Filtering free choice*

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Abstract Sentences involving disjunctions under a possibility modal give rise to so-called 'free choice' inferences, i.e. inferences to the effect that each disjunct is possible. For example, *Maria can go study in Tokyo or Boston* suggests that Maria can go study in Tokyo and that she can go study in Boston (Kamp 1973). This note focuses on the interaction between free choice and presupposition projection. In particular, we focus on sentences embedding both a disjunction in the scope of a possibility modal and a presupposition trigger and we investigate how the free choice inference triggered by the former can contribute to filtering the presupposition of the latter. We consider three cases: conditionals, disjunctions and *unless* sentences. We observe that in all of these cases the presuppositions triggered from the consequent, second disjunct, or the scope of 'unless' appear to be filtered by a free choice inference associated with the rest of the sentence. The case of the conditional can be accommodated by scalar accounts of free choice, but the disjunction and *unless* cases cause a substantial problem for all these accounts (Fox 2007, Klinedinst 2007, Franke 2011 among others). We consider a solution based on free insertion of redundant material, building on an account of presupposition projection and anaphora recently proposed by Rothschild (2017). We point out that this account, combined with a scalar theory of free choice, provides a solution for our basic cases, but still has non-trivial problems with related more complex cases. We also point out that our data can instead be captured by some of the recent semantic accounts of free choice (Willer 2017, Aloni 2016 and Starr 2016), in combination with a standard algorithm for presupposition projection. We end by briefly discussing how these semantic accounts also have unsolved problems having to do with the interaction between certain downward entailing operators and free choice. We conclude that the correct form of a theory of free choice remains open to debate.

1 Introduction

Sentences involving disjunctions under a possibility modal give rise to so-called 'free choice' inferences, i.e. inferences to the effect that each disjunct is possible. For example, (1-a) suggests the inference in (1-b) (Kamp 1973).

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(1) a. Maria can go study in Tokyo or Boston.

b. $\rightsquigarrow$ *Maria can go study in Tokyo and she can go study in Boston*

One successful family of theories of free choice treats it as a kind of scalar implicature, broadly construed (Fox 2007, Alonso Ovalle 2005, Chemla 2010, Klinedinst 2007, Santorio & Romoli 2017, Franke 2011, Bar-Lev & Fox 2017 among others). The main argument for theories in this family is that free choice appears to be linked to polarity: free choice effects disappear in downward entailing contexts. Scalar accounts are very well placed to predict and explain this link. Conversely, semantic accounts, which hardwire free choice in the lexical meaning of modals, do not capture this connection straightforwardly.

This note raises a problem for all scalar accounts of free choice. We focus on the interaction between free choice phenomena and presupposition projection: in particular, we show that all scalar accounts have difficulties explaining patterns of presupposition projection and filtering in some complex sentences that involve free choice effects. For illustration, here is one of our sample sentences:

(2) Either Maria can't go study in Tokyo or Boston, or she is the first in our family who can go study in Japan.

(2) as a whole appears to carry no presupposition, despite the fact that the second disjunct contains a presupposition trigger (*S is the first in our family to* ϕ presupposes that *S* ϕ-ed or is ϕ-ing). This means that, in standard terminology, the presupposition must be filtered.[1] But, for filtering to occur, the clause *Maria can't go study in Tokyo or Boston* needs to trigger a free choice reading when computing the presuppositions of the sentence. At the same time, that same clause needs to not trigger a free choice inference for its interpretation in the first disjunct. The problem, as we point out below, is that this double behavior cannot be predicted by standard scalar accounts.

After describing the problem, we sketch a quick map of the solution space. We point out that a recent theory of presupposition projection, developed by Rothschild 2017, might rescue scalar theories. But a number of difficulties and potential worries remain. We also point out that recent semantic accounts of free choice (for example Willer 2017, Aloni 2016 and Starr 2016) immediately predict the data when paired with standard assumptions about presuppositions. However, as we discuss briefly

1 In principle, presuppositions can also not project by being 'locally accommodated' (cf. von Fintel 2008). This however would predict no difference between the sentence in (2) and (i): that is, the option of suspending the presupposition by local accommodation is equal in these sentences, yet intuitively from (i) we conclude much more that Mary can go study in Japan than in (2).

(i) Either Maria's brother could go study in Tokyo, or Maria is the first in our family who can go study in Japan.

in the end, these semantic accounts also have unsolved problems having to do with the interaction between certain downward entailing operators and free choice. We conclude, therefore, that the correct form of a theory of free choice, being able to capture all the issues at the intersection between monotonicity, free choice, and presupposition, remains open to debate.

The rest of the paper is organised as follows. In section 2, we sketch some background about free choice and presupposition projection. We then illustrate the problem in section 3. We sketch a solution in section 4 and we discuss open issues in section 4.3. We then briefly discuss how recent semantic approaches to free choice can account for our puzzle in section 5, and we also raise some remaining problems for these accounts. We conclude the paper in section 6.

2 Background

2.1 The implicature approach to free choice

One successful family of theories treats free choice as a kind of scalar implicature. We have already mentioned one argument for this general approach: free choice inferences tend to disappear in downward entailing environments, exactly like scalar implicatures. For illustration, notice that (3-a) does not have the reading in (3-b).

(3) a. It's not the case that Maria can go study in Tokyo or Boston
b. $\nrightarrow$ *It's not the case that: Maria can go study in Tokyo and Maria can go study in Boston*

Other arguments for this approach come from the well-known observation that free choice inferences are cancelable (cf. Simons 2005, Fox 2007), and from predicting free choice readings associated with universal quantifiers (Chemla 2009, Bar-Lev & Fox 2017), and nonmonotonic quantifiers (Bassi & Bar-Lev 2016, Gotzner et al. 2017). We refer the readers to the relevant sources for details.

All theories of free choice start from semantic accounts of implicature, hence let us briefly survey the latter. A number of authors (Fox 2007, Chierchia et al. 2012, Chierchia 2013 among others) argue that scalar implicatures are derived via a covert exhaustivity operators, which following tradition we represent as 'EXH'. EXH takes a sentence and a set of its alternatives as arguments and returns the conjunction of the basic sentence with the negation of the 'excludable' subset of its alternatives. Informally, an alternative counts as excludable if negating it doesn't contradict the literal meaning of the sentence asserted, and doesn't force us to accept any other alternative in the set.[2]

2 Here are the lexical entries for EXH and the formal definition of excludability. (The notion below is not the final notion of excludability used by Fox; see Fox 2007 for the full story.)

Let us illustrate how this works in the case of a simple disjunction like (4) giving rise to the implicature that Maria didn't go to study in both places.

(4) Maria went to study in Tokyo or Boston.
$\rightsquigarrow$ *Maria didn't go to study both in Tokyo and Boston*

The assumption is that the sentence in (4) is parsed as in (5) with a covert exhaustivity operator. In addition, we assume that the alternatives of (4), over which EXH quantifies, are those in (6).[3]

(5) EXH[Maria went to study in Tokyo or Boston]

(6)

Maria went to study in Tokyo or Boston	**Tokyo** $\vee$ **Boston**
Maria went to study in Tokyo	**Tokyo**
Maria went to study in Tokyo	**Boston**
Maria went to study in Tokyo and Boston	**Tokyo** $\wedge$ **Boston**

Given the alternatives in (6), only the conjunctive alternative (**Tokyo** $\wedge$ **Boston**) is excludable. This gives the intuitively correct prediction: excluding the conjunctive alternative yields the implicature in (4).

Free choice effects cannot be derived as simple implicatures, at least not by using the classical meanings of disjunction and possibility modals.[4] But they can be predicted on more sophisticated theories of implicature. One attempt, dating back to Fox 2007 (and building on an idea in Kratzer & Shimoyama 2002), derives the effect by postulating multiple occurrences of EXH in the relevant sentences. On this view, free choice is derived as a kind of recursive exhaustificaton. A more recent account (see Bar-Lev & Fox 2017) exploits a different meaning for the exhaustivity operator that allows one to directly conjoin the assertion with some of the alternatives.

For current purposes, it is not important exactly how free choice is derived, as long as the effect is based on one or more iterations of the exhaustivity operator. Both the problem we raise and the possible solutions are independent of the precise mechanism that derives free choice on scalar accounts. Hence we simply use 'EXH*'

(i) $[\![\text{EXH } \phi]\!](w) = [\![\phi]\!](w) \wedge \forall \psi \in \text{EXCL}(\phi, ALT(\phi))[\neg[\![\psi]\!](w)]$

(ii) $\text{EXCL}(\phi, X) =$
$\{\psi \in X : [\![\phi]\!] \nsubseteq [\![\psi]\!] \wedge \neg\exists\chi[\chi \in X \wedge ([\![\phi]\!] \wedge \neg[\![\psi]\!]) \subseteq [\![\chi]\!]]\}$

3 An important issue for this account and for theories of implicatures in general is indeed how the alternatives used to compute exhaustified meanings are determined. This is a controversial issue in the literature but it is orthogonal to our problem, so we set it aside. For relevant discussion see Breheny et al. 2017 and references therein.

4 Though see Klinedinst 2007 and Santorio & Romoli 2017 for attempts at deriving free choice via EXH, in combination with more sophisticated semantics for modals.

as a placeholder for whatever operator, or combination of operators, best suits the purposes of scalar accounts. For example, we will assume that (7) is parsed as in (8).

(7) Maria can go to study in Boston or Tokyo.

(8) EXH*[Maria can go study in Boston or Tokyo]

This approach can account successfully for free choice inferences (or lack thereof) in the various linguistic environments mentioned above, including the DE contexts and embeddings of clauses like (7) under universal and nonmonotonic quantifiers.

2.2 Presupposition filtering and projection

A sentence like (9) gives rise to the inference that Maria went to study in Japan.

(9) Maria is the first in our family who went to study in Japan.
$\rightsquigarrow$ *Maria went to study in Japan*

This inference projects through embeddings in a way that is characteristic of presuppositions (Karttunen 1973, Heim 1982 and much subsequent work). For instance, when we embed (9) under negation, in the antecedent of a conditional, under a possibility modal, or we make a question out of it, the suggestion that Mary went to study in Japan remains robustly. That is, the presupposition of (9) projects through embeddings in (10-a)-(10-d).

(10) a. Maria is not the first in our family who went to study in Japan.
b. If Maria is the first in our family who went to study in Japan, her older brother must have gone to study in the States.
c. Perhaps Maria is the first in our family who went to study in Japan.
d. Is Maria the first in our family who went to study in Japan?
$\rightsquigarrow$ *Maria went to study in Japan*

In certain cases, however, presuppositions are filtered by embeddings. For instance, when we embed (9) in sentences like (11-a)-(11-c), repeated from above, we do not conclude from any of these sentences that Mary went to study in Japan.

(11) If Maria went to study in Tokyo, she is the first in our family who went to study in Japan.
$\not\rightsquigarrow$ *Maria went to study in Japan*

(12) Either Maria didn't go to study in Tokyo, or she is the first in our family who went to study in Japan.
$\not\rightsquigarrow$ *Maria went to study in Japan*

(13) Unless Maria didn't go to study in Tokyo, she is the first in our family who went to study in Japan.
$\not\rightsquigarrow$ *Maria went to study in Japan*

A theory of presupposition projection has to tell us when and how presuppositions project and when they do not. Informally, as we will see, to account for why presuppositions do not project in cases like (11)-(13), different theories capitalize in different way on the fact that the antecedent of the conditional, the negation of the first disjunct, and the negation of the restrictor of *unless* entail the presupposition of the consequent, second disjunct, and nuclear scope of *unless*, respectively.

The literature contains a large variety of approaches.[5] What is relevant here is that most of these approaches make the following predictions.

- A conditional with a presupposition trigger in the consequent as in (14-a), where ϕ_p is any sentence presupposing p, presupposes that if the antecedent is true then the presupposition of the consequent is as well, (14-b). In other words, p is filtered if entailed by ψ.

  (14) a. if ψ, ϕ_p
  b. $\psi \rightarrow p$

- A disjunction with a presupposition trigger in the second disjunct as in (15-a) presupposes that if the negation of the first disjunct is true then the presupposition of the second disjunct is as well (15-b). That is, p is filtered if entailed by $\neg\psi$.

  (15) a. ψ or ϕ_p
  b. $\neg\psi \rightarrow p$

- A sentence with *unless*, treated here as equivalent to *if not*, also presupposes that if the negation of the restrictor is true then the presupposition of the scope also is (and therefore again, p will not project if entailed by the negation of ψ).

  (16) a. *Unless* ψ, ϕ_p
  b. $\neg\psi \rightarrow p$

Some accounts (e.g., van der Sandt 1992, Geurts 1999, Mandelkern 2016a) predict

5 For some traditional approaches, see Heim 1982, Gazdar 1979, Beaver 2001, Chierchia 1995, van der Sandt 1992, Geurts 1999; for more recent approaches, see Schlenker 2008a, 2009, Chemla 2010, Fox 2008, Rothschild 2011, George 2008, Mandelkern 2016a. See also Schlenker 2008b for discussion.

stronger presuppositions: i.e., they predict that the presupposition projects directly to the whole sentence. Resorting to these accounts won't help solve our problem. As we point out below, the problem is that standard theories give us too little filtering; moving to theories that predict even less filtering will only make things worse. So we can safely set these accounts aside.[6]

3 The problem: filtering free choice

Consider again (17)-(19).

(17) If Maria can go study in Tokyo or Boston, she is the first in our family who can go study in Japan (and the second one who can go study in the States).
$\not\rightsquigarrow$ *Maria can go study in Japan(/the States)*

(18) Either Maria can't go study in Tokyo or Boston, or she is the first in our family who can go study in Japan (and the second who can go study in the States).
$\not\rightsquigarrow$ *Maria can go study in Japan(/the States)*

(19) Unless Maria can't go study in Boston or Tokyo, she is the first in our family who can go study in Japan (and the second who can go study in the States).
$\not\rightsquigarrow$ *Maria can go study in Japan(/the States)*

None of these sentences appear to suggest that Maria can go to study in Japan (and that she can go to study in the States). Hence the presupposition triggered by the construction *is the first in our family to...* is filtered out. Our first observation is that free choice must play a role in this filtering.

To illustrate the point, consider a schematic version of the sentences above in (20)-(22) (where p^+ is a sentence asymmetrically entailing p; ignoring the second conjunct from now on for simplicity).

(20) *If* $\Diamond(p^+ \vee q^+)$, $\phi_{\Diamond p}$

(21) *Either* $\neg\Diamond(p^+ \vee q^+)$ *or* $\phi_{\Diamond p}$

(22) *Unless* $\neg\Diamond(p^+ \vee q^+), \phi_{\Diamond p}$

Consider the case of the conditional first: here the predicted projection is (23).

(23) $\Diamond(p^+ \vee q^+) \rightarrow \Diamond p$

6 In addition, most of the account predicting the weaker presuppositions above are generally coupled with a theory of when these presuppositions can be strengthened to p to account for which the weaker presuppositions appear inadequate. This falls under the name of the 'Proviso problem,' see Mandelkern 2016b and references therein for discussion.

What is important here is that the literal meaning of $\Diamond(p^+ \vee q^+)$ does not entail $\Diamond p$, therefore the presupposition is incorrectly predicted not to be filtered.[7]

This case is not too difficult to accommodate once we have a theory of free choice that allows it to appear at embedded levels. This is in fact natural in semantic accounts of implicature, on which the EXH* operator can be merged at global or local level. In particular, we could parse the sentence above as (24).

(24) *If* $\text{EXH}^*(\Diamond(p^+ \vee q^+)), \phi_{\Diamond p}$

Given that now $\text{EXH}^*(\Diamond(p^+ \vee q^+))$ entails $\Diamond p^+ \wedge \Diamond q^+$ and therefore in turn entails $\Diamond p$, the sentence above is correctly predicted not to have any presuppositions, as it projects the tautological presupposition in (25). Hence, as long as we allow for embedded free choice, we can account for the conditional case.

(25) $(\Diamond p^+ \wedge \Diamond q^+) \to \Diamond p$

But things are not as simple for disjunctive sentences and *unless*-sentences. Intuitively, the problem is this: we want to use the enriched, free choice meaning of the possibility clause for the purposes of computing the presupposition, exactly as we have done for the conditional. At the same time, we need the basic, non-free-choice meaning of the same clause to compute the meaning of the first disjunct. The problem is that we cannot have both at the same time.

For illustration, first consider that the predicted proposition that ends up being presupposed by the whole sentence is (21) and (20), which is (26), in both cases.

(26) $\neg\neg\Diamond(p^+ \vee q^+) \to \Diamond p =$
$\Diamond(p^+ \vee q^+) \to \Diamond p$

7 Let us observe that appealing to Simplification of Disjunctive antecedent is of no help here. It is often observed that a conditional with disjunctive antecedents seems to entail the two conditionals with the individual disjuncts as antecedents (see Fine 1975).

(i) If Mary or Sue were at the party, the party would be fun.
  a. $\rightsquigarrow$ If Mary was at the party, the party would be fun.
  b. $\rightsquigarrow$ If Sue was at the party, the party would be fun.

There are a number of accounts of Simplification on the market, some pragmatic (Klinedinst 2007) and some semantic (Alonso-Ovalle 2004, Fine 2012, Santorio 2017, Ciardelli et al. 2018 among many). Here we want to notice that none of these accounts will help. Simplification is a global strengthening: a conditional entails two related conditionals. If anything this operation will add presuppositions to the sentence rather than taking them away (cf. Spector & Sudo 2017). Conversely, the presuppositions of (17)–(19) seem to involve a strengthening that is local to the antecedent: i.e. they seem to presuppose $(\Diamond p \wedge \Diamond q) \to \Diamond p$.

The problem is again that $\Diamond(p^+ \vee q^+)$ doesn't entail $\Diamond p$ and therefore filtering is not predicted. But here, unlike in the conditional case, there is no clear way to strengthen the first disjunct to get free choice effect while obtaining a plausible overall meaning for the sentence. This is because we want free choice to arise on the negation of the first disjunct/restrictor of *unless*, without changing the meaning of the latter. To illustrate, consider the two options we have in either case: we could first exhaustify above negation within the first disjunct/restrictor of *unless*. This however would not help, because exhaustifying above negation is vacuous. In other words, (27) is equivalent to $\neg\Diamond(p^+ \vee q^+)$ and so its negation, cannot, in the same way, filter $\Diamond p$ in the desired way.

(27) $\text{EXH}^* \neg\Diamond(p^+ \vee q^+)$

We could try to exhaustify below negation as in (28) and here its negation $\text{EXH}^*(\Diamond(p^+ \vee q^+)$ would entail $\Diamond p$ therefore correctly filtering the presupposition of the second disjunct/restrictor of *unless*.

(28) $\neg(\text{EXH}^*(\Diamond(p^+ \vee q^+)).$

The problem, however, is that now the meaning of the first disjunct/restrictor of *unless* would be too weak and would correspond to the negation of free choice. In other words, the sentences above would have a reading that we could paraphrase as in (29) and (30) respectively. This reading, if it exists at all, is certainly not the reading we are after: under this reading, (17) would be true if Maria can go study in Tokyo and not in Boston (or vice-versa), while also being neither the first in the family who can go study in Japan nor the second who can go study in the States.

(29) Either it's not true that Maria can go study in Tokyo and can go study in Boston, or she is the first in our family who can go study in Japan (and the second who can go study in the States).

(30) Unless it's not true that Maria can go study in Tokyo and can go study in Boston, she is the first in our family who can go study in Japan (and the second who can go study in the States).

Let us summarize what we have done so far. After introducing both free choice and presupposition projection (in particular in conditionals, disjunction and *unless* sentences), we have considered the interaction of the two. We have found that there is a puzzle for all accounts that treat free choice as a kind of scalar effect. The puzzle is that sentences of the forms (20)–(22) appear to not have presuppositions, despite the fact that the rightmost clause contains a presupposition trigger. Hence the presuppositions of the rightmost clause must be filtered by the material in the rest of the sentence. This filtering is expected for conditionals (i.e. sentences of the form (20)), but not for the corresponding disjunctions or *unless*-sentences.

In the next section, we consider a solution based on a recent proposal about presupposition projection and anaphora by Rothschild 2017. This proposal allows us to make progress, but doesn't fully solve the issue. In section 5, we will notice that recent semantic accounts of free choice fare better with our problematic data.

4 A solution?

4.1 Free insertion of redundant material

Rothschild (2017) proposes a trivalent approach to presupposition projection and anaphora. The crucial ingredient of his account for us is his mechanism of free insertion of redundant material, which builds on his previous proposal in Rothschild 2008 (see also Chierchia 2009, Kamp & Reyle 1993 and Geurts 1999). For illustration, consider a disjunction like (31).[8]

(31) There isn't a bathroom here, or it's under the stairs.

(31) has a coherent reading. This is hard to explain in the light of the fact that anaphora in natural language is highly constrained, and it's not clear how we can assign a suitable antecedent to the pronoun *it* in the second disjunct. In particular, notice that, in minimal variants of (31), anaphora is not felicitous.

(32) There isn't a bathroom here. ??It's under the stairs.

Rothschild (2017)'s account starts from the observation that (32) is equivalent to (33). Assuming that (32) can be analyzed as (33) allows us to get the anaphoric facts right: the underlined inserted part provides a suitable antecedent for the pronoun.

(33) There isn't a bathroom here, or <u>there is and</u> it's under the stairs.

In other words: we can say that sentences involve redundant conjunctions at the level of logical form. For instance, a sentence of the form $\ulcorner \phi \vee \psi \urcorner$ can be analyzed as having the logical form $\ulcorner \phi \vee (\neg\phi \wedge \psi) \urcorner$. The more formal definition of this insertion mechanism is in (34) (adapted from Rothschild 2017):[9]

8 Examples like (31) go back to Barbara Partee; see Partee 2004.

9 Where classical equivalence is defined as follows:

(i) **Definition of classical equivalence**: ϕ and ψ are classically equivalent if for every interpretation $[[]]$ and world $w \in W$, $[[\phi]]^w = 1$ iff $[[\phi]]^w = 1$.

(34) **Adding Redundant Conjunctions (ARC)**: if a sentence χ contains the clauses ϕ and ψ, you may replace any instance of ψ with $\phi \wedge \psi$ if the resulting sentence is logically equivalent to χ.

As Rothschild (2017) points out, this mechanism needs to be constrained not to overgenerate. The viability of his proposal ultimately depends on how principled these constraints are.

4.2 Filtering free choice and free insertion

Let us show how free insertion can provide a solution to our problematic cases. Consider again the cases of disjunction and *unless*. Recall that there was no way to insert EXH* in the first disjunct/restrictor of *unless* that would give us the desired reading without also changing the meanings of the latter.

(35) $\textit{Either } \neg\Diamond(p^+ \vee q^+) \textit{ or } \phi_{\Diamond p}$

(36) $\textit{Unless } \neg\Diamond(p^+ \vee q^+), \phi_{\Diamond p}$

Notice, however, that (35) and (36) are classically equivalent to (37) and (38). We can, therefore, analyze (35) and (36) as having logical forms corresponding to (37) and (38), in accordance with (34).

(37) $\textit{Either } \neg\Diamond(p^+ \vee q^+) \textit{ or } (\underline{\Diamond(p^+ \vee q^+) \wedge} \ \phi_{\Diamond p})$

(38) $\textit{Unless } \neg\Diamond(p^+ \vee q^+), (\underline{\Diamond(p^+ \vee q^+) \wedge} \ \phi_{\Diamond p})$

In this way, we have a site where we can add the EXH* operator. This allows us to obtain free choice, which in turn yields filtering of the presupposition. Hence we can exhaustify the inserted redundant material in the second disjunct/scope of *unless* as in (39) and (40).

(39) $\textit{Either } \neg\Diamond(p^+ \vee q^+) \textit{ or } (\text{EXH}^*(\Diamond(p^+ \vee q^+)) \wedge \phi_{\Diamond p} =$
$\textit{Either } \neg\Diamond(p^+ \vee q^+) \textit{ or } (\Diamond p^+ \wedge \Diamond q^+) \wedge \phi_{\Diamond p}$

(40) $\textit{Unless } \neg\Diamond(p^+ \vee q^+), (\text{EXH}^*(\Diamond(p^+ \vee q^+)) \wedge \phi_{\Diamond p} =$
$\textit{Unless } \neg\Diamond(p^+ \vee q^+), (\Diamond p^+ \wedge \Diamond q^+) \wedge \phi_{\Diamond p}$

With these ingredients in place, we predict the desired readings for (18) and (19). The reason is that the presupposition is filtered by the inserted material, once we strengthen the latter in a suitable way.[10] At the same time, since we have two distinct

10 The predicted projection in a conjunction like $\phi \wedge \psi_p$ is $\phi \rightarrow p$. Therefore in our cases the projection predicted in the second disjunction/scope of *unless* is (i), which is true in every context and therefore predicts correctly that p will not project.

syntactic objects, we can apply our free choice operator EXH* to one, but not to the other. Hence we can still take $\Diamond(p^+ \vee q^+)$ to contribute its basic meaning to truth conditions. This solves our problem, at least for the basic cases above.

4.3 Problems for the free insertion account

In this subsection, we show that Rothschild's theory runs into trouble with cases that are very similar to those we have used so far. To get the right predictions, the theory needs to be modified in a number of ways.

Contextual salience and contextual equivalence. To start with, consider:[11]

(41) John said that Maria is not allowed to go study in Boston or Tokyo. Either he spoke truly, or she's the first person in our family who can go study in Japan.

Our intuition is that (41), similarly to our standard examples, carries no presupposition and hence gives rise to filtering. But this cannot be explained by ARC in (34), for two reasons. First, any plausible candidate for the material to be copied and inserted in (41) is outside sentence boundaries. This may be fixed by allowing ourselves to copy material from the clause that precedes the disjunction. For example, we might plausibly insert the following (and then exhaustify the underlined inserted part):

(42) John said that Maria is not allowed to go study in Boston or Tokyo. Either he spoke truly, or Maria is allowed to study in Boston or Tokyo and she's the first person in our family who can go study in Japan.

(42) is equivalent to (41): if John didn't spoke truly, then it's not true that Mary is not allowed to study in Boston or Tokyo. That is, she is allowed to study in Boston or Tokyo. There is, however, also a second problem. The disjunctive sentence in (42) is not *logically* equivalent to the disjunctive sentence in (41), but only contextually equivalent to it. Hence the constraint on the material to be freely inserted should be relaxed. Freely inserted material needs to be not logically redundant, but only redundant given contextual information.

For a different example that makes essentially the same point, consider also the following, adapted from Rothschild 2017:

(43) Either Maria is a European citizen or else she can't go study in Tokyo or

(i) $\text{EXH}^*(\Diamond(p^+ \vee q^+)) \rightarrow p$

11 Here we stick to disjunction, but the point can be replicated with conditionals and *unless*-sentences.

Boston. And if she is a European citizen, she'll be the first in our high school who can go study in Japan.

Again, our intuition is that in (43) the relevant presuppositions are filtered. To predict this, we need to go beyond the free insertion mechanism in Rothschild 2017. Notice that (43) is of the following form:[12]

(44) *Either r or* $\neg\Diamond(p^+ \vee q^+)$. And if r, $\phi_{\Diamond p}$

To obtain filtering we would need to insert the negation of the second disjunct in the conjunction preceding the conditional and exhaustify the inserted material:

(45) *Either r or* $\neg\Diamond(p^+ \vee q^+)$. And if r, $(\text{EXH}^*(\underline{\Diamond(p^+ \vee q^+)) \wedge} \phi_{\Diamond p})$

Hence we need to (i) insert material that is outside the boundaries of the sentence and (ii) allow ourselves to material that is contextually rather than logically redundant.

The discussion suggests replacing ARC in (34) with:[13]

(46) **Adding redundant conjunctions (ARC, second take)**: if a sentence χ contains the clause ψ you may replace any instance of ψ with $\phi \wedge \psi$, where ϕ is a *contextually salient* clause, if the resulting sentence is *contextually equivalent* to χ.

Of course, it needs to be checked whether the new principle is too liberal, and causes overprediction elsewhere. This task goes beyond the goals of our note.

Can we exhaustify freely inserted material? The second worry is that, even on the more liberal understanding of **ARC**, the account runs into trouble with exhaustification. In particular, we need to exhaustify freely inserted material whose antecedent is not exhaustified. There is some evidence that this kind of exhaustification might not be available.

Let us set aside for a moment free choice and the EXH* operator, and focus on a

12 Assume here that the first disjunction is interpreted exclusively, which, in the approach sketched above would mean that is interpreted in the scope of a global exhaustivity operator as in (i) (thanks to Matt Mandelkern for discussion on this point).

(i) $\text{EXH}(r \vee \neg\Diamond(p^+ \vee q^+)) =$
$(r \vee \neg\Diamond(p^+ \vee q^+)) \wedge \neg(r \wedge \neg\Diamond(p^+ \vee q^+))$

13 Where contextual equivalence is defined as follows:

(i) **Definition of contextual equivalence**: ϕ and ψ are contextually equivalent in a context C if for every interpretation $[[\,]]$ and world $w \in C$, $[[\phi]]^w = 1$ iff $[[\phi]]^w = 1$.

different scalar phenomenon, i.e. the exhaustive reading of disjunction. Consider the following:

(47) Either Maria didn't visit Madrid or Barcelona [at all], or she regrets having visited only one of the two main cities in Spain.

(47) parallels our core example in (18). It is a disjunction with a presupposition that Maria only visited one of Madrid or Barcelona triggered in the second disjunct. This presupposition is not entailed by the literal meaning of the negation of the first disjunct, *Maria visited Madrid or Barcelona*, and it can only be filtered if we are able to freely insert material from the first disjunct and exhaustify it. I.e., we are able to filter out the presupposition if we are allowed to use the following LF for (47):

(48) $\textit{Either } \neg(p \vee q) \textit{ or } (\underline{\textsc{exh}(p \vee q) \wedge} \; \phi_{(p \wedge \neg q) \vee (q \wedge \neg p)})$

But our judgment is that, differently from (18), (47) is *not* presuppositionless. On the contrary, (47) seems to carry the presupposition that, if Maria had visited Madrid of Barcelona, she would have visited exactly one of them. If this is right, then one should explain why the two cases are different. Perhaps EXH* is subject to more liberal constraints than EXH.[14]

But of course under an implicature approach we would want a principled story about this difference.

5 Semantic accounts of free choice

5.1 Predicting filtering

Finally, let us briefly discuss semantic accounts of free choice. These accounts try to hardwire free choice in the meaning of possibility modals and/or disjunctions, rather than deriving it as a scalar inference (see, among others, Simons 2005 and Zimmerman 2000 among others). Classical accounts in this vein have been plagued by the problem of explaining the disappearance of free choice under negation and other DE operators. More recent semantic accounts are designed explicitly to deal with this problem (Willer 2017, Starr 2016, Aloni 2016). Here we want to point out that semantic accounts of the new breed yield the correct predictions for our data. At the same time, we are going to close by pointing out that these accounts are also seriously problematic in other respects, relating to their capacities to account for

14 For instance, as discussed by Kamp (1978) and Barker (2010), free choice interpretations arise robustly also in the antecedent of conditionals, as in (i), where implicatures tend to disappear:

(i) If Maria can go study in Tokyo or Boston, she'll choose Tokyo.

embeddings under downward entailing contexts.

For concreteness, we present informally a very simplified version of the system in (2017), referring the reader to Willer's paper for a full presentation of the semantics. Willer builds a dynamic semantics with some key insertions from inquisitive systems (see Veltman 1996, Ciardelli et al. 2017, among others). They key move that allows Willer to predict the behavior of free choice in DE environments is that the system is 'bilateral': each item is assigned a positive and a negative meaning. Since Willer uses a dynamic semantics, these meanings are characterized as updates. In particular, each sentence is assigned a positive and a negative update. Which between the positive and the negative update is used depends on the embedding operator. Upward entailing operators use positive updates, downward entailing operators like negation negative ones.

For current purposes, we can simply describe informally the positive and negative update of $\ulcorner\Diamond(\phi\vee\psi)\urcorner$. The positive update $[\Diamond(\phi\vee\psi)]^{+}$ mandates checking that an information state contains both ϕ- and ψ-worlds.The negative update $[\Diamond(\phi\vee\psi)]^{-}$ checks that an information state contains neither ϕ- nor ψ-worlds.[15] This combination of updates ensures that $\ulcorner\Diamond(\phi\vee\psi)\urcorner$ generates free choice in upward entailing contexts, when its positive update is used. Conversely, negation and other downward entailing operators select the negative update, which does not generate the free choice inference.

Even on this simple description of Willer's system, we can see that the system captures our problematic data. For illustration, consider again:

(49) Either Maria can't go study in Tokyo or Boston, or she is the first in our family who can go to study in Japan (and the second who can go to study in the States).

Which, as usual, can be formalized as:

(50) *Either* $\neg\Diamond(p^{+}\vee q^{+})$ *or* $\phi_{\Diamond p}$

On a system like Willer's, the clause $\Diamond(p^{+}\vee q^{+})$ appearing in the first disjunct does not give rise to free choice, since that clause appears under a DE operator. At the same time, assuming that a disjunction $\ulcorner\phi\vee\psi_{p}\urcorner$ presupposes $\ulcorner\neg\phi\rightarrow p\urcorner$, and assuming that double negations cancel each other out (as they do in Willer's system), the presupposition of the whole sentence in (49) is predicted to be $\Diamond(p^{+}\vee q^{+})\rightarrow\Diamond p$.

15 More formally: Willer's information states are construed as sets of propositions (which, in keeping with inquisitive semanticists, Willer dubs 'alternatives'), and updates are relations between alternatives. The positive update $[\Diamond(\phi\vee\psi)]^{+}$ works as a test, relating an alternative to itself just in case the union of all alternatives in a state includes both ϕ- and ψ-worlds. Similarly, the negative update $[\Diamond(\phi\vee\psi)]^{-}$ also works as a test, and checks that there is no world in the relevant information state that is either a ϕ- or a ψ-world.

In this case, free choice *is* computed, hence the presupposition is predicted to not pose any requirements (since it is a tautology). So we correctly predict filtering.

5.2 More problems from DE contexts

The 'bilateral' behavior of semantic accounts is crucial for predicting our filtering data. This feature is also crucial for addressing the disappearance of free choice under negation and similar operators. In closing, we want to point out to a related issue showing that bilaterality offers only a partial solution to the problem generated by DE contexts. So, all in all, no existing account of free choice appears able to completely deal with all the problems generated by the interaction of free choice, DE operators, and presupposition discussed in this paper.

The generalization that we have stated is: free choice effects tend to disappear in DE contexts. To illustrate this, we have presented a simple example where a sentence of the form $\ulcorner\Diamond(\phi \vee \psi)\urcorner$ appears embedded under negation.

(3-a) It's not the case that Maria can go study in Tokyo or Boston.
$\neg(\Diamond(\phi \vee \psi))$

But free choice disappears also in more complex DE contexts. For example, it also disappears when an upward entailing operator is inserted between the DE operator and the relevant modal clause. For example, consider:

(51) You're not required to allow students to use tablets or laptops.
$\neg\Box(\Diamond(\phi \vee \psi))$

On the most salient reading, (51) says that the addressee is not required to give students any of the two relevant permissions (use a tablet or use a laptop). On this reading, free choice is not computed. (To be sure, (51) *also* has a second reading, on which it says that the addressee is not required to give students choice between the two. What matters is that the first reading is clearly available.)[16]

The problem with semantic accounts based on 'bilateral' systems is that they regard cases like (51) as no different from ordinary cases of embeddings under upward entailing operators. In a bilateral system, each clause is assigned a positive and a negative meaning. Embedding operators select which kind of meaning to use. Downward entailing operators like negation will select the negative meaning of their argument. Upward entailing operators like necessity modals select the positive meaning of their argument. This selection happens when expressions compose,

16 The choice of a universal modal as the intervening operator is not casual. DPs like *every girl* actually block the cancellation of implicatures and free choice effects. For discussion, see Chierchia 2013 and references therein.

and cannot be changed after this. As a result, in a sentence like (51), the necessity modal selects the positive meaning of $\Diamond(\phi \vee \psi)$. This is the meaning that involves free choice and hence entails $\Diamond\phi \wedge \Diamond\psi$. This meaning is carried along in the compositional computation, and is then used to compute the negative update used by negation. As a result, semantic accounts predict the second of the two readings above, but not the first.

Here is a compact way to state the problem. Whether free choice is canceled or not depends on the polarity of a linguistic environment. Polarity is a nonlocal feature of linguistic environments: it need not be determined by the closest embedding operator. Conversely, existing semantic accounts of free choice operate locally, letting each operator select a positive or a negative meaning at the compositional stage. Hence they are bound to make wrong predictions whenever polarity is determined by a nonlocal operator.

6 Conclusion

We have investigated the interaction between free choice and presuppositions. In particular, we have focused on sentences embedding both a disjunction in the scope of a possibility modal and a presupposition trigger, and we have looked at how the free choice of the former can filter the presupposition of the latter. We have considered three cases: conditionals, disjunctions and *unless* sentences and observed that in all of these cases the presuppositions triggered from the consequent, second disjunct or the scope of 'unless' appear to be filtered by a free choice inference associated with the rest of the sentence. As we have discussed, the case of the conditional can be accommodated by scalar accounts of free choice, but the disjunction and *unless* cases cause a substantial problem for all scalar accounts of free choice (Fox 2007, Klinedinst 2007, Franke 2011 among others). We considered a solution based on free insertion of redundant material, building on an account of presupposition projection and anaphora recently proposed by Rothschild (2017) and pointed out that the free insertion account, combined with a scalar theory of free choice, manages to account for our basic cases, but is still has nontrivial problems, which we left open here. We also point out that our data can instead be captured by recent semantic accounts of free choice, in combination with a standard algorithm for presupposition projection. These accounts, we have argued, also have unsolved problems. Thus the correct form of a theory of free choice remains open to debate.

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