicit using *else* or a conditional.

(46) a. The mystery box contains a yellow ball or else it contains a blue ball.
b. The mystery box contains a yellow ball, or if it doesn't contain a yellow ball, it contains a blue ball.

The sentences in (46), unlike (45), intuitively imply that it is possible that the mystery box does not contain a yellow ball.

There are two ways to account for the acceptability of disjunctions when the first disjunct is certain, such as (45). Either (i) the dynamic effect of disjunction does not apply in these cases, or (ii) it does apply, but only the unrestricted domain is required to be non-empty, i.e. the domain restricted to the $\neg A$-cases may be empty.[25]

5.3 Motivation for a second route to the symmetric reading

Recall that in section 5.1 we derived the symmetric interpretation of *Must A or must B* assuming that the conjunctive interpretation does not arise. This route to the symmetric reading turns out to be unavailable on Aloni's (2023) account of wide scope free choice, which we show now.

It is well-known that wide-scope free choice is cancellable, as in (47).[26]

(47) You may have coffee or you may have tea, I don't know which.

a. $\not\rightsquigarrow$ You may have coffee.
b. $\not\rightsquigarrow$ You may have tea.

It is an open question whether the conjunctive interpretation can disappear without such avowals of ignorance. For example, as we saw in section 1.1, Aloni (2023) predicts wide-scope free choice whenever the modal's accessibility relation is *indisputable*, meaning that all worlds in the agent's information state agree on which worlds are accessible (e.g. which worlds satisfy the rules, which worlds are compatible with the agent's information). This correctly predicts that a sentence such as (48) has a conjunctive interpretation, implying each disjunct, a reading experimentally corroborated by Cremers et al. (2017).

(48) I know exactly what you are allowed to drink. You may have coffee or you may have tea.

The question is whether a symmetric interpretation of *Must A or must B* results from the disjunction not being interpreted conjunctively. Now consider:

(49) I know exactly what you have to do to win the game. You have to roll a three or you have to roll a six.

Here the speaker is explicitly informed about the possibilities, which would lead us to expect a conjunctive interpretation on a theory like Aloni's. However,

[25] A third possibility, proposing that we expand the domain to include more remote $\neg A$-cases when interpreting the second disjunct, where the mystery box does not contain a yellow ball, does not seem plausible here. There appears to be a contrast between plain disjunctions such as (45), and sentences where the possibility of the first disjunct being false is explicitly raised, as in (46b). We would lose the contrast if a disjunction *A or B* required the speaker to consider $\neg A$ epistemically possible.

[26] For discussion of the "I don't know which" sluice, see Fusco (2019) and Pinton (2021).

intuitively the disjunction is still interpreted symmetrically, with neither disjunct viewed as having priority over the other.

There is certainly a contrast between (49) and (50), where the first disjunct has priority over the other.

(50) I know exactly what you have to do to win the game. You have to roll a three, and if you don't roll a three, you have to roll a six.

Given that the two options—rolling three or six—are on a par, (49) is a natural thing to say while (50) is odd, implying that rolling a three is in some sense preferred, with rolling a six a mere backup plan.

Under a theory that predicts a conjunctive interpretation for sentences such as (49), such as Aloni's, we cannot use a disjunctive interpretation to derive the symmetric reading, and in particular, the contrast between (49) and (50). Fortunately, however, there is a second route to the symmetric interpretation, which we turn to now.

5.4 Option 2: symmetric restriction

The second way to derive a symmetric interpretation of *Must A or must B* to use symmetric restriction: $\Box B$ is interpreted given $\neg A$, but vice versa, $\Box A$ is interpreted given $\neg B$.

Symmetric restriction for disjunction is not as strange as might at first seem. A disjunction $A \vee B$ is equivalent to the asymmetric restriction, $A \vee (\neg A \rightarrow B)$, where the second disjunct is interpreted assuming the negation of the first. However, it is also equivalent to the symmetric restriction, $(\neg A \rightarrow B) \vee (\neg B \rightarrow A)$, where each disjunct is interpreted assuming the negation of the other.

$$\begin{aligned} & A \vee B \\ \equiv\ & A \vee (\neg A \rightarrow B) \\ \equiv\ & (\neg A \rightarrow B) \vee (\neg B \rightarrow A) \end{aligned}$$

Symmetric restriction may seem strange because the analogous restriction does not happen for conjunction. A conjunction $A \wedge B$ is equivalent to one where the second conjunct is interpreted assuming the first, $A \wedge (A \rightarrow B)$. But note that the equivalence breaks if the restriction is symmetric, as $(B \rightarrow A) \wedge (A \rightarrow B)$, where each conjunct is interpreted assuming the other.

$$\begin{aligned} & A \wedge B \\ \equiv\ & A \wedge (A \rightarrow B) \\ \not\equiv\ & (A \rightarrow B) \wedge (B \rightarrow A) \end{aligned}$$

While $A \wedge (A \rightarrow B)$ is equivalent to $A \wedge B$, $(A \rightarrow B) \wedge (B \rightarrow A)$ allows both A and B to be false.

At this point the only extra step we need to take is to say that these equivalences can be preserved when each disjunct appears under a modal. That is, given that $A \vee B$ can be interpreted as $A \vee (\neg A \to B)$ or as $(\neg A \to B) \vee (\neg B \to A)$, we add that $\Box A \vee \Box B$ can also be interpreted as $\Box A \vee \Box(\neg A \to B)$ or as $\Box(\neg A \to B) \vee \Box(\neg B \to A)$. What exact mechanism is responsible for this effect we leave for future work.

Under a conjunctive interpretation, the asymmetric restriction means $A \wedge \Box(\neg A \to B)$, which gives rise to the asymmetric interpretation, with A true at more ideal possibilities and B true at less ideal possibilities.

Under symmetric restriction, the *Must A or must B* means $\Box(A \vee B)$, whether or not the disjunction is interpreted conjunctively.

$$
\begin{aligned}
& \Box_{\neg B} A \vee \Box_{\neg A} B \\
\equiv \quad & \Box(\neg B \to A) \vee / \wedge \Box(\neg A \to B) \\
\equiv \quad & \Box(A \vee B) \vee / \wedge \Box(A \vee B) \\
\equiv \quad & \Box(A \vee B)
\end{aligned}
$$

This gives rise to the symmetric interpretation, with the A and B possibilities on a par, as in (42).

5.5 Symmetric disjunction in local contexts

The use of symmetric restriction becomes more plausible when we compare how local contexts behave in the theory of presupposition projection. A widely influential idea is that presuppositions must be satisfied in their local contexts. Suppose the local context of B in *A or B* can be the global context restricted to worlds where A is false. Then if A presupposes $\neg B$, this presupposition is satisfied in A's local context and there is no need for the global context to entail $\neg B$: the presupposition is filtered.

Here we observe a contrast between conjunction and disjunction. Mandelkern et al. (2020) present experimental evidence that presupposition filtering in conjunction is asymmetric. Kalomoiros and Schwarz (2024) later replicated this result, finding in addition that presupposition filtering in disjunction is symmetric.[27] For example, both sentences below sound equally acceptable.

(51) a. John recently quit smoking or he never smoked.
b. John never smoked or he recently quit smoking.

(52) a. There's no bathroom here or it's in a strange place.
b. The bathroom is in a strange place or there's no bathroom here.

[27] For an account that predicts the asymmetry of filtering for conjunction and optional symmetry of filtering for disjunction, see Kalomoiros (2019, 2023).

Schlenker (2009) tentatively suggests that local contexts may be calculated symmetrically for both disjunction and conjunction, proposing that this is generally dispreferred to the asymmetric local contexts. Though nothing in his account suggests any difference between conjunction and disjunction with respect to the availability of symmetric local contexts.

It is tempting to think the restricted interpretations of modals we discuss in this paper and the calculation of local contexts are part of a unified phenomenon, one not specific to presupposition. If so, then the data above—that presupposition filtering is asymmetric for conjunction but can be symmetric for disjunction—point in favour of that pattern also for restricted interpretations of modals. In this direction, Schlenker (2009:30–32) presents an extension of his account of local contexts to handle belief reports. Schlenker, following Heim (1992), assumes a modal analysis of belief reports, which could easily be extended to modals in general, such as *must*.

6 Analysis: Disjunctions of conditionals

Turning to disjunctions of conditionals, we adopt the same dynamic interpretation. If the restriction is asymmetric, the second disjunct is interpreted assuming the negation of the first, or the negation of a subclause of the first. If it is symmetric, each disjunct is interpreted assuming the negation of the other, or the negation of a subclause of the other.

In general, there are three options for which clause is negated: the whole conditional, its antecedent, or its consequent. We discuss each possibility in turn.

6.1 Negating the whole conditional

That the whole conditional is an option is shown by examples such as (53).[28]

(53) The concrete stays intact if it is subjected to high pressure, or it is unsuitable for our purposes.
≡ The concrete stays intact if it is subjected to high pressure, or if is not the case that it stays intact if subjected to high pressure, it is unsuitable for our purposes.

This reading is not very interesting for our present purposes since it has the same truth-conditions as when the dynamic effect does not apply. This is guaranteed by the classical equivalences below, where $\rightarrow$ denotes the material conditional.

$$\begin{array}{ll} & A \vee B \\ \text{iff} & A \vee (\neg A \rightarrow B) \\ \text{iff} & (\neg B \rightarrow A) \vee (\neg A \rightarrow B) \end{array}$$

In other cases the antecedent or consequent is negated. I propose that this is responsible for the diverging interpretations of (2), repeated below.

[28] This example is modelled after the following example from Douven (2016) of a left-nested conditional.

(i) If this material becomes soft if it gets hot, it is not suited for our purposes.

(2) a. If Alice had come to the party, Charlie would have come.
Or if Bob had come, Charlie would have come.
b. If Alice had come to the party, Charlie would have come.
Or if Alice had come, Darius would have come.

(54) a. If A, C or if B, C
$\rightsquigarrow$ If A, C
$\rightsquigarrow$ If B, C
b. If A, C or if A, D
$\not\rightsquigarrow$ If A, C
$\not\rightsquigarrow$ If A, D

We will first discuss the predictions given an asymmetric dynamic effect, and then discuss those of a symmetric dynamic effect.

6.2 Disjunctions of conditionals on the asymmetric interpretation

On the asymmetric interpretation, the first disjunct is interpreted classically, and second disjunct is interpreted assuming the negation of the first or a subclause of the first. Given *If A, C or if B, C*, disjunction's dynamic effect cannot negate the consequent, since this would result in *If A, C or if B and ¬C, C*. The second disjunct is trivially false, since no $\neg C$-cases are C-cases. As discussed, we leave open the possibility that the disjunction is interpreted conjunctively or disjunctively. Either way this interpretation is problematic. On the conjunctive reading, the whole sentence is trivially false, violating the maxim of quality (*Be truthful!*). On the disjunctive reading, the second disjunct is redundant, violating a plausible non-idleness principle proposed by Klinedinst and Rothschild (2012).

(55) No clause may be entirely idle in determining the meaning of a sentence.

Either way, then, interpreting *If A, C or if B, C* as *If A, C or if B and ¬C, C* violates principles of conversation.

However, negating the *antecedent* of the first conditional remains possible. In that case *If A, C or if B, C* is interpreted as *If A, C and if ¬A and B, C*. This appears to be a reasonable prediction for (2a). The key claim here is that the second conditional is interpreted assuming the negation of the first's antecedent. Let us now discuss two pieces of evidence for this interpretation.

6.3 Evidence for restriction to the ¬*A* cases

The first piece of evidence comes from the behaviour of presuppositions. Consider a conditional variation on Partee's bathroom sentence:

(56) If the house doesn't have a bathroom, I'll have to go home, or if it's just hard to find, I'll ask the host for directions.

For *it* to have a referent, the second conditional must be interpreted assuming the negation of the antecedent of the first, i.e. assuming that the house has a bathroom.

(57) If the house doesn't have a bathroom, I'll have to go home, or if it does have a bathroom and it's just hard to find, I'll ask the host for directions.

A second, less direct piece of evidence for a restriction to the $\neg A$-cases comes from comparing conjunctions and disjunctions of conditionals. With conjunctions of conditionals, two interpretations appear available, shown in (58).

(58) *We have a reservation at the restaurant for 9 people.*
   a. If Alice comes to the restaurant we'll need to reserve 10 people, and if Bob comes we'll need to reserve for 10.
   b. If Alice comes to the restaurant we'll need to reserve 10 people, and if Bob comes we'll need to reserve for 11.

The first represents a single-restriction reading, with no interaction between the two conditionals. The second represents a double-restriction reading, where the second conditional is interpreted under the assumption of both antecedents. This reading can be forced by adding, say, "also", "too" or "in addition" to the second antecedent.

Here we leave open the precise mechanism that generates the two readings. It could be due the presence or absence of modal subordination (Roberts 1989), with the presence of modal subordination generating the double-restriction reading and its absence the single-restriction reading. Or it could be due to co-indexing of the modals, following von Fintel's (1994) implementation of the restrictor view of conditionals (indeed, on closer inspection these may turn out to be two ways of articulating the same idea). On von Fintel's view, *if*-clauses restrict modals via covert domain variables. The semantic contribution of if_i A is to restrict modal base assigned to i to those worlds where A is true. Different indices result in single restriction, co-indexing double restriction.

(59) a. If_i Alice comes to the restaurant we will_i need to reserve 10 people, and if_j Bob comes we will_j need to reserve for 10.
   b. If_i Alice comes to the restaurant we will_i need to reserve for 10 people, and if_i (in addition) Bob comes we will_i need to reserve for 11.

What matters for present purposes is that, unlike for conjunction, the double-restriction reading is impossible for disjunctions of conditionals.

(60) a. If Alice comes to the restaurant we will need to reserve 10 people, or if Bob comes we will need to reserve for 10.
   b. If Alice comes to the restaurant we will need to reserve 10 people, #or if (in addition) Bob comes we will need to reserve for 11.

The fact that double-restriction is available for conjunctions of conditionals but not for disjunctions of conditionals is an interesting contrast, one that to my knowledge has not been previously observed. One straightforward way to account for this contrast is to assume that the second conditional is interpreted assuming the negation of the antecedent of the first. That is, (60b), *If A, C or if B, D*, is interpreted as *If A, C or if* $\neg A$ *and B, D*, exactly as we have proposed above. The restriction to $\neg A$-cases then blocks the double restriction reading, since it would amount to *If A, C or if A and* $\neg A$ *and B, D*, in which the second conditional is trivial (and therefore either false on a conjunctive reading of the conditional, or redundant on a disjunctive reading; either way it violates principles of conversation).

6.4 If *A*, *C* or if *A*, *D*

Things change radically when the antecedents are the same, as in (2b), repeated below.

(2b) If Alice had come to the party, Charlie would have come. Or if Alice had come, Darius would have come.

Now, on pain of triviality, the second conditional cannot be interpreted assuming the negation of the first's antecedent; that is, *If A, C or if A, D* cannot be interpreted as *If A, C or if* $\neg A$ *and A, D*. Under this restriction the second conditional has an empty domain, violating a general prohibition on empty domains (von Fintel 1994, Aloni 2023, among many others).

However, negating the first conditional's *consequent* remains possible. In that case *If A, C or if A, D* is interpreted as *If A, C or if* $\neg C$ *and A, D*.

Evidence for this restriction comes again from a variant of Partee's bathroom sentence.

(61) The office will have no bathroom if we hire Ace Architects. Or if we hire them they'll put it in a strange place.

For *it* to have a referent, the second conditional must be interpreted assuming the negation of the first's consequent, which we may paraphrase as:

(62) The office will have no bathroom if we hire Ace Architects. Or if the office has a bathroom and we hire them they'll put it in a strange place.

Given these assumptions, all Meyer needs to derive the conjunctive interpretation is to explain why the conjunctive alternative *A and B* is not an available alternative to *A or B* in the sentences we have considered. Meyer assumes that these sentences involve a covert version of else. Note that and else is unassertable:

(63) #John must be rich and else he wouldn't own a Porsche. (Meyer 2016:ex. 70)

Assuming that alternatives must be assertable (Meyer 2016:33), covert *else* blocks the *and*-alternative, paving the way for the conjunctive interpretation.

6.5 Aloni (2023)

Aloni (2023) assumes that sentences are supported at information states (sets of worlds), where there is a general requirement that every information state involved in the interpretation of a sentence be non-empty. A disjunction $A \vee B$ is supported by an information state s just in case it can be split into two substates t, t', where $s = t \cup t'$, t supports A and t' supports B. A universal modal $\Box A$ is supported just in case for every world w in the information state, A is true at every world accessible from w.

In this framework, a conjunctive interpretation of disjunction falls out assuming a constraint Aloni calls *indisputability*: all worlds in the information state agree on which worlds are accessible. As Aloni explains, where R is the modal's accessibility relation, "an indisputable R means that the speaker is fully informed about R, so, for example, if R represents a deontic accessibility relation, indisputability means that the speaker is fully informed about (or has full authority on) what propositions are obligatory or allowed."

7 Geurts (2005)

Geurts (2005) proposes that disjunctions are in fact conjunctions of possibilities. He considers disjunctions of necessity modals such as

(64) a. You must do this or (else) you must do that.
b. It must be here or (else) it must be there.

On Geurts' account, these sentences are interpreted as $\Diamond\Box A \wedge \Diamond\Box B$. He then applies Zimmermann's (2000) self-reflection principle, which guarantees that these are equivalent to $\Box A \wedge \Box B$. Geurts recognises that this is a problem, since (64) are certainly not equivalent to (65).

(65) a. You must do this and you must do that.
b. It must be here and it must be there.

To solve the problem, Geurts imposes some additional constraints on the interaction between disjunction and modality. Where $A\textsc{m}B$ is a modal expression with domain A and scope B, Geurts proposes:

> Let $A_1\textsc{m}_1B_1 \wedge \cdots \wedge A_n\textsc{m}_nB_n$ be the logical form of a sentence 'S_1 or ... or S_n', which is interpreted against a contextually given background set C:
>
> *Disjointness*: If $1 \leq i, j \leq n$, then $A_i \cap B_i \cap A_j \cap B_j = \emptyset$.
> *Non-triviality:* $A \neq \emptyset$, for any $A\textsc{m}B$.

Geurts uses this to account for the behaviour of (64), proposing that modal domains are by default set to the whole background set, but may deviate from this default and be restricted when forced in order to comply with Disjointness and Non-triviality.

> By default, A and A' are bound to C, i.e. $A = A' = C$. ... The logical form of [(64a) and (64b)] is $A\Box B \wedge A'\Box B'$, and it is interpreted against an epistemic background C. ... if $A = A' = C$, the sentence entails that It must be here and there, which is inconsistent with the fact that, as a rule, a chicken [the 'it' in Geurts' examples] cannot be in more than one place at a time. More generally, Disjointness and Non-triviality cannot be satisfied together if either $A = C$ and $A' \subseteq C$ or $A' = C$ and $A \subseteq C$. Therefore, A and A' are allowed to cover only part of C, i.e. $A \subseteq C$ and $A' \subseteq C$.
>
> (Geurts 2005:396–97)

In this passage Geurts suggests it is important that the disjuncts be incompatible, i.e. that the chicken ('it' in his examples) cannot be in more than one place at a time. However, as we have seen, the same behaviour appears with logically compatible disjuncts:

(66) You must clean your room or you must walk the dog.

Even for the laziest among us, it is not a logical contradiction to do both.

Geurts could reply that the disjointness constraint nonetheless applies: we restrict the modal domains to force A and A' to be disjoint. Thus the Disjointness constraint lies at the heart of Geurts' account of (64). It is Disjointness which forces the modal bases to deviate from their default value of $A = A' = C$.

There is a simple argument against this strategy: Disjointness is not correct. As we discussed in section 5.2, Degano et al. (2023) found experimental evidence that a disjunction can be accepted even when one of the disjuncts is known to be true. In this case disjointness and non-triviality cannot be jointly satisfied, since the first disjoint holds throughout the modal domain. However, if we remove the disjointness constraint, as we should to account for Degano et al.'s experimental results, we can no longer maintain Geurts' explanation of why we deviate from the default of taking A and A' to be C.

As a last resort, one could suggest that, even without insisting on disjointness, the restrictive strategy is available to rescue the sentence from falsity. If so, there is nothing specific to disjunction about this possibility, so we would expect the same strategy to be available in general—including for conjunctions. However, this is not what we observe. Consider:

(67) a. #He must be in Paris and he must be in Berlin.
b. #You must go to Paris and you must avoid Paris.

In light of this response, one might propose that the modal bases could be restricted along the following lines to save these sentences from falsity.

(68) a. (If he is in Paris,) he must be in Paris and (if he is in Berlin), he must be in Berlin.
b. (If you go to Paris,) You must go to Paris and (if you avoid Paris,) you must avoid Paris.

However, such rescuing restrictions are unavailable; (67) are most naturally read as inconsistent. As a final move, one might suggest that conjunctions presuppose that their conjuncts are jointly consistent. Though this is ruled out by examples such as (69), which are clearly fine.

(69) No one can be in Paris and Berlin at the same time.

8 Ignorance inferences

In this final section we discuss a further benefit of our proposal. It extends to accounting for a previously noted puzzle involving disjunction and modality. Dorr and Hawthorne (2013) and Meyer (2016) discuss examples such as (70).

(70) Where is John?
He is at the pool or, if it's raining, at the gym.

Meyer notes, citing Dorr and Hawthorne (2013), that (70) gives rise to unexpected ignorance implicatures. We typically expect an assertion of a disjunction to implicate that each disjunct is not certain. But (70) does not imply that the speaker is uncertain about the second disjunct, shown in (71) (where Bp denotes that the speaker believes proposition p).

(71) He is at the pool or, if it's raining, at the gym.
a. $\not\rightsquigarrow \neg B$(If it is raining he is at the gym).
b. $\rightsquigarrow \neg B$He is at the gym.

Indeed, (70) intuitively implies that if it is raining, John is at the gym.

Meyer accounts for this by assuming that (70) involves a parenthetical *if*-clause, which does not enter into implicature computation, writing that

> [the role of the parenthetical *if*-clause] inside disjunction seems rather to partly specify how the speaker's doxastic alternatives are structured: Though there are both pool-worlds and gym-worlds, making it impossible for the speaker to assert a stronger sentence, the parenthetical *if*-clause in [(70)] adds the information that among these two kinds of worlds, it is the rain-worlds in which John is at the gym.
>
> (Meyer 2016:42)

Here we offer an alternative proposal, in which the *if*-clause is interpreted normally, rather than—perhaps somewhat mysteriously—vanishing from implicature computation.

Before presenting our proposal, let us briefly note that, without further refinement, (71b) is not predicted by Aloni's (2023) semantics of disjunction, given a simple semantics for indicative conditionals (one previously proposed by Yalcin 2007, Gillies 2010, Klinedinst and Rothschild 2012). We assume that *if A, C* is supported by an information state s just in case C is supported by $s \cap |A|$, i.e. the state that results from restricting s to the worlds where A is true (this is inspired by parameter-based approaches to indicative conditionals such as Yalcin 2007, Gillies 2010, Klinedinst and Rothschild 2012).

At present there is nothing in the meaning of (70) that rules out the following information state, $s = \{w_1, w_2, w_3\}$.

w_1:	pool	¬raining	¬gym
w_2:	pool	raining	¬gym
w_3:	¬pool	raining	gym

(70) intuitively communicates that John is at the gym—and not in the pool—if it is raining. That is, it rules out w_2. However, without further refinement, Aloni's theory does not predict this. A speaker with the above information state, which includes w_2, is predicted to not believe that if it is raining, John is at the gym.

8.1 Proposal: Dynamic effect, conjunctive interpretation

We assume that sentences are interpreted with respect to a range of epistemic possibilities. We will leave open the precise implementation of this idea; for example, it could be due to disjunctions being interpreted at information states (Aloni 2023), or due to a covert universal epistemic operator (à la Kratzer 1986, Meyer 2013) applying to each disjunct.

The range of epistemic possibilities is variable, typically restricted to a range of the most plausible possibilities. This idea is familiar from Kratzer's (1991) analysis of modality, but also contextualist analyses of knowledge (DeRose 1992, MacFarlane 2005) For example, on the Relevant Alternatives Theory of knowledge (Dretske 1970, Goldman 1976), knowing a proposition requires being able to rule out its relevant alternatives. Which alternatives count as relevant varies with context. For example, in a conversation with folks on the street we can say that we know that we have hands or that sun will rise tomorrow, even though in a philosophy seminar room we might well deny these. A contextualist theory such as Relevant Alternatives accounts for this by noting that in a philosophy seminar room we are willing to consider more remote possibilities.

As before, we further assume disjunction has a dynamic effect.[29] Disjunction may also receive a conjunctive interpretation. On this reading, (70) is interpreted as follows, where s is the initial modal domain, and $s^+ \supseteq s$ an expanded domain.

(72) $\Box_s$He is at the pool $\wedge \Box_{s+}$(If it's raining, he is at the gym)

[29] Here we will implement the idea with an asymmetric dynamic effect, though the same predictions follow on a symmetric approach, assuming (70) is interpreted as

(i) If it is not raining, he is at the pool, or if he is not at the pool and it's raining, he is at the gym.

The first disjunct is interpreted at a set s of epistemic possibilities. In all of these possibilities he is at the pool. Given disjunction's dynamic effect, the second disjunct is interpreted assuming the negation of the first, that he is not at the pool. Since s only contains worlds where he is at the pool, to avoid an empty domain for the second disjunct, the set of epistemic possibilities must expand to include previously unconsidered possibilities where he is not at the pool. It then asserts that among the worlds in the expanded domain s^+ where it is raining, he is at the gym. The second disjunct rules out the possibility of John being at the pool in the rain (w_2 above), a possibility which (70) intuitively does rule out.

As von Fintel (2001) discusses in the context of counterfactuals, while modal domains can easily expand, it is much harder for them to contract. There is a simple explanation for this. It is easy to raise previously unconsidered possibilities, but must harder to spontaneously ignore them soon after they have been raised. I can make you imagine a pink elephant, but once it has been mentioned, I cannot make you to clear it from your mind.

After (70) has been asserted, the epistemic domain is s^+ rather than s. It is at this expanded domain that we must assess the uncertainty inferences generated by this sentence. This account predicts exactly the uncertainty implicatures that Dorr and Hawthorne (2013) and Meyer (2016) observe.[30]

(73) a. $\Box_s$(He is at the pool)
b. $\neg\Box_{s^+}$(He is at the pool)
c. $\Box_{s^+}$(If it's raining, he is at the gym)

8.2 Extension to conjunctions of modals

A potential issue with this story comes from extending it to conjunctions. Suppose that the second conjunct can be interpreted assuming the first, or a subclause of the first. This works well for conjunctions of necessity modals. For then $\Box A \wedge \Box B$, can be interpreted as $\Box A \wedge \Box_A B$, i.e. as $\Box A \wedge \Box(A \rightarrow B)$, which is equivalent to $\Box A \wedge \Box B$ by the K axiom. This is a welcome result; intuitively, (74a) is equivalent to (74b).

[30] One might object that this proposal cannot account for the oddness of the conjunctive alternative:

(i) # He is at the pool and, if it's raining, at the gym

The objection is that, if the range of epistemic possibilities can expand mid-sentence, as in (72), why can't it also expand to render (i) acceptable?

We can solve this using an independently-observed feature of conjunction. It has an analogous dynamic effect (Schlenker 2009, Klinedinst and Rothschild 2012), whereby the second conjunct is interpreted assuming the first or a subclause of the first. The second conjunct therefore asserts that if *John is at the pool* and it is raining, he is at the gym, which is odd since John cannot be in two places at once. As soon as the incompatibility is removed, as in (ii), the sentence becomes fine.

(ii) He is at the pool and, if it's raining, took the car there.

(74) a. You must clean the kitchen and you must walk the dog.
b. You must clean the kitchen and walk the dog.

It is open question whether this story extends to conjunctions of possibility modals. Take (75):

(75) You may have coffee and you may have tea.

Our story above would suggest that $\Diamond A \wedge \Diamond B$ can be interpreted as $\Diamond A \wedge \Diamond_A B$, that is, as $\Diamond A \wedge \Diamond(A \wedge B)$. This has the additional inference that A and B are possible together (similar to the package deal interpretation discussed by van Rooij 2006). Certainly it seems possible to rule out the joint permission explicitly:

(76) You may have coffee and you may have tea, but you may not have both.

To maintain a uniform story across disjunction/conjunction and universal/possibility modals, one might propose that the avowal "but you may not have both" cancels the restriction to A-worlds in the second conjunction. The details of this proposal will have to remain for future work.[31]

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References

Aloni, Maria (2023). Logic and conversation: The case of free choice. *Semantics and Pragmatics* 15 (5). DOI: 10.3765/sp.15.5.

Beaver, David (2001). *Presupposition and assertion in dynamic semantics.* Vol. 29. CSLI publications.

Bennett, Jonathan (2003). *A philosophical guide to conditionals.* Oxford University Press.

Bolinger, Dwight (1989). *Intonation and its uses: Melody in grammar and discourse.* Stanford University Press.

Chemla, Emmanuel (2009). Similarity: Towards a unified account of scalar implicatures, free choice permission and presupposition projection. *Under revision for Semantics and Pragmatics.*

Chierchia, Gennaro (1995). *Dynamics of Meaning: Anaphora, Presupposition and the Theory of Grammar.* University of Chicago Press.

[31] Note that rewriting the restriction $\Diamond A \wedge \Diamond_A B$ as $\Diamond A \wedge \Diamond(A \rightarrow B)$ would make the wrong predictions, giving it a meaning akin to

(i) You may have coffee, and if you have coffee, you may have tea.

This meaning appears too weak. Intuitively a sentence like (75) explicitly permits one to have tea without having coffee, while $\Diamond A \wedge \Diamond(A \rightarrow B)$ does not.

Cremers, Alexandre et al. (2017). Experimental evidence for a semantic account of free choice. *Colloque de Syntaxe et Semantique à Paris*. URL: http://www.cssp.cnrs.fr/cssp2017/abstracts/Cremers-et-al.pdf.

Degano, Marco et al. (2023). *The ups and downs of ignorance.*

Dehé, Nicole and Yordanka Kavalova (2007). Parentheticals: an introduction. *Linguistic aktuell*, pp. 1–22.

DeRose, Keith (1992). Contextualism and knowledge attributions. *Philosophy and phenomenological research* 52.4, pp. 913–929.

Dorr, Cian and John Hawthorne (2013). Embedding epistemic modals. *Mind* 122.488, pp. 867–913. DOI: 10.1093/mind/fzt091.

Douven, Igor (2016). On de Finetti on Iterated Conditionals. *Computational models of rationality: Essays Dedicated to Gabriele Kern-Isberner on the Occasion of Her 60th Birthday*, pp. 265–279.

Dretske, Fred (1970). Epistemic operators. *The journal of philosophy* 67.24, pp. 1007–1023. DOI: 10.2307/2024710.

Ellis, Brian, Frank Jackson, and Robert Pargetter (1977). An objection to possible-world semantics for counterfactual logics. *Journal of Philosophical Logic* 6.1, pp. 355–357. DOI: 10.1007/BF00262069.

Fine, Kit (2012). Counterfactuals without possible worlds. *Journal of Philosophy* 109.3, pp. 221–246. DOI: 10.5840/jphil201210938.

von Fintel, Kai (1994). Restrictions on quantifier domains. PhD thesis. University of Massachusetts at Amherst. URL: https://semanticsarchive.net/Archive/jA3N2IwN/fintel-1994-thesis.pdf.

— (1998). Quantifiers and 'If'-Clauses. *The Philosophical Quarterly* 48.191, pp. 209–214. DOI: 10.1111/1467-9213.00095.

— (2001). Counterfactuals in a dynamic context. *Ken Hale: A life in language*. Ed. by Michael Kenstowicz. Vol. 36. MIT Press, pp. 123–152. URL: http://web.mit.edu/fintel/fintel-2001-counterfactuals.pdf.

Fox, Danny (2007). Free choice and the theory of scalar implicatures. *Presupposition and implicature in compositional semantics*. Ed. by Uli Sauerland and Penka Stateva. Palgrave, pp. 71–120. DOI: 10.1057/9780230210752_4.

Fusco, Melissa (2019). Sluicing on free choice. *Semantics and Pragmatics* 12, p. 20. DOI: 10.3765/sp.12.20.

Geurts, Bart (2005). Entertaining alternatives: Disjunctions as modals. *Natural language semantics* 13.4, pp. 383–410. DOI: 10.1007/s11050-005-2052-4.

Gillies, Anthony (2010). Iffiness. *Semantics and Pragmatics* 3.4, pp. 1–42. DOI: 10.3765/sp.3.4.

Goldman, Alvin I. (1976). Discrimination and Perceptual Knowledge. *Journal of Philosophy* 73.November, pp. 771–791. DOI: 10.2307/2025679.

Heim, Irene (1982). The semantics of definite and indefinite noun phrases. PhD thesis. University of Massachusetts, Amherst.

— (1992). Presupposition projection and the semantics of attitude verbs. *Journal of semantics* 9.3, pp. 183–221. DOI: 10.1093/jos/9.3.183.

Kalomoiros, Alexandros (2019). Limited symmetry. *European Summer School in Logic, Language and Information*. Springer, pp. 163–176.

Kalomoiros, Alexandros (2023). Presupposition and its (A-) symmetries. PhD thesis. University of Pennsylvania.

Kalomoiros, Alexandros and Florian Schwarz (2024). Presupposition projection from 'and' vs 'or': Experimental data and theoretical implications. *Journal of Semantics*.

Khoo, Justin (2021a). Coordinating *Ifs*. *Journal of Semantics* 38.2, pp. 341–361. DOI: 10.1093/jos/ffab006.

— (2021b). Disjunctive antecedent conditionals. *Synthese* 198.8, pp. 7401–7430.

Klinedinst, Nathan (2024). Coordinated ifs and theories of conditionals. *Synthese* 203 (70). DOI: 10.1007/s11229-023-04458-y.

Klinedinst, Nathan and Daniel Rothschild (2012). Connectives without truth tables. *Natural language semantics* 20, pp. 137–175. DOI: 10.1007/s11050-011-9079-5.

Klinedinst, Nathan Winter (2007). Plurality and possibility. PhD thesis. University of California, Los Angeles. URL: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.184.248&rep=rep1&type=pdf.

Kratzer, Angelika (1977). What 'must' and 'can' must and can mean. *Linguistics and philosophy* 1.3, pp. 337–355. DOI: 10.1007/BF00353453.

— (1986). Conditionals. *Chicago Linguistics Society* 22.2, pp. 1–15.

— (1991). Modality. *Semantics: An international handbook of contemporary research*. Ed. by A. von Stechow and D. Wunderlich. de Gruyter, Berlin, pp. 639–650. URL: https://works.bepress.com/angelika_kratzer/1/.

Kratzer, Angelika and Junko Shimoyama (2002). Indeterminate pronouns: The view from Japanese. *The Proceedings of the Third Tokyo Conference on Psycholinguistics*. Ed. by Y. Otsu, pp. 1–25. URL: https://people.umass.edu/partee/RGGU_2004/Indeterminate%5C%20Pronouns.pdf.

Larson, Richard K (1985). On the syntax of disjunction scope. *Natural Language & Linguistic Theory* 3.2, pp. 217–264. DOI: 10.1007/BF00133841.

Lassiter, Daniel (2018). Complex sentential operators refute unrestricted Simplification of Disjunctive Antecedents. *Semanitcs and Pragmatics* 11. DOI: 10.3765/sp.11.9.

Loewer, Barry (1976). Counterfactuals with disjunctive antecedents. *The Journal of Philosophy* 73.16, pp. 531–537.

MacFarlane, John (2005). The assessment sensitivity of knowledge attributions. *Oxford studies in epistemology* 1, pp. 197–233.

Mandelkern, Matthew et al. (2020). We've discovered that projection across conjunction is asymmetric (and it is!) *Linguistics and Philosophy* 43, pp. 473–514. DOI: 10.1007/s10988-019-09276-5.

McKay, Thomas and Peter van Inwagen (1977). Counterfactuals with disjunctive antecedents. *Philosophical Studies* 31.5, pp. 353–356. DOI: 10.1007/BF01873862.

Meyer, Marie-Christine (2013). Ignorance and grammar. PhD thesis. MIT.

— (2016). Generalized free choice and missing alternatives. *Journal of Semantics* 33.4, pp. 703–754. DOI: 10.1093/jos/ffv010.

Meyer, Marie-Christine and Uli Sauerland (2016). Covert across-the-board movement revisited. *Talk given at North East Linguistic Society (NELS)* 47.

Nute, Donald (1975). Counterfactuals and the Similarity of Words. *The Journal of Philosophy* 72.21, pp. 773–778. DOI: 10.2307/2025340.

— (1980). *Topics in conditional logic*. Springer.

Pinton, Lorenzo (2021). You may like or dislike this thesis, and I do care which: An inquiry into sluicing and free choice. *MSc Thesis, University of Amsterdam*. URL: https://eprints.illc.uva.nl/id/eprint/1801/1/MoL-2021-11.text.pdf.

Postal, Paul M (1978). *On raising: One rule of English grammar and its theoretical implications*. MIT Press.

Roberts, Craige (1989). Modal subordination and pronominal anaphora in discourse. *Linguistics and philosophy* 12.6, pp. 683–721. DOI: 10.1007/BF00632602.

van Rooij, Robert (2006). Free choice counterfactual donkeys. *Journal of Semantics* 23.4, pp. 383–402.

Rooth, Mats and Barbara Partee (1982). Conjunction, type ambiguity and wide scope or. *Proceedings of the first West Coast Conference on Formal Linguistics*. Ed. by N. Wiegand D. Flickinger M. Macken. Vol. 1. Stanford Linguistics Association Stanford.

Ross, John Robert (1967). Constraints on variables in syntax. PhD thesis. MIT.

Santorio, Paolo (2018). Alternatives and truthmakers in conditional semantics. *The Journal of Philosophy* 115.10, pp. 513–549. DOI: 10.5840/jphil20181151030.

Schlenker, Philippe (2008). Be articulate: A pragmatic theory of presupposition projection. *Theoretical Linguistics*. DOI: 10.1515/THLI.2008.013.

— (2009). Local Contexts. *Semantics and Pragmatics* 3, pp. 1–78.

Schwager, Magdalena (2006). Interpreting imperatives. PhD thesis. Frankfurt am Main: Johann Wolfgang Goethe-Universtät dissertation.

Simons, Mandy (2005). Dividing things up: The semantics of *or* and the modal/*or* interaction. *Natural Language Semantics* 13.3, pp. 271–316. DOI: 10.1007/s11050-004-2900-7.

Starr, William B. (2014). A Uniform Theory of Conditionals. *Journal of Philosophical Logic* 43.6, pp. 1019–1064. DOI: 10.1007/s10992-013-9300-8.

Veltman, Frank (1996). Defaults in update semantics. *Journal of Philosophical Logic* 25.3, pp. 221–261. DOI: 10.1007/BF00248150.

Warmbrōd, Ken (1981). Counterfactuals and substitution of equivalent antecedents. *Journal of Philosophical Logic* 10.2, pp. 267–289. DOI: 10.1007/BF00248853.

Webber, Bonnie et al. (2003). Anaphora and discourse structure. *Computational linguistics* 29.4, pp. 545–587.

Willer, Malte (2018). Simplifying with Free Choice. *Topoi* 37.3, pp. 379–392. DOI: 10.1007/s11245-016-9437-5.

Williams, Edwin (1978). Across-the-board rule application. *Linguistic inquiry* 9.1, pp. 31–43.

Woods, Michael (1997). *Conditionals*. Clarendon Press.

Yalcin, Seth (2007). Epistemic modals. *Mind* 116.464, pp. 983–1026. DOI: 10.1093/mind/fzm983.

Zimmermann, Thomas Ede (2000). Free choice disjunction and epistemic possibility. *Natural language semantics* 8.4, pp. 255–290. DOI: 10.1023/A:1011255819284.