Connectives without Truth Tables

Nathan Klinedinst and Daniel Rothschild*

August 25, 2011

1 Non-truth-tabular uses of *and* and *or*

And and *or* have uses which, on the face of it, have little in common with their familiar or truth tabular ones:[1]

(1) The cops show up, and a fight will break out.
≈ If the cops show up, a fight will break out.

(2) I have no friends, or I would throw a party.
≈ I have no friends. If I did have friends, I would throw a party.

(1) has a conditional meaning, with neither conjunct entailed as in a normal conjunction. (2) seems to assert that John has no friends (and that he'd otherwise throw a party). Thus, the first disjunct is entailed, contrary to what we typically find, and what the truth tables warrant. We will argue in §2 below that these uses of the connectives are indeed distinct, and cannot plausibly be explained away as involving the normal truth-tabular meanings for *and* and *or*.[2] For now let us

*Forthcoming in *Natural Language Semantics*. This paper has benefited from discussion with and/or comments from Márta Abrusán, Richard Breheny, Josh Dever, Cian Dorr, John Hawthorne, Dilip Ninan, Philippe Schlenker, Michael Solomon, Seth Yalcin, and two anonymous referees. We are grateful to audiences at the Arché Centre, Berkeley, NYU, and UCL.

[1]These unusual uses of *and* and *or* have long been recognized. See, e.g., Bolinger 1967; Culicover 1972; Clark 1993; Culicover and Jackendoff 1997; Han 2000; Schwager 2006; Russell 2007.

[2]It is worth noting that both of these uses of the connectives are recognized as distinct in the Oxford English Dictionary. The special use of *and* is described as follows: 'A. I. 8. b. Introducing the predicted consequence or fulfillment of a command, or of a hypothesis put imperatively, or elliptically' ("and, *conj.*[1], *adv.*, and *n.*" OED, September 2010). The special use of *or* is described as follows: '5. a. After a primary statement, appending a secondary alternative or the consequence

simply assume this, and refer to sentences like (1) and (2) as *non-truth-tabular conjunctions* and *disjunctions*.

Although we claim that (1) and (2) involve special or distinct uses of the connectives we will argue that they are not merely idiosyncratic ones. Rather they are related in a particular, principled way to normal uses. This relationship requires an explanation, and the principle aim of this paper is to provide one.[3] In the end, our analysis rests on giving an account of certain features of *normal* uses of the connectives, which we will call *dynamic* features. We examine these in §3. In §4 we give an analysis of these dynamic effects by introducing an information parameter that is shifted by *and* and *or*. We then propose, in §5, that the special uses of the connectives arise when the connectives exhibit only their dynamic effects without having their truth-table meaning. Finally, in §6 we discuss how our account handles a host of facts about non-truth-tabular uses. The remainder of this section introduces some of the basic facts, which also lend support to the claim that non-truth-tabular uses are distinct. We turn to that claim in more detail in the following section.

Asymmetry

Changing the order of conjuncts eradicates (the existing) conditional interpretation.

(3) A fight breaks out, and the cops (will) show up. ($\neq$ (1))

(4) I would throw a party, or I have no friends. ($\neq$ (2))

Imperatives

The first disjunct of a non-truth-tabular disjunction can be an imperative, resulting in the issuing of a command:

of setting aside the primary statement: otherwise, else; in any other case; if not' ("or, *conj.*[1]" OED, September 2010).

[3]To our knowledge there is no existing theoretical proposal that derives or explains the uses of *and* and *or* found in (1) and (2). Most authors simply assume them to involve a distinct meaning for the connectives (e.g. Clark 1993 for *or*, Culicover and Jackendoff 1997 for *and*). There do exist more explanatory theoretical proposals for a subclass of non-truth-tabular conjunctions, in which the first conjunct contains an imperative. These cases are introduced below, and we discuss the proposals in §6.1.

(5) Pay us the money, or you will be shot.
≈ Pay us the money. If you don't pay us the money, you will be shot.

Similarly there are non-truth tabular conjunctions whose first conjunct appears to be in imperative form (though often there is no imperative force; no command is issued (Bolinger, 1967)):

(6) Take another step, and I will shoot.
≈ If you take another step, I will shoot.

In addition, both constructions have variants where the first clause is an NP and the second is a full clause (Culicover, 1972):

(7) Another beer and I'm wasted.
≈ I drink another beer and I'm wasted.

(8) Another beer or I won't tip you.
≈ Give me another beer. If you don't, I won't tip you.

On truth-tabular uses, on the other hand, the conjuncts must normally be of the same syntactic (and semantic) type: note the impossibility of any truth-tabular meaning for (7) and (8).[4]

Restrictions on clause type

In both non-truth-tabular conjunctions and disjunctions there are restrictions, not found with normal uses, on what kind of clauses can appear as conjuncts. The general patterns are as follows:

For disjunctions, the second disjunct must contain a counterfactual modal, taking the form that it would in the consequent of a counterfactual conditional.

(9) John's car is broken down, or ...

a. he would/could drive us to the country.
b. he could/might have driven us to the country.

(10) John's car is broken down, or he...

[4] And note that where both conjuncts are imperatives, as in 'Pay us the money, or shoot' and 'Take another step and shoot', we get an interpretation that does appear to be, loosely speaking, truth-tabular.

a. drove to the country.
b. will drive to the country.
c. might/may drive to the country.

The examples in (9) but not those in (10) can be used to assert that John's car is broken (and make a claim about what would obtain were it not). Those in (10) can only be understood as normal disjunctions. Some exceptions to the counterfactual requirement are discussed in §6.1.

For conjunctions, the second conjunct typically contains a modal or admits of a generic construal:

(11) The cops show up, and a fight...
a. will break out.
b. might break out.
c. must have broken out.
d. breaks out.

Simple non-modal, non-generic clauses seem somewhat degraded, but are possible with context:

(12) ?You show up at midnight tonight, and you see something you'll never forget.

(13) ?The cops show up, and Vinny called them / is a snitch.

Form sensitivity

Both types of constructions are extremely sensitive to the form of the disjunction or conjunction. For example neither is possible when one uses NP coordination:

(14) John and Mary (as well) eat
≈ John eats and Mary eats (as well)
$\not\approx$ If John eats then Mary eats (as well).

In addition, many (if not all) cases of non-truth-tabular disjunction are impossible with wide-scope *either*.

(15) context: answering an email request from a student for an appointment

a. I am away at a conference, or I would meet you.
$\approx$ I am away at conference. If I were not I would meet you.

b. ??Either I am away at a conference, or I would meet you.
$\not\approx$ I am away at conference. If I were not I would meet you.

NPI licensing

Negative polarity items can appear in the first conjunct of non-truth-tabular conjunctions but not normal conjunctions (Culicover and Jackendoff, 1997). They cannot appear in non-truth-tabular disjunctions.

(16) You drink any more tequila, and you'll pass out.
*John will drink any more tequila, and (then) he will pass out.

(17) John drank (*any) more tequila, or he would be sober.

2 Problems with a truth-tabular analysis

Before developing our proposal, we will expand and justify the claim that non-truth-tabular uses cannot readily be accounted for on a truth-functional semantics. Of course, it would be theoretically satisfying to treat these uses, in spite of appearances, as merely involving the standard interpretation of the connectives. There are two ways this could be done in principle: by appealing to a pragmatic inference, or by positing a non-standard interpretation for one or more of the conjoined clauses. We know of no successful theory in either vein.

The case for non-truth-tabular conjunction is relatively clear. The problem is that a normal conjunction should entail its first conjunct. Thus, a Gricean account would have to treat non-truth-tabular conjunctions as non-literal uses: the speaker asserts logical conjunction, but the audience infers that he rather intends to convey the conditional meaning. It is neither clear how the inference would run, nor that a speaker could accurately be said to have expressed (but not committed to) a normal conjunction.[5]

One way to escape this problem would be to suppose that in fact the truth-conditions of the first conjunct do not require something to be true in the actual

[5]It is also unclear that the NPI licensing facts from §1 could be accounted for.

world.[6] Let us take an example:

(18) The cops show up, and a fight will break out.

The idea here would be that the clause 'the cops show up' only entails the possibility (perhaps in the common ground) that the cops will show up. Then this possibility might be anaphorically referred to by the modal 'will' in the second conjunct. This would assimilate it to standard cases of modal subordination (Roberts, 1989):

(19) The cops might show up. A fight would break out.

However, there is considerable evidence against this possibility. If the sentence *The cops show up* only entails that the cops might show up, then we should expect a version of (19) to be possible without the *might*.

(20) The cops show up. A fight will/would break out.

It seems to us that in most circumstances (20) *cannot* have the same reading as (19). On the other hand, (18) most naturally has the conditional reading. It is hard to see what explains this difference other than the presence of a special construction in (18). One could respond by claiming that the first clause of (18) contains some (covert) mood/modal which is responsible for its merely entailing the possibility of the cops showing up, and that this mood/modal cannot be present when the clause appears on its own as in (20). But this effectively concedes the same point: the conditional interpretation must be tied to a special construction.

It is clear then that non-truth-tabular conjunctions cannot be analyzed straightforwardly as standard conjunctions. However, one might wonder how crucial *and* itself is to whatever special construction they do involve. After all it is possible to have sentences like (21), which are interpreted as conditionals but do not contain an explicit *and*:

(21) You call the cops, I break her legs.

The conditional reading is clearly dependent on a particular intonation. It is not available when the two clauses are read as separate utterances, separated by a

[6]Thanks to Philippe Schlenker for suggesting (though not endorsing) this possibility.

full stop. So, again it seems that we are dealing with a special construction. We are not sure what the right analysis of (21) is. However, we would stress that it would not be trivial to reduce (18) to a case like (21), for the obvious reason that some explanation would be needed for why (18) contains the word *and*, and for the role it is playing. On the other hand, it seems plausible to us that (21) can be treated as a reduced conditional, or perhaps even as containing an (ellided) non-truth-tabular *and*.

In contrast with *and*, the prospects for treating non-truth-tabular *or* as involving a standard use of the connective are more promising. For, we only need to *strengthen* the meaning of disjunction. In the following paragraph we will loosely sketch a way in which that strengthening could arise by inference. We then argue that, although it is plausibly *one* route to (something like) a non-truth-tabular interpretation, it cannot be the only one. There is a genuine, semantically distinct non-truth-tabular use of *or*.

Consider the sentence:

(22) John is away for the weekend, or his car would be here.

Parallel to (2), this seems to imply 1) that John is away, and 2) a conditional proposition to the effect that if John were not away, his car would be here. Here is an appealing account of how those implications would arise. Most think that the so-called *or-to-if* inference (from A *or* B to *if not* A *then* B) is valid, at least pragmatically (e.g. Stalnaker, 1975). If so we can infer the following from an assertion of (22): *if John is not away his car would be here*. Putting aside some issues about the indicative/subjunctive distinction, it seems plausible that this accounts for the conditional proposition that (22) implies. And from it the implication of the first disjunct falls out. For, the inferred conditional itself seems to presuppose or imply the falsity of its consequent; that John's car is not present. So the antecedent must be false, i.e. John is away. While various questions of detail arise, surely the basic aspects of this sketch of an account are compelling: the conditional proposition arises from the standard meaning of *or* (via the *or-to-if* inference), and the counterfactual form of the second disjunct (qua consequent) is responsible for the implication that the first disjunct does indeed hold.[7]

[7]Thanks to Philippe Schlenker for suggestion some parts of this pragmatic derivation. One thing odd about it is that normally it is pragmatically deviant to assert a disjunction when one of the disjuncts in particular is believed to be true. However, it might be argued that since a simpler

We do find it plausible that *some* instances of (22) (etc.) *are* semantically truth-tabular and get the relevant implications through something like the reasoning we sketched above. There are however, two reasons to think that not all instances of disjunctions like (22) are truth-tabular.

First, there are examples where a pragmatic analysis simply fails. Consider, for instance:

(23) John should practice the piano, or his recital will be a disaster.

The meaning of this is intuitively:

(24) John should practice the piano. If he doesn't practice the piano, his recital will be a disaster.

In this case the *or-to-if* inference does not give us the conditional in (24). For all we can get from it is this:

(25) If it is not the case that John should practice the piano, his recital will be a disaster

But this is clearly not a natural inference, let alone what we would need to derive an implication of the first disjunct itself. So there is no plausible pragmatic/inferential explanation of the entailment of (24) from (23). So we conclude that there must be a semantically distinct, non-truth-tabular use of *or* to handle examples like (23).

Evidence that such a use of *or* exists more generally comes from the fact, noted in §1, that non-truth-tabular interpretations are not typically possible with the *either . . . or* construction. To illustrate this again consider an example like (22), in the following context

context 1: You complain to me that John must have taken your space in the driveway (again), since his car is not parked out front where normally it should be. In defense of John – and his parking habits, I say:

(26) (*Either) John is away for the weekend, or his car would be parked out front.

utterance would not accomplish the same feat, this normally infelicitous use of a disjunction would here be acceptable.

Interestingly, while the variant with *either* is completely unacceptable here, it seems better if the context is instead as follows:

context 2: We are arguing about whether John is away for the weekend or not. You say that he isn't. As evidence that he is indeed away I say – pointing to the empty parking space out front:

(27) (Either) John is away for the weekend or his car would be parked out front.

The intuitive difference between my utterance in the two contexts seems to be as follows. While in the former case I am outright asserting that John is away, in the latter I am rather arguing or providing evidence for the conclusion that he is, based on the observed falsity of the second disjunct.

If all non-truth-tabular cases were, in fact, normal disjunctions, it is far from clear why *either* should not be able to appear in some of them. Moreover, it is not clear why the acceptability of *either* should turn precisely on whether the first disjunct is (apparently) asserted outright, or merely argued for/implied. On the other hand, it is straightforward to explain these facts if the former cases involve a distinct, non-truth-tabular variant of *or*. For it seems plausible that *either* only co-occurs with normal disjunctions (and that something like the inferential route sketched above is responsible for the implication of the first disjunct in context 2).

Of course, we cannot demonstrate that one cannot devise a principled pragmatic explanation of non-truth-tabular uses of *and* and *or*, or appeal to some further semantic assumptions to save a truth-tabular analysis. But we hope to have shown that the most obvious possibilities face serious challenges. In §5 we introduce (further) evidence suggesting that non-truth-tabular uses of *and* and *or* are distinct from normal ones not only semantically, but also *syntactically*.

3 Dynamic effects of truth-tabular uses of *and* and *or*

In this section, we will discuss properties of the truth-tabular uses of *and* and *or* that do not follow directly from their truth-conditional properties. The effects we discuss are 1) the presupposition projection properties of the connective, and 2)

the effects of the connectives on the interpretation of modals that appear under them. In the next section, we will give a static, parameter-based analysis of these effects, modeled on van Benthem (1989), MacFarlane (forthcoming) and Yalcin (2007), which is essentially a static variant of the dynamic semantics of Heim (1982) and Veltman (1996).[8]

3.1 Presupposition projection under *and* and *or*

The sentence 'Mary knows that John came to the park' presupposes that John came to the park.[9] Presupposition projection is the way in which the presuppositions of complex sentences inherit, or fail to inherit, the presuppositions of their parts. What is relevant for us is presupposition projection through conjunction and disjunction.

Conjunction

In Karttunen's terminology connectives such as *and* and *or* are presupposition *filters*. Let us start with *and*. The rule standardly assumed to describe the projection behavior of conjunction is as follows:

(28) For sentences α and β, if $P(\alpha)$ is the presupposition of α, and $P(\beta)$ is the presupposition of β, then $P(\alpha)$ and $(\alpha \supset P(\beta))$ is the presupposition of α and β.

This generalization is motivated by the observation that if the first conjunct entails the presupposition of the second conjunct then the sentence as a whole does not inherit the presupposition of the second conjunct.[10] So, for example, as pre-

[8] van Benthem (1989) notes the equivalence of the static semantics to Veltman's dynamic semantics.

[9] See e.g., Soames (1989); Heim (1990); Beaver (2001) for background on presupposition, which is mainly taken for granted here.

[10] Note that the rule also predicts "conditional" presuppositions in many cases. For example (i-a) is predicted to presuppose (i-b).

(i) a. John is blind and Mary knows that John came to the park.
b. John is blind $\supset$ John came to the park.

This prediction is defended by Heim (1983), but it is regarded by problematic by many, e.g. Geurts (1996), and the issue about this is called the *proviso* problem. This issue is mostly orthogonal to the ones we discuss here.

dicted by (28), sentence (29) does not presuppose anything as a whole:

(29) John came to the park and Mary knows John came to the park.

On the other hand, presuppositions in the first conjunct do not seem to be felicitously filtered out by the second conjunct:

(30) ?Mary knows John came to the park, and John came to the park.

For this reason, it is generally assumed that the first conjunct gives all of its presuppositions to the entire sentence, unaffected by the second conjunct.[11]

Disjunction

There is less consensus in the literature on the presupposition projection rules for disjunction. However, the following limited generalization seems correct (though it is by no means universally accepted):

(31) If α has no presupposition and β presupposes $P(\beta)$ then α *or* β presupposes $\neg\alpha \supset P(\beta)$.

This is motivated by the fact that presuppositions in the second disjunct appear to be filtered out by the negation of the first disjunct. For example, (32) does not presuppose that John came (the presupposition of the second disjunct), because that is entailed by the negation of the first disjunct.

(32) Either John didn't come, or Mary regrets that he came.

For our purposes we will make do with this limited generalization. However, it's worth noting that, unlike with conjunction, there appears to be less of an order-effect for disjunction. For example, switching the order of (32), yielding (33) does not seem to change its presuppositions or felicity.

(33) Either Mary regrets John came, or he didn't come.

[11] Schlenker (2008, 2009) points out that this is not good evidence for the asymmetry, as (30) is independently infelicitous as the second conjunct in (30) is redundant (see, also, Rothschild, 2008). However, to simplify discussion here, we will not consider the alternative symmetric rules.

3.2 Epistemic modals under *or*

Just like presuppositions, the interpretation of epistemic modals is also affected by being inside a disjunction. There is considerable debate on the semantic/pragmatic status of epistemic modals, but most authors agree that such modals either report or urge a certain state of mind of the speaker and/or audience about the facts.[12] So, a statement of the form *must* ϕ would either report or suggest that the speaker/audience knowledge does/should include ϕ.

It is well known that epistemic modals do something slightly different when embedded in attitude reports. For example (34) is used to report a fact about John's beliefs, not a fact about the speaker/audience's knowledge.

(34) John believes that Peter must be here.

But it is not usually assumed that the interpretation of epistemic modals is affected by other embeddings (with the notable exception of conditionals, which we return to later).

If epistemic modals were not affected by embedding in disjunction, there is a reason to think epistemic modals would not be be used at all in disjunctions. It is as follows: in a normal use of a disjunction, you do not commit yourself to the truth of either disjunct. For example, an utterance of (35) would normally only be felicitous if you didn't know the truth of either disjunct.

(35) Johnny is in the basement or he is in the study.

However, assuming, as is normally the case for propositions you are explicitly considering, you know about your own knowledge, then for any given epistemic modal claim, you know whether it is true or not. So, it would be peculiar to have an epistemic modal in a disjunction.

There are however felicitous uses of epistemic modals in disjunction, such as in the following:[13]

(36) Either the dog is in the backyard or it must be in the kitchen.

This does not seem significantly different in meaning than the version without

[12]See, for instance, von Fintel and Gillies (2011) and Yalcin (2007).

[13]Example (36) is from Rothschild (forthcoming), which provides a similar analysis.

must in the second conjunct.

(37) Either the dog is in the backyard or it is in the kitchen.

If *must* ϕ just acted as a report of a mental state then this equivalence would not hold. So something else seems to be going on. If we view *must* ϕ, instead, as urging some sort of attitude, than it is entirely unclear how it should behave under disjunction (without a theory of how expressivist semantics works under disjunction).

Another way of seeing the problem is to think about entailments. In general, a sentence of the form α or β, together with $\neg\beta$ entails α. However, in the case of (36) such a pattern fails; the following inference is not valid:

(38) Either the dog is in the backyard or it must be in the kitchen.

(39) It's not the case that it must be in the kitchen.

Therefore:

(40) It is in the backyard.

Any standard semantics for epistemic modals and disjunction needs to explain this.[14]

One way of looking at these facts is as follows: epistemic modals in disjunctions do not directly report or suggest speaker or hearer attitudes. Rather they only do so indirectly. While the unembedded use of *must* ϕ relates directly to the speaker and/or audience attitude the use of *must* ϕ in a disjunct relates only indirectly to it. In α *or must* β we instead see *must* β as conveying something (either reporting or urging) about the speaker/audience attitude conjoined with $\neg\alpha$. So (36) is a disjunction of the claim that the dog is in the backyard, and the report that the state of speaker/audience knowledge is such that if it is not in the backyard, it is in the kitchen.[15]

So, as with presupposition projection, the negation of the first disjunct is used in interpreting the second disjunct. In the next section, we will give a unified semantic treatment of the presuppositions and modals within disjunctions and

[14] We are grateful to Seth Yalcin (p.c.) for suggesting this argument.

[15] Again, it's less clear how to implement the expressivist view under disjunction.

conjunction. (We discuss the facts about epistemic modals under conjunctions later, in section 4.3, as they are somewhat more subtle.)

3.3 Dynamic effects in non-truth-tabular uses of *and* and *or*

The same dynamic effects of *and* and *or* are found in non-truth-tabular uses of these expressions. This demonstrates a semantic/pragmatic commonality between the truth-tabular and non-truth-tabular uses of the connectives. We will later argue (§5) that the non-truth-tabular uses are uses where *only* the dynamic effects of the normal uses are present. In this section we just make the smaller point that the same dynamic effects we found in truth-tabular uses are also found in non-truth-tabular uses.

First, presupposition projection. The projection rule for *and* allows a presupposition in the second conjunct to be satisfied by the first conjunct (and thus fail to project out of the entire sentence). Here are some examples where this also occurs in non-truth-tabular conjunction:

(41) A woman starts smoking, and she wants to stop within a few months.

(42) You drink too much at the party, and you will regret that you did tomorrow.

In both cases, the presupposition of the second conjunct is satisfied by the first conjunct. This should not be that surprising as, on most theories, the presupposition projection rule for conditionals is the same as for conjunctions. So even if the non-truth-tabular use of *and* were merely an idiosyncractic way of expressing a conditional we would expect this pattern. Things are more interesting for the non-truth-tabular use of *or*. For regular disjunction a presupposition in the second disjunct can be satisfied by the negation of the first conjunct. Here is an example where this happens with non-truth-tabular disjunction.

(43) Mary wasn't pregnant, or her doctor would have known it.

(44) Bill didn't drink too much last night, or his wife would have made him regret it.

In each case, the presupposition in the second disjunct is satisfied by the negation of the first disjunct and is not inherited by the whole sentence. This is just what

we get in normal disjunction.

Testing the facts with epistemic modals is more difficult. We cannot find epistemic modals in the second disjunct of a non-truth-tabular disjunction, for reasons we discuss later. However, the modals such as *would* that we do find in non-truth-tabular disjunction seem to have their interpretation affected therein in the same way that epistemic modals have their interpretation affected in normal disjunctions. For instance, the domain of *would* in (43) appears to be restricted to worlds where the first disjunct is false. So the interpretation of modals under disjunction seems to follow the same principles in both truth-tabular and non-truth tabular uses.

In sum, the dynamic behavior present in the truth-tabular uses of *and* and *or* carries over to the non-truth-tabular uses. This is another reason to view non-truth-tabular uses as not mere idiosyncrasies.

4 Parameter Treatment of Dynamic Effects

In this section we give a semantic account of the dynamic effects of the connectives. The inspiration for this treatment is Yalcin (2007) though that paper treats different features of epistemic modals from the ones we discuss here and does not discuss presuppositions at all. This account is essentially equivalent to dynamic semantics, though its formalism allows a more perspicuous statement of our proposal for the non-truth-tabular uses of *and* and *or*.[16]

It is standard in semantic theories to define semantic values as relative to parameters for world, time, and location. What we posit is a parameter which we call, following Yalcin, the *information parameter* which presuppositions and certain modals are sensitive to. This parameter, s, can also be shifted by certain operators, including the connectives. For the purposes of this paper, we will only use two parameters, the information parameter, s, and the world parameter, w. So, the semantics for this language determines the truth of a sentence relative to a context, c, and these two parameters.

We assume, following Yalcin, that most non-presuppositional factual expressions are not responsive to the information parameter. So, for instance, the se-

[16]See van Benthem (1989) for a presentation of a semantics formally similar to Yalcin's and a discussion of its connection to dynamic semantics.

mantics for a sentence like 'It's raining' do not make reference to the information parameter. Thus, it might be defined as follows:

(45) $[\![$It's raining$]\!]^{c,w,s}$ is true iff it's raining in w at the location in c.

By contrast, epistemic modals make reference to the information parameter:

(46) $[\![\Diamond\phi]\!]^{c,s,w}$ is true iff there exists $w' \in s$ such that $[\![\phi]\!]^{c,s,w'}$ is true.

(47) $[\![\Box\phi]\!]^{c,s,w}$ is true iff for every $w' \in s$, $[\![\phi]\!]^{c,s,w'}$ is true.

The information parameter thus gives the domain of quantification for epistemic modals.

We will assume also that presuppositional expressions are only defined when their presuppositions obtain in every world in the information parameter. For every simple presuppositional expression ϕ which presupposes the proposition p we will assume the following rule:

(48) $[\![\phi]\!]^{c,s,w}$ is defined iff $p \supset s$

We also assume that any given complex expression is defined only if all parts that any semantic rule makes reference to are defined.[17]

Now all we need is the principle governing the shifting of the information parameter across connectives. Here are such rules, in the form of semantics for *and* and *or*.

(49) $[\![\alpha$ and $\beta]\!]^{c,s,w}$ is true iff $[\![\alpha]\!]^{c,s,w}$ is true and $[\![\beta]\!]^{c,s_\alpha,w}$ is true.

(50) $[\![\alpha$ or $\beta]\!]^{c,s,w}$ is true iff $[\![\alpha]\!]^{c,s,w}$ is true or $[\![\beta]\!]^{c,s_{\neg\alpha},w}$ is true.

For any formula α and information parameter s, $s_\alpha = s \cap \{w' : [\![\alpha]\!]^{c,s,w'}$ is true$\}$. So, α and β only differs from a classical conjunction in that the information parameter with respect to which β is evaluated is s conjoined with the semantic value of α. For α or β, the difference from classical disjunction is that β is evaluated with respect to s conjoined with the semantic value of the negation of α.

We conclude this section with two notes on this treatment of presupposition projection:

[17] This is effectively the weak-Kleene notion of definedness.

1. Recent work on presupposition projection has attempted to provide an explanation of why, in our terminology, the information parameter is shifted under connectives such as conjunction and disjunction (e.g. Schlenker, 2008, 2009; Rothschild, 2011). While our account is not stated in an explanatory way, it is compatible with some such explanations.[18] That is, it is probably not merely a lexical stipulation that *and* and *or* work the way they do. Rather, there are reasons why the information parameter is shifted in this exact way under disjunction and conjunction. So, we should not expect to find languages in which truth-tabular conjunction and disjunction affect the information parameter in different ways. However, to get into these reasons would take us too far afield.

2. It may seem odd that we allow one single parameter to be responsible both for the truth of statements with epistemic modals *and* presupposition projection. As an anonymous reviewer pointed out, while both such modals and presuppositions are sensitive to contextual information they seem to be sensitive to different kinds of contextual information: presuppositions are sensitive to the common ground, while epistemic modals seems to be sensitive to something more like distributed knowledge of a group. The reviewer suggests we considered introducing separate informational indices for modals and presuppositions. We agree that epistemic modals and presuppositions behave differently, but we do not think that this should lead us to proliferate information parameters. Rather, we think that substantive pragmatic principles are needed explain the role of the information parameter in conversation. We merely sketch these here. Yalcin (2007) argues convincingly that a sentence whose truth or falsity depends on the information parameter (such as those with epistemic modals) should be understood as requiring that the common ground be updated in such a way that when it sets the value of the information parameter the sentence is true. By contrast, we would suggest that when the definedness is at issue (as in the case of presuppositions) the felicity conditions on a sentence require that the sentence be defined when the common ground serves as the value of the information parameter. These two principles require us, like Yalcin, to

[18]Schlenker (2009) can especially be read in this way, though it is formulated in a somewhat different framework.

reject the idea that the information parameter is akin to other contextual parameters and has its value simply set by context.[19]

4.1 *If*

The parameter-based treatment of dynamic effects can also be extended to give a semantics of conditionals. We present this here as it will be useful later for explaining how it is that certain conjunctions can get conditional interpretations. Yalcin (2007) and Gillies (2010) give the following semantics for indicative conditionals:[20]

(51) $[\![\alpha \rightarrow \beta]\!]^{c,s,w}$ is true iff for all $w' \in s_\alpha$, $[\![\beta]\!]^{c,s_\alpha,w'}$ is true

We won't discuss in detail this semantics, but note that it makes *if* α *then* β equivalent to an epistemic necessity modal with a domain restricted by α.[21]

This is extremely close to the proposal in Kratzer (1986). On Kratzer's view the antecedent of a conditional serves only to restrict the domain of a modal governing the second ("consequent") clause. When no explicit modal is present, this will typically be a silent epistemic necessity modal. Thus, Kratzer's account gives similar truth-conditions to Yalcin's, though it has a more involved derivation, as she, unlike Yalcin, posits an unpronounced epistemic modal.

We could, moreover, give a version of the semantics in (51) even closer to Kratzer's. What we need to do is assume that unpronounced modals are always present in all consequents, in which case all that we need in the semantics of the conditional is to effect a shift in the information parameter:

(52) $[\![\alpha \rightarrow \beta]\!]^{c,s,w}$ is true iff $[\![\beta]\!]^{c,s_\alpha,w}$ is true

In this case, the antecedent simply shifts the information parameter and the effect of this shift is determined by what modal operators appear in the consequent.

[19] We are grateful to Yalcin for discussion of this point.

[20] There is one difference form Yalcin's: our update rule for s_α is only the same as his when α is not itself sensitive to the information parameter.

[21] This is anyway the case where α itself does not contain a modal. We do not here want to discuss the complicated cases where there is an epistemic modal in the antecedent.

4.2 Counterfactual Conditionals

The account of conditionals above does not obviously extend to counterfactual conditionals like this:

(53) If John were here, he would be tired.

The problem is that to get adequate truth conditions for counterfactuals we need to look outside the standard worlds in the context set which the information parameter tracks (Lewis, 1973; Stalnaker, 1968). To handle counterfactuals we thus need a more structured information parameter that includes not just worlds deemed epistemically possible but also nearby possibilities that are incompatible with known information. For simplicity here we will assume a strict-conditional account of counterfactuals: (53) is true iff in all accessible worlds in which John is here, John is tired . To get this account to work we need to make the information parameter s have an inner and outer sphere: the inner sphere tracks epistemic possibility, the outer sphere tracks nearby counterfactual possibility.[22] Modals, we assume, quantify over just the worlds in the inner sphere if the inner sphere is non-empty, but if the inner sphere is empty the modals quantify over the worlds in the outer sphere.

So we now take s to be an ordered pair of sets of worlds $(s_{\text{in}}, s_{\text{out}})$. We also refine our definition of s_α, so that both the inner and outer parts of the information parameter are adjusted.

(54) $s_\alpha = (s_{\text{in}} \cap \{w' : [\![\alpha]\!]^{c,s,w'} \text{ is true}\}, s_{\text{out}} \cap \{w' : [\![\alpha]\!]^{c,s,w'} \text{ is true}\})$

We slightly adjust our definition of modals to reflect this more nuanced treatment of the information parameter:

(55) if s_{in} is nonempty then $[\![\Box\phi]\!]^{c,s,w}$ is true iff for every $w' \in s_{\text{in}}$, $[\![\phi]\!]^{c,s,w'}$ is true, otherwise $[\![\Box\phi]\!]^{c,s,w}$ iff for every $w' \in s_{\text{out}}$, $[\![\phi]\!]^{c,s,w'}$ is true.

We can now maintain the Krazterian semantics of *if* in (52) along with the assumption that *would* is a standard necessity modal, and get an adequate treatment

[22] We follow von Fintel (2001) and Gillies (2007) here in assuming that a sophisticated dynamic story of context change accounts for the unacceptability of Sobel sequences and other classic objections to the strict conditional account of counterfactual (see Moss, forthcoming, for a critique of these views).

of counterfactuals like (53). If it is known that John is not here, then we assume an information parameter whose inner sphere contains no worlds in which John is here. For any s that has this property, according to (52) and (55), (53) is true iff all the worlds in s_{out} in which John is here are ones in which he is tired. We assume here that *would* and *must* have the same truth-conditions, but that the use of *would* signals that the outer sphere of possibilities is being quantified over. This simple semantics would need considerable refinement to deal with many of the puzzles about counterfactuals, but it should be adequate for our purposes here.

Note that, unless relevant, we will just refer to s_{in} as s and keep the simple semantics we used prior to this section.

4.3 Epistemic modals and conjunction

There is no clear consensus on how epistemic modals behave under conjunctions. What does our semantic account predict? A first prediction is that the domain of epistemic modals in the second conjunct will already contain the information of the first conjunct. Note that this does not have any surprising implications for unembedded conjunctions since these can be regarded as consecutive assertions.[23]

However, there are cases where a conjunction is itself embedded under another operator and thus cannot be regarded as amounting to consecutive assertions of the conjuncts:

(56) Either John is in Tawain and Tim must be too, or John is in Haiti.

The key prediction is in the interpretation of the *must* in "Tim must be too": this has as its information parameter not the s of the whole sentence, but rather s plus the information that John is in Tawain (i.e. $s_{[\![\text{John is in Taiwan}]\!]}$). This seems like a good prediction to us. It is less clear what the prediction made by more standard theories would be, because it is not clear from their perspective why you should ever find epistemic modals under disjunction in the first place.

[23]Stalnaker (1974) suggests regarding a conjunction, for pragmatic purpose, as two consecutive assertions. He uses this to motivate the presupposition projection rule for conjunction.

5 Purely parameter-shifting uses of connectives

In this section we propose a typology of uses of the connectives that result from preserving their ability to alter the information parameter while dispensing with their truth-tabular meaning. The non-truth-tabular uses are two particular cases in this typology. [24]

Let $*$ represent either *and* or *or*. We propose that in sentences superficially of the form $\alpha * \beta$, rather than $*$ acting as a binary operator with its usual truth table, instead $*$ may signal *only* a change in the information parameter for the evaluation of β. How then do we make sense of sentences where *and* and *or* appear without their truth-table meaning? What we assume is that default principles of semantic interpretation determine what the semantic effect of each clauses is when there is no higher truth-tabular connective governing them. The two principles we posit are as follows:

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

(58) Any clause may be entailed unless the meaning of some operator prevents it.

Principle (57) is obvious: we should not have entirely extraneous linguistic material of the type S: every clause must do something. Principle (58) may seem less obvious, but is, in fact, quite natural. It simply states that it is a default option for a clause to be *entailed*. One piece of evidence for this comes from the fact that a wide-variety of subordinate clauses, including those with no higher pronounced operator, are entailed:

(59) a. Alfred came in, so, he must still be here.
b. Lance being an astronaut, Mary suspected he'd have a taste for freeze-dried food.

In the first example, (59-a), both clauses are entailed. In the second example both the starting *free absolute* and the main clause are entailed. Indeed, there are a num-

[24] Our proposal here is related to an unpublished squib by Michael Solomon who proposes a dynamic system in which *all* uses of connectives, including truth-tabular uses, free-choice disjunction, and our non-truth-tabular uses, include just the dynamic aspects of the meaning of the connectives. Solomon accounts for truth-tabular aspects of connectives by positing covert operators that determine whether clauses have entailment-like effect on the context.

ber of connective terms (or adverbs) that indicate that both clauses are entailed (*but*, *so*, *because*, *however*, *otherwise*). One view of these is that they all semantically encode a form of conjunction. Another is that they only modify the clause they appear in and that default semantic rules enforce entailment.[25]

We will return to some of the details of exactly when and why some clauses get entailed later in §6.2. For now, let us simply accept the reasonable posit that without a governing truth-functional operator, a clause *must* do something, principle (57), and a clause *may* be entailed, principle (58). We will see that these assumptions do useful work for us without over-generating interpretations.

Recall that our background assumption is that there is a possibility for the connectives only to exhibit the dynamic part, i.e. the information parameter changing part, of their semantics in rules in (49) and (50). According to those rules, β, the second conjunct or disjunct, plays no dynamic role; in particular, it doesn't affect the information parameter under which β is evaluated. Thus, if β is to play any role at all, and so not fall afoul of principle (57), the only option available is that β is entailed, by principle (58). So we predict that in any "dynamic-only" use of conjunction and disjunction, β will be entailed (subject to the usual information parameter effect of the connective). As for α, the first conjunct, given (57) and (58) there are two possible semantic roles for α in dynamic-only uses of connectives: 1) it makes no contribution to the truth-conditions of the sentence (except in so far as it alters the information parameter) and 2) it is also entailed under principle (58). We assume that both possibilities exist, but we argue that for each connective only one of the possibilities results in a substantially different meaning and so is actually realized.[26]

To state this more formally, we have the following rule governing the connectives:

(60) Let $*$ be a connective (either *and* or *or*). An assertion of $\alpha * \beta$ can take the following three forms:

Normal Connective The normal use discussed above.

Double Entailment In this possibility α is entailed and β is entailed with

[25]On this view, for "but", for example, the word does not have a truth-table like *and*, but rather simply marks a form of contrast with preceding material.

[26]This last point relates closely to the claims of Michael Solomon, see fn. 24, who suggests that one can vary assertive content in connectives and account for non-truth-tabular uses without overgenerating.

the information-parameter change associated with $*$.

Use of α for changing information parameter only Here α is not entailed but just used to alter the information parameter for β

We can represent all the possible uses of the two connectives in this table:

connective	use type	content
and	normal	$[\![\alpha \text{ and } \beta]\!]^{c,s,w}$ (as defined in (49))
and	double entailment	$[\![\alpha]\!]^{c,s,w}$ and $[\![\beta]\!]^{c,s_\alpha,w}$
and	information-parameter change	$[\![\beta]\!]^{c,s_\alpha,w}$
or	normal	$[\![\alpha \text{ or } \beta]\!]^{c,s,w}$ (as defined in (50))
or	double entailment	$[\![\alpha]\!]^{c,s,w}$ and $[\![\beta]\!]^{c,s_{\neg\alpha},w}$
or	information-parameter change	$[\![\beta]\!]^{c,s_{\neg\alpha},w}$

Thus, we are positing that any sentence with *and* and *or* in the right structure will exhibit certain interpretative options beyond the normal truth-tabular one. What the options have in common is that the dynamic effect on the second clause is the same as in the truth-tabular case (and that they are derived from (57) and (58)).[27]

Two of the possibilities are not very interesting: ***and* - double entailment** reproduces normal conjunction. In addition, ***or* - information-parameter change** is hard to distinguish from regular disjunction. For it is equivalent, to *if* $\neg\alpha$ *then* β, which would be very close in meaning to the disjunction α *or* β.[28] This leaves two possibilities for uses of the connectives that differ substantially from the truth-tabular uses: ***and* - information-parameter change** and ***or* - double-entailment**. We argue below that both of these possibilities are realized, and that these explain the non-truth-tabular uses our paper focuses on.

[27]It should be noted that we are using 'and' metalinguistically in specifying the content of the 'double entailment' uses. Specifically, we are using it to indicate that the two clauses, as interpreted with respect to the specified information parameters, jointly constitute the content of the sentence. Thus on the 'double entailment' use type the two clauses need not be thought of as within the scope of a (normal) conjunction; rather it is as if each is independently uttered (under the relevant information parameter). This distinction is not important for the examples discussed thus far, but becomes relevant when we return to a discussion of examples involving imperatives in §6.1.

[28]See again the semantics of the conditional in (52). Although the semantics of conditionals and disjunctions are different their assertability conditions are extremely close. Of course, the information parameter change use of *or* will be equivalent to a simple assertion of β if β is not responsive to the information parameter, but we assume those cases are ruled out by principle (57) for both disjunctions and conditionals.

***and* - information-parameter change**. This would be a form of conditional conjunction: for example α *and* $\Box\beta$ would become equivalent to $\alpha \rightarrow \Box\beta$, with the semantics for $\rightarrow$ given in (52). Certain non-truth-tabular examples fall out straight away if treated in this way; for example:

(61) The police show up, and there might be trouble.
$\approx$ If the police show up, there might be trouble

In this example, the meaning according to information-parameter change option for *and* can be presented as follows, where P = "Police show up", and T = "there is trouble."

(62) $[\![\Diamond T]\!]^{c,s_P,w}$

This is true iff there is some world w' in s_P (all worlds in information parameter, s, in which the police show up) such that $[\![T]\!]^{c,s_P,w'}$, which itself is simply true if there is trouble in w'. This captures the intuitive meaning of (61): that it's possible relative to the assumption that the police show up that might be trouble. It is also equivalent to $P \rightarrow \Diamond T$ on the semantics in (52).

Other non-truth-tabular cases require further analysis. The reason is that unless β is sensitive to the information parameter, on the information-parameter change use α *and* β would simply be truth conditionally equivalent to β alone. We assume such cases are ruled out by principle (57). For examples like (1), which contains the future modal *will*, there are two main options: a) treat β as governed by a covert epistemic necessity modal scoping over the future tense (or, equivalently for our purposes, treat *will* itself as epistemic), or b) treat *will* as a Kratzerian "doubly relative" modal, which picks up its *modal base* from the information parameter. Going with a) assimilates (1) to standard cases of epistemic modals being altered by the information parameter. While this may be feasible here, we probably need b) for other cases. For instance, some examples with deontic modals are not plausibly treated as having hidden epistemic modals:

(63) Your son comes home late, and you should scold him.

A natural interpretation of this says that in the best deontic worlds in which your son comes home late are ones in which you scold him. To get this reading correctly we cannot just restrict the worlds of a (silent) epistemic modal, rather

we need to affect the interpretation of the deontic modal. We could, using the "doubly relative" semantics for modals suggested in Kratzer (1981), treat deontic modals as having an *ordering* unique to them, but take their base of worlds as given by the information parameter. So in this case, the shift in the information parameter carries through to the deontic modal inside.[29]

Similarly, in cases with adverbs of quantification in β, such as (64) we need to rely on the shift in the information parameter affecting the interpretation of the adverb of quantification, unmediated by a silent epistemic modal.

(64) John comes late to practice, and the coach is usually pissed.

We will discuss how to do this in section 6.1.

There are also cases without any overt modals or adverbs of quantification, such as those discussed in §1:

(65) The cops show up, and someone is a snitch.
$\approx$ If the cops show up, then (it follows that) someone must be a snitch

For this case we would seem to need to posit a covert necessity modal (option a) above). This of course, is exactly the move made by Kratzer (1981, 1986) in analyzing indicative conditionals without overt modals or adverbs of quantification.

***or* - double entailment** This would be a use on which α *or* β entails α, and entails β relative to the information parameter updated with $\neg\alpha$. Some of the data discussed in §1 are pure cases of this:

(66) John has no friends, or he would throw a party
$\approx$ John has no friends. If he did he would throw a party.

Taking *would* to be (in this instance) an epistemic necessity modal, the relevant

[29]Here is a lexical entry for such a doubly-relative deontic *must* that does the trick. Assume that there is a deontic partial ordering $>_d$ on worlds, such that if $x >_d y$ then x is a deontically better world than y:

(i) $[\![\text{Must}_d\ \alpha]\!]^{c,s,w}$ is true iff for all worlds w' in s such there is no w'' in s s.t. $w'' >_d w$, $[\![\alpha]\!]^{c,s,w''}$ is false.

Essentially, $\text{Must}_d\ \alpha$ means that in all the deontically best worlds in the information parameter α is true.

interpretation falls out directly. On the *or*-double entailment interpretation, with F = "John has no friends" and P = "John throws a party", we have that (66) is interpreted as follows:

(67) $[\![F]\!]^{c,s,w}$ and $[\![\Box P]\!]^{c,s_{\neg F},w}$

That this indeed corresponds to the intuitive, non-truth-tabular meaning of (66), can be made apparent by considering the following property of the information parameter. It does not appear to be felicitous to utter a normal conjunction if the second conjunct relies for its truth on an information parameter that includes worlds in which the first conjunct is false.[30] For example, the following assertion is not acceptable:

(68) John is here and he might not be.

This suggests that for (66) to be acceptable, we need to evaluate it with respect to an s where s_{in} contains no worlds in which John has friends (see §4.2 for discussion of s_{in} and s_{out}). In this case, the second clause will be evaluated with respect to worlds in s_{out} in which John has friends, in other words, counterfactual possibilities in which John has friends. It follows that the total effect of (66) is to 1) assert that John has no friends, and 2) assert the counterfactual conditional that if John had friends, he would throw a party.

Other cases are slightly different:

(69) John must be in Turkey or his car would have been outside.

(70) John must clean his room, or he'll get in trouble.

To put things in terms of our semantic framework: the critical feature here is that the information parameter is updated by something different than $\neg\alpha$, in particular $\neg\alpha'$, where α' is a subclause of α. So, for example, in (69) we update the information parameter with John not being in Turkey rather than with it not being the case that John *must* be in Turkey. This means we can, consistently with pragmatic norms, allow ourselves to stay within s_{in} when evaluating (69).[31] We discuss these cases in more detail in §6.1.

[30] See Yalcin (2007) for further discussion of such Moore-paradoxical-seeming sentences in this semantic framework.

[31] This phenomenon is reminiscent of anankastic conditionals:

In summary, we see that the non-truth-tabular uses of *and* and *or* can be derived from the truth-tabular uses, on the supposition that there are uses of *and* and *or* where only the dynamic effects are present without the normal semantics.

5.1 Lexical and Syntactic Ambiguity

Above, we presented some semantic rules which allowed us to shift the interpretation of *and* and *or*. We think that a better implementation of the core idea is to treat *or* and *and* as lexically ambiguous among uses which select different syntactic frames. Non-truth-tabular uses have separate lexical entries that are only related to the regular connectives insofar as they have the same dynamic effect. The cross-linguistic prevalence of these lexical entries is explained by the fact that they are achieved through simple transformations of the original, basic truth-tabular meanings. On this view, what we have done is give a theory that explains an ambiguity (polysemy) that otherwise looked somewhat puzzling. (For example, perhaps the non-truth-tabular uses are fossilizations of a stage in the language where they *were* derived by operations applying within semantic derivations.)

We believe that the lexical ambiguity version of our proposal has an advantage over the purely semantic ambiguity version, in that it provides the possibility of accounting for some of the syntactic peculiarities of the non-truth-tabular uses. For example, in §1 we presented some properties of non-truth-tabular uses that seem to be arbitrary:

- The possibility of α being an NP and β being a full clause, as in *Another beer, and/or I am leaving*.
- The possibility α being an imperative and β being a full clause, as in *Do that and/or I will shoot*.
- The impossibility of using wide-scope *either* in non-truth-tabular disjunctions.
- The impossibility of having non-truth-tabular conjunctions with NP coordination.

(i) If you must have fish, you need to go to the port.

Here it seems like the consequent is evaluated not with the information from the antecedent, but rather with a sub-clause of the antecedent.

It seems natural to suppose that these peculiarities cannot be explained semantically, but rather indicate that we are dealing with a different construction. Some of the properties listed above indicate that the non-truth-tabular uses of *and* and *or* are not true coordinative uses of the connectives, since the syntactic mark of coordination is an identity of syntactic categories between the items coordinated (see, e.g., Haspelmath, 2004).

Below we will introduce further evidence that non-truth-tabular do not involve the same, coordinative structures as their truth-tabular counterparts. In non-truth-tabular conjunctions α seems to behave syntactically like a subordinate clause with respect to extraction and binding possibilities. This is of course consistent with our semantic treatment of it as essentially like an *if*-clause. Similarly, in non-truth-tabular disjunctions we find some limited possibilities for extraction from α (but not β), whereas extraction is impossible in truth-tabular cases. We illustrate these facts below.

First, the case of conjunction. Culicover and Jackendoff (1997) observe that universal quantifiers in β can bind into α, paralleling their ability to bind into an *if*-clause from the consequent of an overt conditional. However, in normal, truth-tabular conjunctions binding into α from β is impossible. They illustrate with the following examples (their (23)):

(71) a. You give him$_i$ enough opportunity and every senator$_i$, no matter how honest, will succumb to corruption.

b. If you give him$_i$ enough opportunity, every senator$_i$, no matter how honest, will succumb to corruption.

c. *We gave him$_i$ enough opportunity and every senator$_i$, no matter how honest, succumbed to corruption.

Rather surprisingly, Culicover and Jackendoff argue that non-truth-tabular *and* nonetheless does involve a coordinate structure *syntactically*.[32] We find their arguments to be rather weak, however, and take some of the data they provide

[32]They propose that coordinate syntactic structures involving *and* can either be mapped to semantic representations that express simple conjunction, or to ones where α is subordinate to β, with roughly a conditional meaning. To account for the binding facts they assume that binding relations are established over semantic representations, and that quantifiers can bind into semantically subordinate clauses. We reject their arguments that *and* involves a coordinate structure. But in any case it should be noted that they simply stipulate that *and* can get mapped to a conditional meaning, and thus don't engage with the central aim of this paper.

to support the *opposite* conclusion. Their first argument is the simple observation that, normally, subordinate clauses in English are introduced by a connective that appears to their *left* rather than their *right*: {*If/when/after*} *John leaves,...* But on our view, the fact that non-truth-tabular *and* appears to the right of α is straightforwardly explained, by the fact that it is derived from its truth-tabular (coordinate) counterpart.

Their second argument is based on a claim that extraction from non-truth-tabular conjunctions patterns against subordinate structures, e.g. ones that provide an explicit paraphrase.

(72) a. ?This is the loot that you just identify t and we arrest the thief on the spot. (left conjunct extraction)
b. ?This is the thief that you just identify the loot and we arrest t on the spot. (right conjunct extraction) [their (29a-b)]

(73) a. ??This is the loot that if you identify t(,) we will arrest the thief on the spot.
b. ??This is the senator that when the Mafia pressured t(,) the senate voted for health care reform. [their (31a-b)]

As indicated by the extra '?', extraction from the two clauses of 'if' conditionals is alleged to be more difficult. We find the data somewhat dubious, and in any event the argument to be weak. Furthermore, as Culicover and Jackendoff themselves note, non-truth-tabular *and* behaves very *unlike* a coordinate structure with respect to extraction. For one, 'left' and 'right' conjunct extraction from overt coordinate structures is *clearly* degraded.

(74) a. *This is the senator that I voted for t and Terry met Bill Clinton in Washington. (left conjunct extraction)
b. *This is the senator that I voted for Bill Clinton and Terry met t in Washington. (right conjunct extraction) [their (27b-c)]

Thus it seems to us that the acceptability of extraction from α and β in non-truth-tabular conjunctions is much closer to what we find in subordinate structures than what we find in coordinate ones. This would seem to provide support for the lexical ambiguity variant of our proposal, since it would be somewhat surprising if the syntactic structure of a sentence containing *and* could be (in effect)

determined by an operation on semantic derivations.

Turning to the case of disjunction, we again find that certain non-truth-tabular disjunctions pattern against normal (coordinative) ones with respect to possibilities for extraction. It is never possible to extract from one disjunct in the truth-tabular case, but it is sometimes possible to extract from α in the non-truth-tabular case:

(75) *What did John clean t or he hired a maid. [extraction from normal disjunction]
cf. 'John cleaned his room, or he hired a maid.'

(76) a. John must clean his room or he'll get in trouble.
b. What must John clean t or he'll get in trouble? [extraction from α]
c. What must John clean t if he doesn't want to get in trouble? [extraction from main clause]

This strongly suggests a syntactic difference between non-truth-tabular uses and their truth-tabular counterparts. Just what the structure is in the former case, we leave open.[33]

5.2 Deriving All Uses of Connectives from Dynamic Effects

In this section we consider an interesting variant of our basic proposal. In particular, suppose that the meaning of *and* and *or* simply consisted of its dynamic effects, and we could freely alter whether or not the first clause was asserted or not. Then the table of possible readings we would get for *and* and *or* would be this:

[33]The fact that extraction from β in examples like (76) seems severely degraded, may provide some relevant clues.

(i) a. ??What must John finish his dinner or he'll have to do t [extraction from β]
cf. 'John must finish his dinner, or he'll have to go to bed early'
cf. also ??What will John have to go bed early if he doesn't do t? [extraction from subordinate clause]

connective	use type	assertive content
and	subordinate	$[\![\alpha]\!]^{c,s,w}$ and $[\![\beta]\!]^{c,s_\alpha,w}$
and	information parameter change	$[\![\beta]\!]^{c,s_\alpha,w}$
or	subordinate	$[\![\alpha]\!]^{c,s,w}$ and $[\![\beta]\!]^{c,s_{\neg\alpha},w}$
or	information parameter change	$[\![\beta]\!]^{c,s_{\neg\alpha},w}$

The and-subordinate reading seems just like normal conjunction, while the or-information parameter reading is equivalent to "if not α then β" which is at least close in meaning to normal disjunction. So you might think that we could posit that the only *encoded* meanings of *and* and *or* are their dynamic effects. In essence – though in a different framework – this is the proposal of an unpublished squib by Michael Solomon.[34]

There is a great theoretical appeal to this account: it is clever and elegant. However, we think it suffers from both theoretical and empirical deficits, so we reject it:

Missing Explanation of Dynamic Effects: First of all, this account seems to sacrifice any explanation of why the dynamic effects of *and* and *or* take the form they do. There are a variety of recent explanations of the dynamic effects with regard to presupposition projection of different connectives (e.g. Schlenker, 2006, 2008; Chemla, 2008; George, 2007; Fox, 2008; Rothschild, 2011). All these accounts explain the dynamic meaning based on the truth-conditional meanings, something which we cannot do if we have to stipulate the dynamic meaning.

Priority of Truth-Tabular Uses: It is clear that the truth-tabular uses are the more frequent and less marked than the non-truth-tabular uses. The non-truth-tabular uses are harder to get immediately and are reported to be even more difficult in other languages, e.g. Hungarian. The obvious explanation of this is that the truth-tabular uses are prior, and the non-truth-tabular uses are parasitic upon them.[35]

[34]See footnote 24. It was also independently suggested to us by Richard Breheney and Philippe Schlenker.

[35]The origins of disjunction are well-known in certain languages, and what is known may be relevant to our claims here. The main claim of interest is a standard origin for a disjunctive connective is from something including negation, in some cases something meaning "and if not". Davies (1975, p. 165) notes that this is the case for garden variety contemporary Arabic disjunc-

Syntactic Differences: We have pointed out various syntactic differences between the truth-tabular and non-truth-tabular uses. We think this can be explained by the fact that the non-truth-tabular uses figure in different syntactic frames then the truth-tabular uses, the latter appear in what are traditionally called coordinative structures, while the former do not (we leave open what they do appear in). We can only help ourselves to this strategy for explaining the syntactic differences if we posit some kind of basic difference between the two uses. The unified analysis does not allow this.

We think these are strong considerations against the unified analysis.

6 Analysis and issues

Having presented our basic analysis of non-truth-tabular uses, we turn to a discussion of how our proposal can account for some of the peculiarities. We begin by discussing some of the different grammatical forms that non-truth-tabular constructions can have in §6.1. We move on to discuss some more general empirical and theoretical issues in §6.2–§6.4.

6.1 Different Forms

Adverbs of quantification

An issue we have so far put off is how to treat adverbs of quantifications that appear in non-truth-tabular conjunctions and disjunctions. Adverbs of quantification seem to be affected in the same way modals are when they appear under non-truth-tabular conjunction or disjunction. Here are a couple of examples:

(77) a. I eat light lunches, or usually I need a nap afterwards.

tion, *walla*, which comes from *wa 'in lā* "and if not". This suggests that the *opposite* transformation to the one we propose for disjunction has come about, historically.

This might seem to challenge our claim that the truth-tabular meaning for disjunction is more basic than the non-truth-tabular meaning (which might well be paraphrased "and if not"). However this is to confuse diachronic priority with synchronic priority. Once an item has become a proper disjunction, the "and if not" reading needs to be derived from that disjunction, and we provide a route to do so. The slight markedness of these uses indicates that they require some effort and are not simple lexically encoded into the meaning of *or*. That the *opposite* route has been travelled historically provides, if anything, evidence that the leap we suggest is quite a natural one.

b. I eat light lunches, or I must nap after.

(78) a. I eat a heavy lunch, and usually I need to nap afterwards.

b. I eat a heavy lunch, and I have to nap after.

In both cases, it appears that the adverb of quantification in the second clause is restricted by the information parameter change associated with the first clause and the connective. In order to treat these cases within the framework provided we need to explain how a shift of the information parameter can affect the interpretation of an adverb of quantification.

We are not alone in facing this challenge. Indicative conditionals are also known to shift the interpretation of adverbs of quantification, such as in example (79):

(79) If it's spring, Jack usually sneezes a lot.

Anyone, who like Yalcin (2007) treats the antecedents of conditionals as information parameter shifters needs to explain how such shifting affects the interpretation of adverbs of quantification.[36] As far as we know, none of the contemporary literature suggesting something like the information parameter account of conditionals, such as the original dynamic version in Gillies (2004) or Yalcin's static version, account for the capacity of antecedents of conditionals to restrict adverbs of quantification (see Khoo, 2011, for discussion).

We will describe one way of allowing an information parameter shift to affect the interpretation of an adverb of quantification. Such an account will show both how our semantics for non-truth tabular conjunctions and disjunctions can handle examples with adverbs of quantification like those in (77-a) and (78-a) and how a semantics for conditionals along the lines of Yalcin's can handle examples like (79).

Up till now we represented the information parameter as merely a set of possible worlds. If we do this there is no obvious way of showing how a shift in the information parameter can affect the domain of an adverb of quantification: For

[36]Of course there is another school of thought on conditionals and adverbs of quantification designed to handle examples like (79) directly: On the account due to Lewis (1975), the function of the if-clause here is just to restrict the domain of the adverb of quantification. Kratzer expands this by suggesting that conditionals generally restrict quantifiers, whether adverbs of quantification or modal operators. Thus, the generic "restrictor" account of conditionals easily handles the capacity of antecedents to restrict both adverbs of quantification and modals.

adverbs of quantification quantify over *parts* of the actual world and thus merely restricting the set of possible worlds compatible with one's knowledge cannot directly lead to a restriction on an adverb of quantification.

The first move we need to make, then, if we are to relate shifts in the information parameter to restriction of adverbs of quantification is to make the basic units of the information parameter more fine-grained. In fact, this is independently motivated by considerations about de se belief. For example, someone totally knowledgeable about the state of the world, but who lacks belief about where she is cannot be easily modeled on an account where the information parameter consists of a set of entire worlds.[37] For example she might say:

(80) I might not be in America.

This should be possibly true even if she is, in fact, in America and she has no relevant confusion about what the state of the actual world is. All she lacks is a *self-locating belief* about where she is.

There are various options for modeling this form of uncertainty about one's own location using an information parameter. To choose one that will be most be convenient for us, we will treat the information parameter as a set of pairs of worlds and situations in them, so a set of pairs (w, e) where w is a world and e is a situation in w.[38] To be concrete we can just take situations to be parts of the worlds they are in. We will make sentences true not just with respect to worlds but also with respect to situations e. We, then, assume that certain updates of the information parameter go by way not just of reducing worlds, but also affecting the situation parameter. Take, for example, (79), where the antecedent is *it's spring*. We interpret this as updating the information parameter as follows:

(81) $s_{\text{it's spring}} = \{(w, e) \in s : \text{ it is spring in } e\}$

So, we now have associated with an update of the information parameter, not just a set of possible worlds, but also, corresponding to each such world, various situations that are ruled in or out. We can now model sentences like (80) by suggesting that what is not resolved by the speaker's knowledge is what the value

[37] See, for instance, Lewis (1979) and Stalnaker (1981), for discussion of such cases.

[38] We could just have sets of situations since they have all the information necessary in them, but it makes some things clearer to keep these separate.

of e is for the information parameter, even if w is certain.

This treatment of the *de se* leaves us with the resources to explain the restriction of adverb of quantification by conditionals and constructions with non-truth-tabular connectives. All we need to posit is that pragmatically or semantically adverbs of quantification *pick up* the restriction of the information parameter. To return to (79), here the information parameter with respect to which the consequent, *usually John sneezes* is evaluated is only can include pairs of worlds and situations in which it is spring in the situation.[39] Of course, unlike epistemic modals, we think of adverbs of quantification as only quantifying over real world cases. Here, for instance, is a lexical entry for *usually* that quantifies only over situations in the world of evaluation:

(82) $[\![\text{Usually } \alpha]\!]^{c,s,(w,e)}$ is true iff for most pairs $(e', w) \in s$, $[\![\alpha]\!]^{c,s,(w,e')}$ is true.

We will also assume the following meaning for *John sneezes a lot*, which is sensitive to the situation parameter.

(83) $[\![\text{John sneezes a lot}]\!]^{c,s,(w,e)}$ is true iff John sneezes a lot in (w, e).

Putting all these together, we get what seems like the right semantics for (79). This style of treatment will also extend to non-truth-tabular connectives in cases like (77-a) and (78-a) since on our account non-truth-tabular connectives cause shifts in the information parameter. Of course, this is just a sketch and many non-trivial details need to be ironed out, but we hope the basic approach is clear.

In sum, antecedents and non-truth tabular connectives shift the information parameter which contains both information about the topic situation and the relevant possible worlds. While epistemic modals quantify across possible worlds (and potentially situations too) in the information parameter, adverbs of quantification quantify only across situations in the information parameter that are in the world of evaluation.

[39]Note that we take the value of e, the situation part of the information parameter to represent something more like what the topic of conversation is about, rather than always simply being the situation of the speech-act situation. It just happens that in classic *de se* examples the topic of conversation *is* where the speaker is.

Counterfactual Morphology

As noted in §1, non-truth tabular conjunctions and disjunctions differ with respect to the tense/mood forms that can appear in them. In a non-truth tabular conjunction β can be a simple indicative clause though sometimes the relevant interpretation is hard to access. We discussed these types of cases in §5. In non-truth-tabular disjunctions, on the other hand, β must take the form that would appear in the consequent of a counterfactual conditional:[40]

(84) John's car is broken down, or he would/*will drive us to the country.

In §4.2 we endorsed the idea that *would* is a necessity modal with counterfactual morphology, and that the morphology is appropriate only if it is evaluated against an information parameter whose inner sphere is empty. As we argued in §5, since *John's car is broken down* is asserted, the information parameter s (for (84) as a whole) must contain no worlds (in the inner sphere, s_{in}) in which John's car is not broken down. This mean that when the second disjunct is evaluated under the shifted information parameter, $s_{\neg\alpha}$, its inner sphere $s_{\neg\alpha_{\text{in}}}$ must be empty. In this case, counterfactual morphology in the second disjunct is required.

NPI licensing

As noted in §1 NPIs can appear in α in non-truth-tabular conjunctions but not non-truth-tabular disjunctions (examples (16)-(17)). This follows straightforwardly on our account given more general facts about NPI licensing and standard assumptions about what explain them. Under our semantics α in the conjunctive case is effectively the antecedent of a conditional, and NPIs are licensed in the antecedents of conditionals. In the disjunctive case, since α is asserted 'downward entailments' in α are not necessarily valid.

Imperatives

That α can be an imperative in a non-truth-tabular disjunction, as in (5) or (85) below, is, we believe, compatible with our analysis.

[40]Provided that β is being asserted conditionally on the negation of α itself, rather than the negation of a *sub-clause* of α as in (70); see below for a discussion of the latter type of case

(85) Give me your money, or I'll shoot you.

On the *or*-double entailment use type, the two clauses are essentially treated as if they are separate utterances (made relative to the specified information parameters), rather than embedded under a normal conjunction; see footnote 27 for discussion. Thus, the fact that imperatives are, presumably, non-truth-conditional is not an obstacle to treating (85) as a case of *or*-double entailment.[41]

The situation regarding imperatives in conjunctions like (6) or the following, is more complicated, as the imperative does not seem to have its usual meaning.

(86) Turn the key like this and the door will be locked.

Since the latter kind of example has been discussed relatively extensively in the recent literature (Han (2000); Schwager (2006); Russell (2007)), we will review that literature before considering our own proposal. Our goal here is not specifically to argue against any of the recent proposals, since as we point out below, they are not in direct competition with our own, being limited in scope to (certain) conjunctions with imperatives. Rather, the discussion serves to point up some empirical issues that bear on whether our own framework can cover the same data.[42]

Within the literature a distinction is often made between conjunctions that (putatively) directly convey α with imperative force, and those that do not. Consider:

(87) a. Eat this apple and you will be healthy.
$\approx$ Eat this apple. If you do you will be healthy.
b. Eat this poison and you will die.
$\approx$ If you eat this poison, you will die.

[41] To derive (85) as a case of *or*-double entailment does seem to require associating a truth-condition/proposition with the imperative clause, to provide the required information parameter update for the second clause. In particular the latter should be evaluated with respect to worlds in the information parameter in which the addressee does not give the speaker his money. We believe that this is a case of updating the information parameter with a *sub-clause* of the first disjunct – in particular, one which does not contain the material responsible for the imperative force. This general possibility is independently attested, as noted in (69) and (70) and discussed below.

[42] See von Fintel and Iatridou (2009) for a critical review of the recent literature on imperatives in conjunctions.

Schwager and Russell argue that in (87-a) α is a true imperative, morphologically and semantically, while in (87-b) it is simply a bare clause, homophonous with a true imperative. They treat the true imperative cases as involving a variant of *and* with a special speech act interpretation, essentially indicating that two acts are being performed. Thus (87-a) is treated as equivalent to sequential utterances of the two conjuncts, just as in the given paraphrase. To account for its conditionalization, the second conjunct is assumed to be interpreted as *modally subordinate* (Roberts, 1989) to the first.[43]

Schwager and Russell's line of analysis does provide some principled explanation for why *and* can appear to have a conditional meaning in cases like (87-a) – at least, in so far as their appeals to modal subordination, and the notion of a conjunction *of speech acts*, can be motivated. However the explanatory power is very limited; their anaylsis fails to generalize to cases such as (1), in which α is not in imperative form and is certainly not asserted.[44] Similarly for (87-b), which does not convey its first conjunct imperatively. While Schwager does propose a different analysis for (87-b), it is not obvious that it could be extended to examples like (1).

Like Schwager and Russell, Clark (1993) maintains that in cases like (87-a) α is a true imperative. However, he also tries to maintain the idea that *and* has its normal, truth-tabular meaning. To this end he proposes that imperatives (can) have essentially declarative meanings; for example, *Eat this apple* is assumed capable of expressing (roughly) the proposition that it is *desirable* to eat the apple. (He too assumes something like modal subordination to be responsible for the conditionalization of β.) Whether or not this view of imperatives is plausible, we would point out that, like Schwager and Russell, Clark's view leaves unexplained cases like (1). And while he does discuss many interesting examples of non-truth-tabular disjunctions, he simply stipulates an ambiguity to account for them.

[43]The details of (the theory of) modal subordination aren't important to appreciate Schwager and Russell's proposals, so we will not give them here. It suffices to observe that Schwager and Russell effectively assimilate (87-a) to the sequence *Eat this apple. You will be healthy.*, and that as a matter of empirical fact the second assertion of the latter is understood as conditional on the addressee eating the apple.

[44]Nor is it obvious how it would apply to disjunctive examples like (5) in which α is an imperative, as it is unclear what a disjunctive speech act would amount to.

Still, even on our own approach, it does not seem to be straightforward to treat (87-a) and (1) uniformly, with the former also being a case of *and* - information-parameter change. At least not under the assumption that (87-a) contains a true imperative, given commonplace assumptions about the semantics of imperatives. There are two ostensible problems. First, imperatives seem not to be of an appropriate semantic type to modify the information parameter for β. (While adopting Clark's alternative assumptions about imperative meanings alleviates that problem, it would not help us derive the *correct* interpretation for (87-a)). Second, even if they are it is not obvious that our account would predict α to be conveyed with imperative force.

On the other hand, Han (2000) explicitly argues that even (87-a) involves a fake imperative – a clause in imperative form, but which has roughly a normal declarative meaning, just as Schwager and Russell assume for the (87-b). If this is correct, the only thing in the way of treating (87-a) and (87-b) as involving *and* - information-parameter change, is the "imperative force" in (87-a). But this can plausibly be explained away as an inference, as Han and von Fintel and Iatridou (2009) point out. It seems that to the extent that an imperative to eat the apple is conveyed by (87-a), so is it conveyed by the simple *conditional* sentence *If you eat this apple, you will be healthy*. And the two would be entirely equivalent on our analysis, given that the former involves *and*-information-parameter and a fake imperative.

von Fintel and Iatridou (2009), however, also point out that (morphological) imperatives appear in examples like (87-a) across historically and typologically distinct languages (Modern Greek, German, and Korean are cited). It seems that a good theory should address this fact, and it may seem implausible that unrelated languages should happen to use the imperative form vacuously to express a declarative meaning. Thus their observation might cast doubt on Han's claim.

Still, von Fintel and Iatridou argue for a theory that treats *and* in (87-a) and (87-b) as having essentially a conditional meaning, much as our *and*-information-parameter does. (They do not concern themselves with our question, that of *why* it should have this meaning). Thus, from their perspective, the problem of treating (87-a) and (87-b) as cases of *and*-information-parameter, may simply be a deficiency in our current theoretical understanding of the semantics of imperatives. Alleviating this deficiency could potentially explain the cross-linguistic facts. Thus the possibility seems to remain for a unified treatment

of non-truth-tabular conjunctions with imperatives as cases of *and*-information-parameter-change.[45]

Evaluating β with respect to sub-clauses of α

In §5 it was observed that there are non-truth-tabular disjunctions on which β is asserted conditionally on the negation of a *clause embedded in* α, rather than the negation of α itself. (e.g. (69)). Here are some further, relevant examples:

(88) John must pay alimony, or he will be arrested.
$\approx$ John must pay alimony. If **John does** not **pay alimony**, he will be arrested.

(89) I want you to leave, or I will call the police.
$\approx$ I want you to leave. If **you do** not **leave**, I will call the police.

(90) John must pay alimony on time, or he (generally, usually) gets a threatening call from his ex-wife.

The account presented in §5 can be made compatible with such examples, by adding an assumption that β can optionally be evaluated with respect to $s_{\alpha'}$, where α' is a sub-clause of α. This need not be stipulated as a special option for non-truth-tabular disjunctions, but may be assumed to also be available in principle for non-truth tabular conjunctions, that is, information-parameter change uses of *and*. Though cases where α *and* β means *if* α' *then* β seem to be unattested, there is a plausible independent explanation for this. Interpreting β under $s_{\alpha'}$ (α' a sub-clause of α) would render some of the words in α completely idle

[45]It is worth noting that our general framework makes available another potential way to handle (87-a) while maintaining the assumption that it contains a true imperative with its usual force. In §5 we noted that our basic explanation for the existence of non-truth-tabular cases (qua cases of *and*-information-parameter) suggests another possible use, one which comes very close to normal (dynamic) conjunction. This is the use type we called *and*-subordinate. What distinguishes it from normal conjunction is that α and β are not really coordinates embedded under a truth-functional operator. Rather, they are separate clauses (with the first updating the information parameter to the second); uttering α *and* β on this use type amounts to something like uttering α, and then uttering β. One need only observe, then, that *Eat this apple. You will be healthy.* is a good paraphrase of (87-a), to see that it might profitably be handled as a case of *and*-subordinate. (87-b) would still need to be treated as a case of *and*-information parameter, since its first conjunct is not conveyed imperatively. Thus this option is particularly appealing if, like Schwager and Russell we want to distinguish between true and fake imperatives in conjunctions.

semantically.[46]

It must be noted that there are constraints on when α' can be used instead of α that we have no explanation for.

(91) John may go home early, or his boss will give him a reward.
$\neq$John may go home early. If he doesn't, his boss will give him a reward.

6.2 Entailment of α and Stump's Generalization

One of the most perplexing aspects of non-truth-tabular conjunction examples, is their limited distribution. In many cases, it is extremely hard to read conjunctions as having a conditional meaning, even though the corresponding conditional is easily comprehended. These examples illustrate how difficult it is to get the non-truth-tabular readings in some cases.

(92) John goes to the barber, and he tips a lot.
$\approx$ If John goes to the barber, he tips a lot.

(93) John went to the barber, and he tipped a lot yesterday.
$^{?}\approx$ If John went to the barber, he tipped a lot yesterday.

(94) John is generous, and he tips a lot.
$^{?}\approx$ If John is generous, then he tips a lot.

While both (93) and (94) can with effort get non-truth-tabular interpretations, these readings are not as easily available as they are either for (92) or for the explicit conditionals below them. The semantic operations and/or semantic ambiguities we posit in this paper do not predict this difference between (92) and (93) and (94).[47]

[46] An interesting exception to this generalization is a type of example discussed in von Fintel and Iatridou 2007:

(i) You only have to go to the North End and you will get good cheese.

This seems not to mean "If you only have to go to the North End, you will get good cheese", but rather "if you go to the North End, you will get good cheese", with a suggestion that that the North End is not a far away or difficult place to have to go to. Note here, however, that it seems like the "only have to" is doing some sort of semantic or pragmatic work, so that our explanation for the absence of these cases would not apply, though we also have no analysis of these cases.

[47] We do predict that non-truth-tabular uses are less natural than truth-tabular uses, but not the differences between these different examples.

However, we do have some resources that point the way towards an explanation, or at least place this problem within a wider context. Recall that on our view, the non-truth tabular readings arise because *and* ceases to act as a connective and only retains its dynamic effect. In this case we suggest, entailment is a natural option for the interpretation of the first clause. Part of our support for this idea came from other types of cases where two clauses are connected without any apparent operator governing them both. One prominent example is free adjuncts and free absolutes. Stump (1981, 1985) notes that sometimes these constructions can act as conditional-like restrictors whereas sometimes they are entailed when they combine with modal expressions in the main clause. Thus, they exhibit the same ambiguity that conjunctions exhibit.

Here are examples of free adjunct and free absolutes with both types of readings.

(95) a. Shooting vodka, John throws up.
b. Being a teetotaler, John throws up.

(96) a. John being away, Mary would steal the files without him noticing.
b. John being stupid, Mary would steal the files without him noticing.

Both (95-a) and (96-a) have conditional readings available, in addition to conjunctive readings (i.e. readings in which the free adjunct or absolute is entailed). By contrast (95-b) and (96-b) only seem to have conjunctive readings. Stump proposed that only free adjuncts or absolutes with stage-level predicates, such as those in (95-a) and (96-a), allow conditional interpretations (this is what is known as Stump's generalization).

We note that a similar sort of generalization seems to characterize non-truth-tabular conjunctions. As in Stump's generalization, individual-level predicates in the first conjunct tend not to allow non-truth-tabular (conditional) readings, as in (94) and these examples:

(97) Mary speaks Russian, and the Agency must be pleased.
$^{?}\approx$ If Mary speaks Russian, the Agency must be pleased.

(98) Bill is tall, and he will get elected.
$^{?}\approx$ If Bill is tall, he will get elected.

In addition, we might relate the difficulty of finding non-truth-tabular readings in past tense conjunctions, such as (93), to similar effects with free adjuncts and free absolutes: past tense examples of free adjuncts do not seem to allow conditional readings, even if the predicates in the adjunct is stage-level. Here is one such example where a conditional reading seems impossible despite a stage level free adjunct.

(99) Going to the barber, John tipped a lot yesterday.

So, the difficulty of getting non-truth-tabular readings in conditionals parallels the availability of conditional readings in free adjuncts and free absolutes.[48]

We do not have an explanation of Stump's generalization. What does seem plausible is that there is some general constraint – covering both free adjuncts and absolutes and our non-truth-tabular conditionals – about how ungoverned clauses manage *not* to be entailed. This constraint would supplement our account, providing an explanation of the limited distribution of non-truth-tabular conjunctions.

6.3 Related expressions

We effectively posit a lexical ambiguity for *or* and *and*: there are the normal uses as connectives and then there are the special uses where only the dynamic effect is present. We should expect that there are other lexical items that have the special function of *and* or *or* without also acting as regular truth-functional connectives.

That these exist is obvious in the case of *and*. Non-truth-tabular *and* acts, with the first conjunct, as a restrictor of modals and adverbs of quantification. Of course, *if* and *when* also seem to serve this function.

Our treatment of *or* was slightly more complicated. Non-truth-tabular *or* introduces a subordinate clause whose modal force is restricted by the negation of the main clause or a sub-clause of it. This is exactly what *otherwise* does.

[48] In all cases, conditional readings are possible with the past tense when the sentences are understood generically.

(i) a. Going to the barber, John tipped a lot (in the good old days).
b. (In the good old days days) John went to the barber, and he tipped a lot.

(100) Bill is in Tahiti, otherwise, we would have seen his car.

(101) Bill must be in Tahiti, otherwise, we would have seen his car.

(102) Do the dishes, otherwise, you'll get in trouble.

In French, there is an even cleaner paradigm. The non-truth-tabular uses of *and* and *or* correspond to *si* (= *if*) and *sinon* (= *otherwise*, morphologically a combination *si* and *non* = *not*), respectively.

(103) Emmanuel doit être à Paris, sinon on aurait vu sa voiture.
Emmanuel must be in Paris, *sinon* one would have seen his car.
'Emmanuel must be in Paris, otherwise we would have seen his car.'

The French paradigm is nice because it seems that there is one parameter shifting morpheme *si* and that it comes in two forms: the simple form and a complex form (*sinon*) where the shifting is with the negation of some material that comes before. Of course, *si*, like the English *if*, comes before the restricting information, whereas *sinon* comes after it. It seems to us that *sinon*, like *otherwise* and non-truth-tabular *or* does not combine with the restricting material directly, but rather picks up the restriction in some way from previous material. This comports with the fact that in uses of these expressions, the material that comes before *sinon*, *otherwise*, or non-truth-tabular *or* is separately asserted, whereas the material in the antecedents of conditionals or in the first clause of non-truth-tabular *and* is not separately asserted. Since there is no separate assertion in these latter cases, any material not picked up as a restriction on the information parameter would be entirely idle, which would be pragmatically very odd.

6.4 Order, Modal Interpretation, and Presupposition Projection

We noted in §1 that we cannot felicitously reverse the order of the conjuncts or disjuncts in non-truth-tabular uses. So, for instance, for disjunction:

(104) John's car would be here, or he must be in Tahiti.
$\neq$ John must be in Tahiti, or his car would be here.

Our account directly predicts this as the dynamic effects of the connectives are, in our account, asymmetric.[49]

This also fits in with an asymmetry in the interpretation of modals in truth-tabular uses of disjunction. For example the following two sentences do not seem equivalent to us:

(105) a. John is probably in China, or he's Singapore.
b. John is in Singapore, or he's probably in China.

The first entails that he is probably in China, but the second does not. So this asymmetry in the dynamic effects of modals in truth-tabular disjunctions seems to carry over to non-truth-tabular cases, as we would expect.

However, as we mentioned in §3.1, presupposition projection is not clearly affected by order (Schlenker, 2008, 2009; Rothschild, 2008). So, for instance, these two sentences seem to fail equally to trigger any global presuppositions:

(106) a. Ted didn't used to smoke much, or he has stopped smoking.
b. Ted has stopped smoking, or he didn't use to smoke much.

There are two ways to explain this: 1) posit two separate systems for presupposition projection and modal interpretation, 2) keep one system but allow "backtracking" switches in the information parameter only as a way of rescuing presuppositions, not as a means of affecting modal interpretation.

6.5 Free Choice

The phenomenon of free-choice permission bears an obvious relationship to non-truth-tabular disjunction, for it involves disjunction giving rise to (an unexpected) conjunctive interpretation.

(107) You may eat an apple or an orange.
→ You may eat an apple and you may eat an orange.

It might seem attractive, for this reason, to try to account for such cases as instances of non-truth-tabular disjunction. We do not think this is very plausible

[49] To see this just look at the semantic entries for truth-tabular conjunction and disjunction in §4.

though. One reason is that the disjunction in (107) appears to be an instance of NP coordination, and non-truth-tabular *or* is not generally possible with such structures. In addition, there are already plausible Gricean accounts of the free-choice inferences available (e.g., Fox, 2006; Klinedinst, 2007). More generally, Fox (2006) argues that in examples like (107), *or* scopes below the modal, and as such it does not seem that positing it to be the non-truth-tabular variant of *or* is enough to explain the free choice interpretation. For, then we would have (107) amounting to a claim that the following proposition is permissible: *You eat an apple, and if you don't eat an apple, you eat an orange*, but the permissibility of that proposition does not straightforwardly entail the permissibility of (you) eating an orange.

However, as Zimmerman (2000) and Geurts (2005) note, a conjunctive or free-choice meaning can still arise when *or* has (apparent) wide scope:

(108) You may eat an apple, or you may eat an orange.
$\rightarrow$ You may eat an apple and you may eat an orange.

This type of case, we believe, could be amenable to treatment as a non-truth-tabular disjunction, in which case it would have the truth conditions, *You may eat an apple, and, if you do not eat an apple, you may eat an orange.* This seems like a fairly accurate summary of the relevant interpretation of (108). So, while non-truth-tabular disjunction may not account for free-choice generally, it might account for some varieties of it, such as in (108). And it is worth noting that the latter variety has proved particularly problematic for accounts in the literature.[50]

7 Conclusion

As the last section made clear there a number of outstanding issues with the constructions we discuss here. We hope, however, to have provided a plausible,

[50]For example, the accounts of Fox (2006) and Klinedinst (2007) fail to generalize to cases like (108). And while Zimmerman (2000) and Geurts (2005) do offer an account of the latter, it proves to be empirically inadequate. Geurts idea, which expands on Zimmerman's, is that *or* simply means *and*, and that *or* always coordinates modal clauses (see also Dever, 2010). Where no modals are present Geurts posits covert epistemic modals; thus 'It is cold or it is raining' is analyzed as 'It might be cold, and it might be raining'. While the analysis may be plausible for (108), for its negation, and in many other cases of embedding, the analysis yields truth conditions that are far too weak – as both authors acknowledge themselves. Of course, we are sympathetic to Zimmerman and Geurts on the idea that *or* sometimes gets a conjunctive interpretation. But, crucially, we do not think this is the only interpretation *or* can have.

unified framework for thinking about the non-truth-tabular constructions. Although these constructions have been much discussed, our account is the first that systematically relates non-truth-tabular disjunction and conjunctions while trying to explain the relation between these constructions and their truth-tabular cousins.

References

(September 2010). *OED Online*. Oxford University Press.

Beaver, David (2001). *Presupposition and Assertion in Dynamic Semantics*. CSLI.

van Benthem, Johan (1989). Semantic parallells in natural language and computation. In *Logic Colloquium '87*. Elsevier.

Bolinger, Dwight (1967). The imperative in English. In *To Honor Roman Jakobson*. Mouton.

Chemla, Emmanuel (2008). Similarity: Towards a unified account of scalar implicatures, free choice permission and presupposition projection. Unpublished manuscript, ENS.

Clark, Billy (1993). Relevance and "pseudo-imperatives". *Linguistics and Philosophy*, 16(79-121).

Culicover, Peter and Jackendoff, Ray (1997). Semantic subordination despite syntactic coordination. *Linguistic Inquiry*, 28(2):195–217.

Culicover, P.W. (1972). Om-sentences: On the derivation of sentences with systematically unspecifiable interpretations. *Foundations of Language*, 8:199–236.

Davies, Anna Morpurgo (1975). Negation and disjunction in Anatolian—and elsewhere. *Anatolian Studies*, 25:157–168.

Dever, Josh (2010). Must or might. Manuscript.

von Fintel, Kai (2001). Countefactuals in a dynamic context. In Michael Kentstowicz (ed.), *Ken Hale: a life in language*. MIT Press.

von Fintel, Kai and Gillies, Anthony (2011). *Might* made right. In Andy Egan and Brian Weatherson (eds.), *Epistemic Modality*. OUP.

von Fintel, Kai and Iatridou, Sabine (2007). Anatomy of a modal construction. *Linguistic Inquiry*, 38(3):445–483.

— (2009). LSA 2009 class notes: Covert modals. http://web.mit.edu/linguistics/people/faculty/iatridou/lsa_modals.pdf.

Fox, Danny (2006). Free choice and the theory of scalar implicatures. Unpublished manuscript.

— (2008). Two short notes on Schlenker's theory of presupposition projection. *Theoretical Linguistics*, 34:237–252.

George, Benjamin (2007). Predicting presupposition projection: some alternatives in the strong Kleene tradition. Manuscript, UCLA.

Geurts, Bart (1996). Local satisfaction guarenteed: A presupposition theory and its problems. *Lignuistics and Philosophy*, 19:259–294.

— (2005). Entertaining alternatives: Disjunctions as modals. *Natural Language Semantics*, 13:383–410.

Gillies, Anthony (2004). Epistemic conditionals and conditional epstemics. *Nous*, 38(4):585–616.

— (2007). Counterfactual scorekeeping. *Linguistics and Philosophy*, 30:329–360.

— (2010). Iffiness. *Semantics and Pragmatics*, 3(4):1–42.

Han, Chung-hye (2000). *The structure and interpretation of imperatives: mood and force in Universal Grammar*. Routledge.

Haspelmath, Martin (2004). Coordinating constructions: An overview. In Martin Haspelmath (ed.), *Coordinating constructions*, pages 3–39. Benjamins.

Heim, Irene (1982). *The Semantics of Definite and Indefinite Noun Phrases*. Ph.D. thesis, University of Massachusetts, Amherst.

— (1983). On the projection problem for presuppositions. In D. Flickinger and M. Wescoat (eds.), *WCCFL 2: Second Annual West Coast Conference on Formal Linguistics*, pages 114–125. Blackwell.

— (1990). Presupposition projection. In R. van der Sandt (ed.), *Reader for the Nijmegen Workshop on Presupposition, Lexical Meaning, and Discourse Processes*. University of Nijmegen.

Khoo, Justin (2011). Operators or restrictors? A reply to Gillies. *Semantics and Pragmatics*, 4(4):1–43.

Klinedinst, Nathan (2007). *Plurality and Possibility*. Ph.D. thesis, UCLA.

Kratzer, Angelica (1981). The notional category of modality. In H.-J Eikmeyer and H. Reiser (eds.), *Words, Worlds, and Contexts*, pages 38–74. Walter de Gruyter.

— (1986). Conditionals. *Chicago Linguistics Society*, 22(2):1–15.

Kratzer, Angelika (1989). An investigation of the lumps of thought. *Linguistics and Philosophy*, 12:607–653.

Lewis, David (1973). *Counterfactuals*. Harvard.

— (1975). Adverbs of quantification. In Edward L. Keenan (ed.), *Formal Semantics of Natural Language*. Cambridge University Press.

— (1979). Attitudes de dicto and de se. *Philosophical Review*, 88:513–543.

MacFarlane, John (forthcoming). Epistemic modals are assessment-sensitive. In B. Weatherson and A. Egan (eds.), *Epistemic Modals*. Oxford.

Moss, Sarah (forthcoming). On the pragmatics of counterfactuals. *Noûs*.

Roberts, Craige (1989). Modal subordination and pronominal anaphora in discourse. *Linguistics and Philosophy*, 12(6):683–721.

Rothschild, Daniel (2008). Presupposition projection and logical equivalence. *Philosophical Perspectives*, 22:473–497.

— (2011). Explaining presupposition projection with dynamic semantics. *Semantics and Pragmatics*, 4(3):1–43.

— (forthcoming). Do indicative conditionals express propositions? *Noûs*.

Russell, Ben (2007). Imperatives in conditional conjunction. *Natural Language Semantics*, 15(2):131–166.

Schlenker, Philippe (2006). Anti-dynamics: Presupposition projection without dynamic semantics. *Journal of Logic, Language, and Information*, 16:325–56.

— (2008). Be articulate: A pragmatic theory of presupposition projection. *Theoretical Linguistics*, 34:157–212.

— (2009). Local contexts. *Semantics and Pragmatics*, 2:1–78.

Schwager, Magda (2006). *Interpreting Imperatives*. Ph.D. thesis, University of Frankfurt.

Soames, Scott (1989). Presuppositions. In D. Gabbay and F. Guenther (eds.), *Handbook of Philosophical Logic*, volume IV, pages 553–616. Dordrecht.

Stalnaker, Robert (1968). A theory of conditionals. In N. Rescher (ed.), *Studies in Logical Theory*, pages 98–112. Oxford.

— (1974). Pragmatic presuppositions. In M. K. Munitz and D. K. Unger (eds.), *Semantics and Philosophy*, pages 197–213. NYU.

— (1975). Indicative conditionals. *Philosophia*, 5:269–286.

— (1981). Indexical belief. *Synthese*, 49:129–151.

Stump, Gregory T. (1981). *The Formal Semantics and Pragmatics of Free Adjuncts and Absolutes in English*. Ph.D. thesis, Ohio State University.

— (1985). *Semantic Variabiltiy of Absolute Constructions*. Reidel.

Veltman, Frank (1996). Defaults in update semantics. *Journal of Philosophical Logic*, 25:221–61.

Yalcin, Seth (2007). Epistemic modals. *Mind*, 116:983–1026.

Zimmerman, Thomas Ede (2000). Free choice disjunction and epistemic possibility. *Natural Language Semantics*, pages 255–290.