Being pragmatic about biscuits

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1 Introduction

Austin (1956) pointed out differences between what came to be known as *biscuit conditionals* (henceforth BCs) (1), and *hypothetical conditionals* (henceforth HCs), (2).[1]

(1) If you are hungry, there are biscuits on the sideboard. BC

(2) If you are hungry, I will make biscuits. HC

When comparing (1) and (2), the most prominent difference is that in BCs like (1) the truth of the consequent does not depend on the truth of the antecedent, i.e. upon the utterance of (1) we learn that there are biscuits on the sideboard regardless of whether the addressee is hungry. The speaker uttering (2), in the most prominent reading, may not make biscuits if the addressee is not hungry.

Standard analyses of indicative[2] HCs predict that in uttering an *if*-construction *if p*, *q* the consequent is only claimed to be true in the selected subset of worlds in the context set (in Stalnakerian terms) in which the antecedent is true across the board. However, upon the utterance of a BC we learn that the consequent is true. In particular, that it is true in all the worlds in the context set and not just in the selected antecedent worlds. We will call this the *global update puzzle* (GUP). The puzzle is how to derive that with an *if*-construction we learn that the consequent is true globally and not just in the selected antecedent worlds. This difference in behavior raises the question of whether the semantics of BCs is the same as the semantics of HCs.

In addition to explaining the GUP, a theory of BCs should also be able to explain inferences frequently arising with BCs (the 'inferences' puzzle). For example, given (1) we not only understand that there are biscuits on the sideboard, but also that the speaker is giving permission to the addressee to eat the biscuits (a *permission* inference). Another example is provided in (3):

(3) If they ask you how old you are, you are four. (Siegel 2006)

The age of the addressee does not depend on whether or not they[3] are asked, and (3) is considered a BC. The problem presented by this example is that the utterance of (3) is perfectly natural in a scenario in which the speaker is not committing to the truth of the addressee being four, but rather wants to convey a request for

[1] Austin's (1956) original example was similar to (1) but with a final *if*-clause: *There are biscuits on the sideboard, if you want them*.

[2] In this paper we do not address subjunctive biscuit conditionals (see, e.g., Swanson 2013; Romero and Csipak 2019). However, we are hopeful that the model presented here could be extended to subjunctives, and we include some pointers throughout the text regarding what would need to be done to do so.

[3] Through out this paper we make use of the gender unmarked singular *they*. See, e.g., *Dictionary.com* (`https://bit.ly/2FUu6nw`) for a non-specialist overview and, e.g., Konnelly and Cowper (2020) for a recent theoretical overivew on the matter.

the addressee to lie (a *request* inference). A theory of BCs has to explain such inferences as well as the fact that some BCs, like this one, don't trigger a global update (the speaker is not claiming that addressee is four, nor that they tell the ticket collector that they are four without being asked).

There are (roughly) two lines of research in BCs: a semantic approach that derives the differences between BCs and HCs by appealing to differences at LF or in the semantic make-up, and a pragmatic approach that tries to derive the differences between the two from pragmatics alone. Semantic (/syntactic) approaches are quite elaborate and are carefully carved out to derive (most of) the hallmarks of BCs we have mentioned so far. For the most part, semantic approaches propose that the consequent in the *if*-construction introduces a speech act on its own (see DeRose and Grandy 1999; Ebert et al. 2014; Krifka 2014, see also Siegel 2006 for a different take on semantic proposals). Pragmatic approaches, on the other hand, propose that the semantics of BCs and HCs is the same and derive their differences from pragmatic factors (see Franke 2007, 2009; Francez 2015; Lauer 2015; Sano and Hara 2014, a.o., see also Swanson 2017 for an alternative take within a pragmatic proposal).[4] This literature proposes accounts of the GUP within a logical system, but has not not fleshed out a full account of how to derive all the inferences triggered by (some) BCs.

In this paper we build on pragmatic theories to propose a pragmatic account of BCs. There are two main goals in this paper: (I) to provide a definition of BCs (and hence, to characterize the differences with HCs) based on conversation participants' shared world knowledge[5] of possible dependencies between antecedent and consequent, and (II) to show that differences between BCs and HCs, particularly with respect to associated inferences, are due to discourse effects (/pragmatic enrichment) and should not be encoded in the semantics. Regarding (I), we argue in §2 that an *if*-construction is understood as a BC when and only when participants presuppose that antecedent and consequent are independent. We aim to build on previous literature (in particular Franke 2007, 2009) to characterize a precise notion of independence that allow us to predict when *if*-constructions are interpreted as BCs. Our characterization of independence distinguishes between *factual* and *informational* independence. The difference between the two is exploited to both define BCs and to characterize their behaviour in a dynamic conversation setting. Global update is a by-product of independence, and in fact we adopt Franke's (2009) solution to the GUP, but our amendement also provides the notion of independence with predicitve power. We address (II) in §3, arguing that the particular inferences often associated with BCs are triggered discursively and should be separated from the semantics. We develop a dynamic Q(uestion) U(nder) D(iscussion) discourse model to show that the mapping beween BCs and discourse structure can account for the variety of inferences that the literature has noted are often associated with BCs, explaining a wide range of data without unnecessary BC-specific complications in the system. It is important to underline that independence, as characterized in §2, plays an important role in accounting for the inferences puzzle in §3, since it is independence that drives our intuitions regarding discourse relevance and ultimately leads to enrichment/ additional inferences. These inferences arise as a result of participants' (discourse) reasoning when trying to maintain relevance. The section offers a detailed overview of how questions and answers interact in a QUD-model and points to the discourse principles and information-structure constraints that guide conversation participants in the identification of the (often implicit) QUD. It offers a discussion of how *if*-constructions are mapped to discourse and spells out constraints on this mapping arising from independence that make BCs special. Once this mapping has been established and with an appropriate notion of independence in hand, the inferences often associated with BCs are shown to follow from general discourse principles. In §4 we offer a (brief) comparison with alternative accounts, with the goal of showing that proposals that make special assumptions about the syntax or semantics of BCs end up also appealing to pragmatic principles like the ones defended here, which we

[4] See Rawlins (2017) for an overview of the different proposals.

[5] The word *knowledge* in this paper stands for the participants' cognitive attitude, as is often used in the pragmatics literature. It concerns the assumptions about the world that are relevant for the interpretation of natural language utterances and that are taken to be mutually accepted. The word *knowledge* here is not to be contrasted with *belief* (as it is often found in the philosophy literature).

have argued are sufficient on their own to account for the intuitions surrounding BCs. In §5 we offer a few concluding remarks.

Before starting, let us provide an overview of the main theoretical points made in the paper as well as some details of how they are technically implemented. In order to achieve our goals, we assume a minimal semantics for *if*-constructions that is uniform across HCs and BCs. This semantics, to be cashed out in a dynamic framework in §2, builds on the quantificational intuition described above: an *if*-construction *if p, q* makes a (quantificational) claim about selected *p*-worlds, that they are *q*-worlds. Differences between HCs and BCs are derived along two dimensions: independence between antecedent and consequent (in §2) and mapping to discourse structure in a dynamic discourse model (in §3). One consequence of this view is that traditional ideas of 'conditionality' end up weakened. Given a uniform semantics for HCs and BCs, *if*-constructions do not directly encode the types of dependencies traditionally associated with causality, etc. Such intuitions arise only in relation to a subset of *if*-constructions and depend on the assumptions made by conversational participants regarding dependence relations between antecedent and consequent. The semantics of *if*-constructions simply involves (the dynamic implementation of) quantificational claims. Conditional interpretations arise when and only when both of the following conditions hold: (i) the interpreter doesn't believe that the consequent is true across the board at the time of the utterance (which is not as strong as saying that the addressee believes that the consequent is not true across the board, but includes these cases too) and is agnostic about other participants' beliefs or, else, it is common ground that the speaker doesn't believe that *q* is true across the board (i.e. it is common ground that either the speaker is agnostic or that they believe that *q* is not true across the board) and, (ii) we infer that there is a plausible dependence between antecedent and consequent. In the absence of a plausible dependence (as in BCs), a conditional meaning does not arise. In a nutshell, our proposal is that we can explain the difference in interpretation while maintaining the same conventional semantics with an appropriate characterization of independence (accounting for the GUP) and a dynamic discourse theory that explains enrichment on the basis of independently motivated principles (deriving the special inferences associated with BCs).

In order to model a notion of independence that makes the right prediction we make use of Veltman's (2005) system and build on Franke's (2009) solution to the GUP. Veltman's system allows us to easily represent participants' cognitive attitude about what is true as well as how propositions depend, or don't, on other propositions. The downside is that Veltman's (2005) system uses material implication to represent dependencies, leading to problems that we point out along the way. There are other alternatives to Veltman's (2005) system, e.g. Kratzer's (1989) lumping framework or frameworks in the causal models paradigm (see e.g. Schulz 2007; Dehghani et al. 2012; Kaufmann 2013; Starr 2014a; Snider and Bjorndahl 2015; Santorio 2019). These alternatives would also allow us to represent the necessary networks that we represent in Veltman's (2005) system and, at points in which Veltman's (2005) framework is problematic, would behave better. However, Veltman's system allows us to illustrate the core idea in a much simpler and more intuitive way and, even though the overall system may have shortcomings, it allows us to more easily bring the main point in this paper across: to explain how participants interpret *if*-constructions we need to not only encode what participants accept as true, but also their assumptions about how facts are interconnected.

In §3 we carefully lay out a discourse model that allows us to see how what we have learned in §2 regarding independence affects the dynamic update. The discusion builds on (similar) dynamic models and ideas in the literature that deal with far more complicated phenomena (see e.g. Bledin and Rawlins 2019). We greatly simplify the models and fine-tune them for our needs in this paper. We need enough level of detail to be able to show how inferences in *if*-constructions are generated, and explain that they can update the context regardless of whether the *if*-construction itself can be accepted. This will, for example, allow us

to explain cases like (3) in §4.3.

2 Presupposing factual independence: A model of information update

In the pragmatics literature, 'independence' between the antecedent and consequent has been claimed to be a contextual property of those *if*-constructions that are interpreted as BCs (Franke 2007, 2009; Francez 2015; Lauer 2015; Sano and Hara 2014). An *if*-construction like *if you are hungry, there are biscuits on the sideboard* is interpreted as a BC, and independence reflects that we assume that biscuits do not appear magically when one is hungry. This notion of independence is grounded on our assumptions regarding how the world actually works but independence as defined in Franke (2007, 2009) is not a sufficient condition to identify *if*-constructions as BCs. It is not designed to predict when *if*-constructions are interpreted as BCs, but rather to explain how we obtain consequent entailment (to explain the GUP) when they are interpreted as BCs, (e.g., to explain how we learn that there are biscuits on the sideboard from the example above). In this section we build on Franke (2007, 2009) to provide a formal notion of independence that can be considered a definitional property of BCs, one that makes predictions about when an *if*-construction can be interpreted as a BC (as opposed to an HC). An important ingredient in our proposal is the idea that to achieve an adequate predictive characterization of independence for BCs, it is necessary to establish a distinction between independence in terms of how the facts in a world relate to each other and independence in terms of how pieces of information are linked in an information state. Put more concretely, if an agent doesn't make any assumptions about whether two facts depend on each other with respect to the actual world, the respective pieces of information are independent relative to their information state, they are *informationally* independent (i.e. the information state does not 'model' a dependency). This is compatible with learning about a worldly dependence later on. Things are different if informational independence stems from the assumption that the facts in questions are *factually* independent with respect to the actual world (then the information state 'models' independence).

The structure of this section is as follows. In §2.1 we review Franke's notion of independence and spell out shortcomings that arise when we try to use it as a predictive notion in the interpretation of *if*-constructions. Franke's (2009) formal notion of independence, deployed as a guide to which conditionals are interpreted as BCs, does not make the right predictions because it pays attention only to what participants accept to be the case and looses track of our intuitions about what speakers accept to be possible/impossible dependencies. As we will see in §2.1, if we attempted to use Franke's notion of independence in a predictive manner, we would predict, for example, that all factual conditionals (*if*-constructions in which the antecedent is accepted to be true) are BCs.[6] In §2.2 we introduce a notion of independence that overcomes those shortcomings. We build on a suggestion in Franke (2007) to use counterfactual mechanisms to model independence and on Francez's (2015) idea that in interpreting BCs an interpreter rules out dependence in the common ground. In our proposal, that two propositions are (factually) independent is a stable and transcontextual[7] property of information states. In §2.3 we begin spelling out how the new notion of independence allows us to make predictions about the interpretation of *if*-constructions. As we show in §3, this notion of independence is crucial in our interpretation of *if*-constructions, i.e, in deriving the GUP and in explaining the array of additional meanings often triggered in BCs.

Our final goal is to provide an understanding of how speakers' assumptions about the world, and what they envision as possible or impossible dependencies, affect whether or not they identify *if*-constructions as

[6] Factual conditionals are *if*-constructions in which the antecedent is taken to be true by somebody other than the speaker (and possibly also the speaker) (see a.o. Iatridou 1991; Bhatt and Pancheva 2006; Constant 2014). See, e.g., (6) below. We take this label to be descriptive label and not to affect the semantics of *if*-constructions.

[7] The label *transcontextual* is from Merin (2007).

BCs. We can give a quick illustration of the important role played by those assumptions with the following example:

(4) If you like blue, the wedding dress is blue.

Whether or not (4) is understood as a BC or an HC depends on contextual factors. Imagine that (4) is uttered by someone who is offering to buy the wedding dress for the addressee and is discussing what color the dress will be. With (4) the speaker conveys that the dress will be in whatever color the addressee likes, for example, blue. However, in a context in which the dress has already been made without consulting the addressee about the color, and we know that its color can't be changed, (4) will be understood as a BC (the speaker is probably hoping for a happy coincidence).

The proposal presented here builds on previous pragmatic accounts of BCs relying on a notion of independence. However, not all pragmatic proposals to account for BCs do. In §2.4 we discuss problems presented in Swanson (2017) against independence-based accounts of BCs, as well as his own proposal.

2.1 Previous notions of independence

The notion of independence in Franke (2007, 2009) is designed to explain how the utterance of a BC comes to have the same informational impact as an utterance of the matrix clause (the consequent) alone. It targets consequent entailment (GUP) in BCs: upon understanding that *if you are hungry, there are biscuits on the sideboard* is a BC, we learn that there are biscuits on the sideboard. In Franke's characterization, two propositions are independent iff upon learning that one is true, we do not learn anything regarding the truth of the other (this notion of independence is equivalent to Lewis's (1988) notion of orthogonality of subject matters). In Franke's approach,[8] independence is a relation between propositions relative to information states characterized as sets of possible worlds. It can be viewed as a notion of *informational independence*:[9]

(5) Let W be a set of possible worlds and $\phi, \psi \subseteq W$, i.e. ϕ, ψ are propositions, X and Y variables over propositions and σ an information state, a set of possible worlds. Propositions ϕ and ψ are orthogonal/ informationally independent iff

$$\forall X \in \{\phi, \overline{\phi}\}, \forall Y \in \{\psi, \overline{\psi}\} : \text{ if } \Diamond_\sigma X \text{ and } \Diamond_\sigma Y, \text{ then } \Diamond_\sigma (X \cap Y)$$

where $\Diamond_\sigma P$ is shorthand for $P \cap \sigma \neq \emptyset$, i.e., compatibility of P and the information state σ.

Lauer (2015) walks us through the explanation of consequent entailment in BCs within Franke's system: upon the utterance of a BC $\phi > \psi$, the interpreter *Int* reasons about what the speaker's S information state σ_S is like. Their hypotheses are sets of information states (Σ_{σ_s}) whose elements are *Int*'s candidates for S's presuppositional state.[10] When interpreting a BC, *Int* assumes informational independence between ϕ and ψ in σ_S as defined in (5), and also learns that $\neg\Diamond(\phi \cap \overline{\psi})$ (because of the semantics of the *if*-construction), and that $\Diamond\phi$ in σ_S (accommodating if necessary the presupposition of the conditional[11]). The only information state that satisfies informational independence between ϕ and ψ and the information learned from the utterance of the *if*-construction is one in which ψ is true in all information states in σ_S (i.e., $\neg\Diamond_\sigma(\overline{\psi})$). Under the assumption that informational independence has to be maintained across updates, consequent

[8] See (Franke 2009, def. 5.12). As Franke points out, this notion of independence captures the idea that two propositions are independent for an agent when learning the truth or falsity of a proposition doesn't allow the agent to decide whether the other is true or false **when the truth of such propositions was not decided before**. As we argue below, this notion of independence doesn't allow us to explain our intuitions about factual conditionals.

[9] Franke calls this notion of independence *epistemic independence*. We thank Cleo Condoravdi for this alternative denomination.

[10] Σ_{σ_s} evolves (i.e. shrinks by eliminating information states that are no longer candidates) as *Int* learns more about the speaker's information state through her utterances.

[11] This presupposition is assumed for indicative conditionals, and also holds in the counterfactual case given that the *if*-construction is evaluated w.r.t. a revised state where the antecedent is true.

entailment in a BC $\phi > \psi$ is the unavoidable result of orthogonality together with the information conveyed by the *if*-construction. We retain in our proposal this way of deriving the formal update (see §3), but we crucially supplement it with an explanation of why orthogonality has to be maintained across updates in BCs: *if*-constructions are interpreted as BCs when propositions are not just informationally independent, but when they are taken to also be *factually* independent.

Discussion Franke's characterization of independence was meant to derive consequent entailment given an *if*-construction identified as a BC. However, if we try to use this notion of independence in a predictive manner, to identify when *if*-constructions are interpreted as BCs, we appear to run into trouble. There are two types of concerns. The first problem is that Franke's notion of independence was not intended to be predictive: it told us what the update process is when we have already identify an *if*-construction as a BC, but not how we know that's the update to be implemented. Franke's (2009) proposal does not explain how participants decide to keep orthogonality between antecedent and consequent in the update process (and strengthen the literal meaning of an *if*-construction), and when orthogonality should be lost. The second problem arises because the conditional statement of (5) makes incorrect predictions when the antecedent in an *if*-construction is assumed to be true relative to an information state. We will spell this out below and use the discussion as a stepping stone to our modified characterization of independence in §2.2.

Let's start with the predictions that would be made for cases in which conversation participants are ignorant about dependencies (see also Mandelkern and Rothschild 2019 for this problem and for a version of the following example). Consider the propositions denoted by utterances of *Bill is going to the party* and *Sue is going to the party*. If these propositions are not common ground, and neither is information about dependencies amongst them, the information state of a participant will have worlds where Bill goes and Sue doesn't, worlds where Bill goes and Sue goes, worlds where Bill doesn't go and Sue does, and worlds where neither Bill nor Sue go. This information state satisfies informational independence/orthogonality as characterized in (5). Imagine that in this scenario, a speaker utters the *if*-construction *if Sue is going to the party, Bill is going to the party*. If we were to use (5) in a predictive fashion, we would expect such *if*-constructions to be understood as a BC where orthogonality is maintained (and hence we strengthen the update conveyed by the *if*-construction). However, a plausible outcome from such an utterance would be to actually learn about a dependency between the two propositions (that Bill's going to the party depends on Sue's going). Franke's proposal does not address this. That is, the proposal, as is, does not account for the fact that discourse participants can give up orthogonality and learn a dependency, or maintain orthogonality and obtain a BC interpretation.

The second concern mentioned above is about the predictions made when a proposition is mutually accepted, i.e. mutually taken for granted or assumed to be true, to be common ground. The issue can be illustrated with so-called *factual conditionals*, exemplified below:

(6) John is visiting his grandmother, who lives very far away from him:
John: Hi grandma! I'm starving!
Granny$_1$: But of course, my dear. You've had such a long trip! If you are (so) hungry, I will make some biscuits.

The importance of (6) is that even though we can understand that the antecedent is in the common ground, Granny$_1$'s utterance may be taken to convey that it is John's hunger that would prompt her to make biscuits. Contra Franke's prediction, Granny$_1$'s utterance can actually be interpreted as an HC (though the BC-reading is also available).[12] Franke's notion of independence in (5) is stated as a conjunction of material implications and predicts that only a BC interpretation will be available. Consider ϕ as the (assumed) antecedent in

[12] A BC-reading for a factual conditional would be even more prominent with reversed temporal order, as in *Granny$_2$: But of course, my dear. It's been a long trip! If you are (so) hungry, I just made some biscuits. They are on the sideboard.*

Granny$_1$'s *if*-construction, and ψ as the consequent (providing new information). The propositions will be independent (in an information state σ) iff:

(7) a. If $\Diamond\phi$ and $\Diamond\psi$, then $\Diamond(\phi \cap \psi)$
b. If $\Diamond\phi$ and $\Diamond\overline{\psi}$, then $\Diamond(\phi \cap \overline{\psi})$
c. If $\Diamond\overline{\phi}$ and $\Diamond\psi$, then $\Diamond(\overline{\phi} \cap \psi)$
d. If $\Diamond\overline{\phi}$ and $\Diamond\overline{\psi}$, then $\Diamond(\overline{\phi} \cap \overline{\psi})$

Given the truth of ϕ relative to the conversational state ($\Box\phi$) and ignorance regarding ψ, both (7a) and (7b) hold. But the truth of ϕ also makes the conditionals in (7c) and (7d) true (since their protasis is false). This means that if we use Franke's notion of independence as predictive for the BC-interpretation of an *if*-construction, all factual conditionals will be BCs: once we learn about one proposition being true, we lose the ability to track dependencies with other propositions. The established proposition just becomes independent from any other proposition.

The two problems outlined above stem from the fact that independence and dependence are modeled only as structural properties of an information state characterized as a set of possible worlds:[13] in this system independence is only the result of considerations regarding what is compatible with the information state at hand. To overcome these issues, we propose a system building on Franke's (2009)'s in which we severe the storage of information gain about facts separately from storage of information about how those facts depend or not on each other. This allows us to encode the independence at play in the interpretation of BCs as a stable assumption in the respective information state and also allows for the possibility that we learn about dependencies.

2.2 Severing informational independence from factual independence

The key problem to using Franke's (2009) notion of independence in a predictive manner is that it is satisfied also if the information state at hand is compatible with a dependence (see Mandelkern and Rothschild 2019 and discussion in 2.1 above). Our notion of independence supplies Franke's notion of independence (*informational independence*; defined solely in terms of compatibility with the information state) with a notion of *factual independence* capturing the intuitive notion we are after in BCs: two propositions are independent when agents rule out that one being true or false affects the truth of falsity of the other. The notion of factual dependence refers to how facts depend on one another with respect to a world,it does not refer only to information gained about what is the case in the actual world, i.e., it does not solely and exclusively refer to the compatibilities in the information state but explains how these arise as a consequence of factual independence. When we have factual independence between two propositions there is informational independence, but not the other way around. As a consequence, factual independence allows us to predict when *if*-constructions are BCs but being informationally independent (i.e. that the information state being such that all options are possible) doesn't mean that the speaker rules out that they may be factually dependent (i.e. that they are factually independent). The resulting system still appeals to Franke's (2009) solution to the GUP but crucially provides the system with predictive and explanatory power.

The proposal we put forward in this paper to characterize a predictive notion of independence is that two propositions are taken to be independent if the participants rule out that they are factually dependent. That is, independence is presupposed in a Stalnakerian sense,i.e. it is a contextual assumption and is concerned with what participants mutually accept. In order to model these notions we make use of machinery used to model factual dependencies in the interpretation of counterfactual conditionals (a.o.Veltman 2005; Kratzer 1989; Arregui 2011). In a way, the proposal made below can be understood as showing that the same notion

[13]The term 'structural property' is due to Francez (2015), who also argues, as we will, that this structural property should be derived from knowledge about causal and epistemic dependencies. This insight is, however, not implemented in Francez's (2015) formal proposal.

of dependence between facts that modulates the interpretation of counterfactual conditionals surfaces in the case of indicatives to predict whether an *if*-construction is interpreted as an HC or a BC.

2.2.1 Factual independence and independence between propositions

Dependence between facts is known to play a role in the interpretation of counterfactual conditionals. Counterfactual antecedents invoke circumstances that differ from actuality with respect to certain facts. In identifying the worlds quantified over, we need to consider what facts depend on each other and, hence, what other facts have to be revised. That is, we need to understand "how facts stand and fall together" (Kratzer 1989). We argue that considerations about factual dependencies are also relevant in determining whether *if*-constructions are interpreted as BCs or HCs. In particular, we need to pay attention to how facts 'stand' together.[14] In this section we spell out a predictive characterization of independence building on proposals for the semantics of counterfactuals in Veltman (2005) together with modifications in Arregui (2011).

In Veltman's (2005) proposal, dependencies are *factual dependencies*, and assumptions about facts and about dependencies between facts are tracked separately.[15] We adopt a modification from Arregui's (2011) take on Veltman (2005). We add to this Starr's (2014a) concept of *structured possible worlds* to be able to build dependencies directly into possible worlds ontologically. That possible worlds are *structured* means that a world represents what is true at that world, but also how some propositions are made true by other propositions being true via dependencies between facts. Following Arregui (2011), worlds are made of a *base*, i.e., facts that do not depend on other facts, and a set of dependencies between facts, *laws* in Veltman's (2005) terminology, that determine facts that depend on other facts and how.

That something is a fact of a world just means that a certain (atomic) sentence or a certain proposition holds relative to that world. The notion of a *law* in Veltman (2005) captures how facts depend on one another. In general Veltman defines laws as being assumptions that discourse participants are not prepared to give up (p. 166). Regardless of whether participants may or may not give up those assumptions, the important feature of the system, for our purposes, is that participants are taken to make those assumptions in the first place. In previous work (Velman 1976), laws are prejudices in a morally neutral, theoretical way. These propositions, in a way, constitute the world view or the ideology (or, in Quine's terms, what is at the core of the web of beliefs). Factual dependencies are a subset of those prejudices/laws in concerning how one proposition depends on another. Such factual dependencies often stem from generalizations like *whenever it rains, Jones takes his hat*. It is important to understand that Veltman's (2005) propositional framework encodes this generalization indirectly. First, because such generalizations involve some kind of quantification that is not available with respect to a propositional account and, second, because what is at issue are dependencies between *particular matters of fact*. Hence, factual dependencies are particular instantiations of such generalizations in specific circumstances. Notice that what a discourse participant considers to be a (Veltmanian) law is not fixed for all times. Certainly, an agent may change their theoretical prejudices. But importantly, an agent will not give up laws without any reason. Many of the laws will have default character representing what an agents takes to be normal. However, this default character is not formally represented in Veltman's framework. What is represented is the fixed world view in specific circumstances at a specific moment.[16] In what follows we spell out the basic formal details of this model.

[14] It is important to consider here that premise semantics contrasts with the Lewisian defintion of dependencies in terms of counterfactuals. Premise semantics (i) has an explicit representation of dependencies between facts and (ii) the interpretation of counterfactuals relies on modifications on this kind of representations. We relie on (i) to account for BCs.

[15] Dependencies between facts are represented differently in different models. In this paper we adopt Veltman (2005) because it is sufficient to bring the main points made in this paper across. It is, however, not out of problems. Alternatives to this system include causal models or structural equations (directed graph structures), currently used not only to model counterfactuals (Schulz 2007; Dehghani et al. 2012; Kaufmann 2013; Starr 2014a; Snider and Bjorndahl 2015; Santorio 2019), but also to model the meaning of implicative verbs and similar inferences (Francez and Baglini 2015; Lauer and Nadathur forthcoming).

[16] This is illustrated by (4): Depending on discourse participants' conceptualization of how the particular matters of fact in the situation referred to are or can be connected, i.e. on how they depend on one another, either an HC or a BC reading arises.

Adopting Veltman, we assume that possible worlds are complete valuation functions from a (finite) set of atomic sentences of a language $\mathscr{L}$ to the truth-values $\{0,1\}$.[17] To express that an atomic sentence p is true at a world w we write $\langle p,1\rangle \in w$ or $w(p) = 1$ or 0 if it is false (this is the definition of positive and negative facts in Veltman 2005 and underlies our informal talk of facts being true in a world). We take situations to be subsets of worlds, $s \subseteq w$ (a partial function from $\mathscr{L}$ to truth values). Facts are minimal situations, but situations can contain more than one fact, and worlds are maximal situations. Sentences denote propositions as sets of possible worlds: the proposition expressed by p is $[\![p]\!]$.

The truth/falsity of a fact often times depend on other facts being true or false as well.[18] Facts are then connected by a web of factual dependencies. The classic illustration in the literature refers to Jones and his hat-wearing habits (Tichy 1976). When the weather is bad, Jones wears his hat (the wearing of the hat depends on the weather being bad) and, hence, if it is a fact that at w the weather is bad, the dependence relation establishes that it is also a fact in w that Jones wears his hat.

A complete world can be determined with the independent fundamental facts of the base and the set of dependencies (laws). We follow Arregui (2011) in the modification of Veltman's system, and consider a single world as a starting point. Dependencies are taken to be dependencies of a particular world (since they can be different in different worlds). A world w is associated with a *law horizon* U_w, the set of worlds having the same laws as w. U_w determines a set of factual dependencies and allows us to have an indirect representation of the laws in effect in w. The other component necessary is the *base set*, i.e. the set of independent facts in w that, together with the factual dependencies operating in U_w, determines w.

(8) a. A situation s determines a world w w.r.t. U_w iff for all $w' \in U_w : s \subseteq w', w' = w$.
b. A situation s is a *base set* for a world w iff s is a minimal situation that determines w w.r.t. U_w, i.e. there is no $s' \subset s$ such that s' determines w.

In this system, if it is a base-fact that the weather is bad and there is a dependency linking bad weather and Jones wearing a hat holding at w, it is a dependent fact in w that Jones is wearing his hat. The table in (9) illustrates this proposal. In this toy example we consider sentences $p =$ *The weather is bad*, $q =$ *Jones is wearing a hat*, and a random sentence $r =$ *Lake Constance is 63 km long*; $w_@$ is the actual world where Jones' wearing a hat depends on bad weather. This factual dependence is formally represented by material implication. w_1 to w_5 represent random possibilities. The worlds that do not comply with the laws of the actual world, i.e., worlds that do not belong to $U_{w_@}$ are crossed out.

(9)

W	p	q	r
$w_@$	1	1	1
w_1	1	1	0
~~w_2~~	~~1~~	~~0~~	~~1~~
w_3	0	0	1
w_4	0	1	0
~~w_5~~	~~1~~	~~0~~	~~0~~

$U_{w_@} = \{w_1, w_3, w_4\}$ represents the permutations of facts that are in line with the factual dependencies holding at $w_@$. For this example, each world has a single base: $s_{w_@} = \{< p,1 >, < r,1 >\}, s_{w_1} = \{< p,1 >, < r,0 >\}, s_{w_3} = \{< p,0 >, < r,1 >\}, s_{w_4} = \{< p,0 >, < r,0 >\}$. Given that Veltman uses material implication to represent laws the system allows multiple bases for a given world. This generates several problems that

[17] In different settings like Kripke's framework one would want to claim that possible worlds *determine* such functions, but are not equivalent to them.

[18] Strictly speaking, facts are not true or false, but positive and negative.

we circumvent by claiming that in an utterance situation context settles that there is a unique base.[19,20]

This proposal, so far, allows us to identify independent facts (those in the base set) and dependent facts (those that depend on base set facts), e.g. that p and r are independent in our example. However, we also want to be able to say whether non-base facts are independent or not, e.g., in our toy example q and r are also independent. That is, we need to be able to identify whether two given facts are somehow (perhaps indirectly) related in the web of dependencies of a world.

Two facts may be 'dependent' (on other base-facts) and yet *independent of each other* if they are dependent on, or can be traced back to, different base facts. Let's take Jones hat-wearing fact, which depends on the bad weather (base fact) and let's take Mary's going out to dinner tonight, which depends on some dinner arrangements (base fact). Those two dependent facts (Jones wearing his hat, and Mary going out for dinner tonight) are independent of each other because their respective sets of base facts do not overlap. Informally, two facts m and n are independent of each other with respect to a world w and its factual dependencies iff they can be retraced to two disjoint mutually exclusive, non-overlapping subsets in the base sets of w. However, it is not enough to just look at one world, but we also have to consider how the dependencies look like in the other law-like worlds amongst U_w because a fact may depend on more than one other fact: in Veltman's (2005) there can be disjunctive laws/dependencies (for example, $(p \vee q) \rightarrow r$).[21] In order to track factual dependencies in the Velmanian system we have to look at the bases of each world w' in U_w. If the set of all base facts that a certain fact depends on does not overlap with the set of all base facts that another fact depends on, the two facts are factually independent. That is, tracking factual dependencies between one fact and another amounts to collecting the base facts of each world in U_w for each of the facts and then see whether the sets of base facts overlap.

We cash this out more formally moving up to the level of propositions and adopting aspects of the system in Arregui (2011). We first characterize situations that (minimally) force a proposition (given a law horizon U_w) (10). We then characterize factual independence between propositions in terms of situations that minimally force the propositions (11b).

(10) a. A situation s forces a proposition $[\![p]\!]$ within U_w iff for every world w' in U_w such that $s \subseteq w'$, $w' \in [\![p]\!]$.

b. A situation s minimally forces a proposition $[\![p]\!]$ within U_w iff s forces $[\![p]\!]$, $s \subseteq s'$, where s' is the base set of w, and there is no $s'' \subset s$ that forces $[\![p]\!]$.

(11) Two propositions $[\![p]\!]$ and $[\![q]\!]$ are factually independent with respect to w and U_w iff the set of all facts f' that are elements of situations $s' \in U_w$ that minimally force $[\![p]\!]$ does not overlap with the set of all facts f'' that are elements of situations $s'' \in U_w$ that minimally force $[\![q]\!]$, $\{f' \mid f' \in s', \text{ s.t. } s' \text{ minimally forces } [\![p]\!]\} \cap \{f'' \mid f'' \in s'', \text{ s.t. } s'' \text{ minimally forces } [\![q]\!]\} = \varnothing$ and the following conditions are satisfied

a. there exist such s' and s'' (non-emptiness)

b. $[\![p]\!] \neq [\![q]\!]$, i.e. the facts that are factually independent are not identical

The definitions above provides the expected result: two propositions are factually independent for w iff whether they are true or false at w can be traced via factual dependencies (laws) to mutually exclusive situations in the base sets of the worlds in U_w.

Let us take stock. Informational independence/orthogonality as discussed earlier builds on the distribution of worlds amongst an information state. This means that whether informational independence is

[19] As noted in Starr (2014a) what counts as a base (in the case of a causal model, what counts as salient variables) might be context dependent. For purposes of simplicity, we do not go into this issue.

[20] Systems that do not make use of material implication do not face this problem, but are also formally more complicated and possibly not as general as Veltman (2005).

[21] We thank an anonymous reviewer for this observation.

satisfied is only determined by whether there is a world in the information state for each combination of truth values in question. However, this does not encode that a specific combination of values may spring from certain relations between the respective facts *in* these worlds, e.g. that one sentence being true at a world is 'responsible' for the other sentence being true there too. The proposal argued for here is that accounting for such 'worldly' relations amongst facts in worlds allows us to predict BC and HC readings, in addition to Franke's understanding of independence.

2.3 Tracking (in)dependence in conversation

Our goal is to explain how our assumptions about independence play a role in the dynamic interpretation of *if*-constructions. How does conversational update interact with our assumptions about our world (w) and its laws? What is the difference between the cases in which the utterance of an *if*-construction leads us to learn something about dependencies vs. the cases in which we interpret it as a BC? Our proposal augments a Stalnaker-style view of context update by considering context sets to be formed by the ususal Stalnakerian context set together with considerations about the laws governing the worlds in it.[22] This move allows us to track different types of information. This complex cs includes both assumptions shared by conversation participants about facts in the world, and shared assumptions about its laws, i.e. about how facts interact.

To be more concrete, we consider context sets (cs) to be tuples $\langle cs_F, L\rangle$ where cs_F is a Stalnaker-style context set consisting of the worlds at the intersection of the propositions mutually accepted in discourse; while L is the *law sphere* made up of the set of possible worlds compatible with mutually assumed laws, modelling shared assumptions about laws. The dependencies encoded in L are not hard laws, e.g. not only the laws of nature. Assumptions of dependencies between particular matters of fact in this framework stem from generalizations such as that whenever it's cold I sneeze or that when the weather is bad Jones wears his hat, but also that things do not materialize because someone thinks of them (the reader is referred to Veltman 2005; Arregui 2011 for a more detailed discussion). Naturally, $cs_F \subseteq L$ and, crucially, (informational) dependencies depicted in cs_F cannot go against (factual) independence assumptions in L (i.e. if q is assumed to be factually independent from p, it cannot be informationally dependent on q with respect to cs_F). A cs_F expressing an informational dependency going against assumptions in L is incoherent. We call this the *mirror constraint*.

(12) Mirror Constraint: For any $cs = \langle cs_F, L\rangle$ the following two conditions hold:
   a. $cs_F \subseteq L$
   b. If two facts are factually independent in L, they can't be informationally dependent in cs_F (i.e. learning about the truth of one cannot lead to learning about the truth of the other).

Notice, however, that since the agents' assumptions about the dependencies in a given situation is incomplete, more dependencies hold in the worlds in L than the ones shared by the interlocutors. For example, if interlocutors take p and q to be factually dependent, all worlds in L will be worlds in which p and q are factually dependent. Participants may not know, however, about the dependence between r and s and hence L will include at least one world where p and q factually depend and r and s factually depend, as well as one world where p and q factually depend but r and s do not.[23]

[22] This complex context set is what Isaacs and Rawlins 2008 termed Information Store. They suggest that a context also encodes modal information that can be used to evaluate counterfactual claims. We use it here to store information about dependencies.

[23] There is a class of conditionals that could be argued to present a counterexample to this constraint: so called *epistemic conditionals*. An example is provided below:

(i) We know that John was murdered. If the gardener didn't do it, the butler did.

What is characteristic of these examples is that we have somehow narrowed down options to two incompatible possibilities: either the gardener or the butler did it. The conditional reflects this epistemic state with an antecedent that negates one of the options.

This complex *cs* effectively encodes what participants presuppose about the facts and about the laws at a particular point in discourse (cs_F and L can be taken to track participants assumptions about w and U_w respectively). Both cs_F and L *evolve*: cs_F shrinks with information gain about what is the case (facts), and so does L, storing new dependencies by eliminating the worlds that do not include those dependencies (since, following Arregui 2011, we have encoded dependencies between facts in the structure of worlds themselves). What do cs_F and L look like? Assume that $\langle p, 1\rangle$ is a mutually shared fact, while the value of q is not established. The worlds in cs_F are then all worlds in which $\langle p, 1\rangle$ but there are worlds in which $\langle q, 1\rangle$ and worlds in which $\langle q, 0\rangle$. The same applies for dependencies. Imagine that it is shared that q depends on p (we write $p \rightarrow q$). The dependency will be part of all the worlds in L. However, if it is undetermined whether sentence r depends on sentence s, or vice versa, or whether they are not related at all, we will have worlds in L in which r depend on s, worlds in which s depends on r and worlds in which they are factually independent. Given that $cs_F \subseteq L$, what can be accepted is restricted by L.

With these tools in hand we can now model what it means for participants in a conversation to *presuppose* factual independence:

(13) Two propositions (or the corresponding facts) are *presupposed* to be factually independent with respect to L iff they are factually independent (as defined in (11b)) in every world in L.

With the presupposition of factual independence, L has the structural feature of satisfying informational independence/orthogonality as characterized in (5). This allows us to keep Franke's (2009) derivation of the global update with respect to cs_F that is driven by the requirement that live possibilities (cs_F) have to comply with the assumed laws ($cs_F \subseteq L$). If two propositions are factually independent in L, they are also informationally independent w.r.t. L. This means that if we presuppose factual independence between p and q, L includes $p \wedge q$-worlds, $p \wedge \neg q$-worlds, $\neg p \wedge q$-worlds and $\neg p \wedge \neg q$-worlds. The difference with Franke's proposal is that now informational independence is stable with respect to L: our assumptions about independence are tracked by L (we say informational independence is induced by L) and those assumptions are not affected by learning about the truth of any proposition. Conversely, learning a dependence amounts to getting rid of worlds in which the dependence doesn't hold.[24]This latter update is only possible if there is no assumption of independence. If independence is presupposed, the system prevents us from learning dependencies that are ruled out: if all worlds in L are worlds with respect to which two propositions are independent, this will also be the case in all worlds in cs_F ($cs_F \subseteq L$).

Having separate but connected representations for assumptions regarding factual dependencies (L) and facts (cs_F) allows us to differentiate between cases when informational independence/orthogonality is transcontextually stable over updates and cases when it is not. It is transcontextually stable when the propositions in question are presupposed to be factually independent, captured by L. Let us consider the example of the blue dress again:

(14) If you like blue, the wedding dress is blue.

In a context in which it is presupposed that you liking blue and the color of the wedding dress are independent (as encoded in L), (14) will be interpreted as a BC. Since $cs_F \subseteq L$, it will be impossible for (14) to result in an update that violates informational independence/orthogonality. If, on the other hand, we are in

Epistemic conditionals present a theoretical challenge, and have been argued to be problematic for analyses of *if*-constructions in terms of truth values (see discussion in e.g. Stalnaker 1975; Lewis 1976; Jackson 1979; Gibbard 1981; Warmbrōd 1983; Edgington 1995; Gillies 2004). They fall outside the scope of our discussion of *if*-constructions in this paper, which focuses on cases in which facts are independent and compatible. We leave epistemic conditionals for future research.

[24]This is similar to Snider and Bjorndahl's (2015) proposal that information is learned from counterfactuals: worlds with an incompatible structure are ruled out. However, the structure need not be that antecedent and consequent directly depend. The could also, for example, be correlated because they depend on the same fact (common cause structure). I.e., what is learned from an HC is something about the web of dependencies. This is left here for future research.

a context in which it is not known (or not established) whether or not the facts are dependent, an utterance of (14) could lead to an update of L (and cs_F) that eliminates worlds in which the facts are independent, leading us to learn a new dependency. What is presupposed 'informationally' about the facts (cs_F) before the utterance of (14) is the same in both cases (they are informationally independent). It is our assumptions about dependencies as encoded in L that will decide whether an HC interpretation is possible, leading us to learn a new dependency, or whether to assign a BC-interpretation, with informational independence remaining transcontextually stable. The extra layer of structure provided by the distinction between cs_F and L within cs allows us to make sense of this difference.

Let us take stock. In this section we have provided a notion of independence, factual independence, that allows us to distinguish speaker's assumptions regarding what facts depend on other facts (stored in L) from informational (in)dependence. It is the assumption of factual independence that identifies *if*-constructions as BCs. In §3 we will see how this plays a role in explaining the inferences puzzle. However, let us first discuss in §2.4 potential problems for the claim that independence is what allows us to identify *if*- constructions as BCs.

2.4 Biscuits and biscuitty *if*-constructions

The proposal offered in this paper builds on previous independence-approaches to BCs. These are not, however, the only pragmatic approaches to BCs. Swanson (2017) also argues for a pragmatic approach without, however, endorsing an *independence-driven* proposal due to examples like (15) and (16) (Swanson's (2017) ex. (18) and (21)), which he takes to be problematic for independence-based accounts:

(15) If you go swimming, there'll be snacks on the other shore…

a. … in fact there'll be snacks however you get there.

b. … but not if you kayak over.

(16) If you're hungry, your hunger can be alleviated by eating some biscuits from the sideboard.

Swanson argues that (15) shows that consequent entailment in BCs is an implicature, unlike what is predicted in independence-based accounts. The problem with (16), Swanson argues, is that it seems to convey that there are biscuits regardless of the addresee's hunger, but it is hard to argue that antecedent and consequent are independent given that the satisfaction of the presupposition in the consequet depends on the antecedent.

Let us explore first the contrast in (15). Swanson (2017) argues that it shows that that there being snacks on the other shore regardless of how you get there can be reinforced, (15a), or cancelled, (15b). Hence, that there are snacks on the other shore regardless of how one gets there behaves just as any other (Gricean) implicature. Notice, however, that (15a) is not reinforcing the inference that there are snacks on the other shore regardless of how the addressee gets there (that is not the most prominent interpretation of (15) out of the blue). We take it that (15) is most naturally interpreted as an HC in which the speaker uttering (15) is making the promise of rewarding the addressee with snacks provided they swim to the other shore. The continuation in (15a) is "correcting" this HC-reading to indicate that it there will be snacks no matter what (to a BC-reading). That (15a) is a correction is signaled by the use of *in fact*, which is usually taken to be a marking of cancellation (see Rett 2020 for recent a discussion). Conversely, (15b) is very naturally interpreted as stating that kayaking does not result in snacks being available and, hence, reinforcing the prominent HC-reading of (15) that obtaining snacks is contingent not only on getting to the other shore, but also on the method used to get to the other shore. Consequently, (15b) emphasizes that there is a dependence relation between antecedent and consequent. At any rate, one thing that is clear from (15) and its possible continuations is that speakers are very aware of the ambiguity of an *if*-construction: even if there are factors favoring an HC- or a BC-reading, an *if*-construction can be potentially interpreted in either way.

That there is uncertainty in the interpretation of *if*-constructions is predicted by the proposal made in this paper, since *if*-constructions do not conventionally encode either an HC- or a BC-reading. The proposal

we argue for predicts that a BC-reading is enforced if independence of antecedent and consequent is presupposed. This is a speaker's presupposition in a Stalnakerian sense and, since it is not conventionally conveyed, there is room for uncertainty. Contextual factors indicating the speaker's intentions as well as assumptions regarding how the world works usually help to disambiguate, just as with any other case of Stalnakerian presuppositions.[25] In our system *L* encodes the dependences that participants take to be mutually accepted. Sometimes participants' assumptions about *L* may be misaligned or the speaker may be uncertain regarding whether they are aligned. In those cases there is a confusion that needs to be clarified. As with any other presupposition.

Notice that while contextual factors may affect whether the reading intended is an HC- or a BC-reading, grammatical factors can also favor one or the other interpretation (see also Merin 2007, pg 21).[26] That the most prominent reading of (15) is an HC-reading is helped by the use of the future marking. It is easily understood that the consequent follows temporarily the antecedent and hence that they are in a dependence relation. One can easily interpret (15) as the speaker making a promise and, of course, once we interpret that the speaker is making a promise of snacks provided the addressee swims, we understand that the addressee may also be enticed to swim instead of going by kayak, but this is a posteriori. In contrast, the use of the present tense in the consequent favors a BC-reading. This is because the use of the present tense makes easily available an interpretation in which the running time of the event in the antecedent and consequent overlap and, hence, it is harder to obtain a reading in which they depend on each other. In general, this is the case with stative predicates, which are very commonly found in the classical examples of BCs in the literature. See (17) in contrast with (15b):

(17) If you go swimming, there are snacks on the other shore, #but not if you kayak over.

Given that a BC-reading is very easily brought about in these cases, without further contextual assumptions favoring a dependence relation, it is very odd to try to cancel an HC-reading, (18) (since it does not arise to begin with). Contrast (15a) and (18):

(18) If you go swimming, there are snacks on the other shore, #in fact there are snacks however you get there.

With a present tense, it is harder to interpret that the presence of snacks on the other shore depends on how you get there. With a present tense, the continuations in (17) and (18) are felicitous only in a context in which we understand that we are using the present for the future. In that case, this would be equivalent to (15) (see discussion above). Once again, whether this is the intended use of the present is something that the utterance situation often disambiguates (i.e. understanding the speaker's intentions and that they are in

[25] Stalnaker characterizes presuppositions in terms of attitudes that do not need to be conveyed conventionally. These are affected by contextual factors. In general, Stalnaker rejects the commonly assumed idea in the semantics literature that there are dedicated (lexical) presupposition triggers (see Stalnaker 2014 for a recent discussion). In fact, it seems that most presuppositions can be cancelled given the appropriate context. Take *stop*, for instance. It is assumed that the utterance of *Susan stopped smoking* triggers the presupposition that Susan used to smoke. However, such inference doesn't arise in (i) (Simons 2001 attributes this example to Geurts 1994). In light of this, it is hard to maintain that the presupposition is encoded in the lexical entry of *stop*:

(i) I noticed that you keep chewing on your pencil. Have you recently stopped smoking?

We do not reject here the idea that there may be some lexical items whose contribution is solely to convey that certain information is backgrounded, but this is not what we assume for the independence presupposition in *if*-constructions that leads to stereotypical BCs.

[26] Merin (2007, pg. 21): "Lexical and inflectional information, including indicators of tense, along with their respective semantic interpretations and convictions about the physical world make the assumptions of causal independence in [(1)] accessible to every linguistically competent listener. If any of these lexical or grammatical features are modified, the scope for consequential readings will usually increase."

a position of making a promise and follow through, that there may be some motivation for doing so, even if the motivation is just to see us suffering through the process).

While grammatical factors favor one or the other reading, the future marking doesn't necessarily trigger a promise-interpretation. A promise-interpretation still depends on contextual factors and a BC-interpretation upon the utterance of (15) is also possible if we can interpret that the future marking intends to merely signal our future arrival to the other shore and we assume that antecedent and consequent are independent: 'when in the future you arrive at the other shore, you will see that there are snacks over there'. As illustrated by the impossibility of rejecting a BC-reading in (19), our assumptions about independence play a crucial role:

(19) If you go swimming, there will be lions awaiting on the other shore, #but not if you go kayaking.

One needs a very elaborated context to interpret (19) as an HC. Crucially, an HC-interpretation of (19) requires that we manipulate our assumptions about the (in)dependence relation between antecedent and consequent to either allow the magic apparition of lions upon arriving swimming, or to give the speaker powers to make lions appear were we to swim to the other shore.

A greater problem for an independence-based approach is presented in (16). Swanson (2017) argues that the *if*-construction in (16) triggers the inference that there are indeed biscuits on the sideboard no matter what (and prima facie one would say it is then a biscuit conditional) but, given that the interpretation of the consequent requires the satisfaction of a presupposition depending on the antecedent, it is hard to argue that antecedent and consequent are independent.

It is worth noting that, despite the inference that there are biscuits no matter what, (16) is not a BC (according to our definition) but an *if*-construction in which the consequent depends on the antecedent. That is, speakers can naturally be taken to share the assumption that alleviating your hunger depends on you being hungry (having hunger). What about the inference that there are biscuits no matter what? This inference doesn't behave in the same way as the inferences in stereotypical BCs. Compare (20) with (21) (the infelicitous follow up in (20) is only possible if it is an autocorrection / afterthought, which is not the relevant interpretation here):

(20) If you are hungry, there are biscuits on the sideboard, # assuming there are some.

(21) a. If you're hungry, your hunger can be alleviated by eating some biscuits from the sideboard, assuming there are some.
b. If you're hungry, your hunger will be alleviated by eating some biscuits from the sideboard, assuming there are some.

There is certainly a contrast between (20) and (16)/(21a). We may infer from (16) that the speaker entertains that there are biscuits on the sideboard, but this inference is not arrived at in the same way as in the case of actual BCs. Our proposal predicts that in the case of BCs that there are biscuits no matter what cannot be cancelled (as in stereotypical cases like (20)), but it doesn't make predictions about cases like (16), HCs (in which the inference may be cancelled). How the (cancellable) inference that there are biscuits on the sideboard may arise in (16) is an interesting question, and Swanson's (2017) proposal may very well be the way to explain those cases. However, the contrast in behavior illustrated in (20) and (21) shows that the inference regarding the existence of biscuits is of a different nature and requires a different explanation.[27]

[27] Swanson (2017) provides another example with presupposition triggers, in this case with *too*:

(i) If you want to go to the movies, Henry and Iris are going too.

Swanson's concern, again, is that even though we take (i) to convey that Henry and Iris are going to the movies no matter what, the satisfaction of the presupposition triggered by *too* in the consequent depends on the antecedent. Notice, however, that the licensing conditions of *too* are of a different nature from our notion of independence: *Too* does not impose that the antecedent be true (or false) depending on the truth of the prejacent ((ii) is adapted from Heim (1992), ex. (71); the original example involves *also*):

There is an additional set of cases in which an independence-based theory of BCs may have problems (Swanson p.c.). These are cases in which knowledge that the consequent is true makes the antecedent more likely. An illustration is provided by (22) uttered in a scenario in which all participants know that whenever the addressee sees a good tapas restaurant they feel like tapas (this is a dependence encoded in L). Speaker and addressee are now looking through the window of what is obviously an amazing tapas restaurant:

(22) If you feel like tapas right now, this is an excellent tapas restaurant.

The point is that we understand that (22) conveys that the restaurant is excellent (no matter what), but antecedent and consequent do not seem to be independent in this context. Or are they? Notice that the dependence relation we know of is not between a particular restaurant being excellent and the addressee feeeling like tapas. The dependence is between the addressee being in front of a restaurant that they realize is an excellent tapas restaurant and they are feeling like tapas. Notice the contrast between (22) and (23).[28]

(23) If you feel like having tapas right now, as you obviously do/must, because as we both realize this is a great tapas restaurant, this is a great tapas restaurant.

Considering the dependence we are aware of between realizing that a restaurant is a good tapas restaurant and the addressee's craving for tapas, is (22) a BC or an HC? Whether the restaurant is a good tapas restaurant or not is independent of whether they can realize it is. Can (22) be uttered to mean (23)? No, (23) would be a very strange redundant utterance. It is true that we often state the obvious in language, but in this case, the question is why we used an *if*-construction in which both antecedent and consequent are mutually accepted to be true and the consequent entails the antecedent. Imagine the speaker and a friend are watching a gambling ad on TV (this is obvious to both and was acknowledged; there is no possible uncertainty). The friend is known to be a recovering gambling addict and is now starting to show obvious symptoms of distress, obviously caused by the gambling ad:

(24) If you are in distress right now, this is a gambling ad.

In this scenario (24) is infelicitous. The only way (22) and (24) are felicitous is if the speaker assumes (or pretends to assume) that the addressee doesn't realize that the restaurant is a great tapas restaurant, or that the ad is a gambling ad. Therefore, it is not clear either whether the addressee feels like having tapas at that moment or whether the addressee feels like gambling/in distress. The question persists though: in this

(ii) A: I am already in bed.
B: My parents think I am in bed too.

In (ii) A is in bed but B isn't and yet, *too* is licensed. The proposal in this paper predicts that (i) is a BC because that you want to go to the movies and that Henry and Iris are going to the movies are presupposed to be independent (in the most obvious contexts of interpretation for (i)).

Notice also that the discussion regarding *too* also applies to other presupposition triggers such as possessives (see Heim 1992, ex. (28)):

(iii) Patrick and Ann both dream of winning cellos. Ann would like one for her own use. Patrick wants to sell his cello for a profit.

The use of the possessives does not require that that Patrick or Ann won (and hence, actually have) a cello each. The anaphoric relation imposed by the possessive is of a different nature.

[28] The example in (23) attempts to be a more natural instance of the Stalnakerian translation of (22) with the contextual assumptions provided above. This translation would be more literally (i):

(i) If you feel like having tapas right now, as we both (mutually) accept you do because we both (mutually) accept that this is a great tapas restaurant, this is an excellent tapas restaurant (as we both already mutually accept).

situation, are (22) BCs or HCs. Notice that the dependence that is encoded in L is that once the addressee realizes that they are in front of a good tapas, they feel like tapas. The main clause "this is a great tapas restaurant" is not the same as "you know this is a great tapas restaurant": *if you feel like having tapas right now, this is a great tapas restaurant* is a BC; *if you feel like having tapas right now (as we know yo do), we both know that you know this is a great tapas restaurant* is an HC, and a bizarre one to utter (see (23)). Of course, once it's learned that the tapas restaurant is good (if (22) is a BC), the addressee will (a posteriori) feel like tapas:

(25) If you feel like having tapas (which I'm not sure of), this is a good tapas restaurant (in case you didn't realize it). Oh! Of course now that you know this you will feel like having tapas!

There is, yet, another possibility. Imagine the same context as above in which all participants accept that when A realizes she is in front of a great tapas restaurant she feels like having tapas:

(26) A: I'm so feeling like tapas right now.
B: If you feel like tapas right now, this must be/is an amazing restaurant.

B's utterance is an example of detective reasoning (see Chisholm 1946).[29] In this context the utterance is justified when understanding that the speaker is spelling out how A got to feel like having tapas at that very moment (*I take it that you think this is an amazing restaurant and, hence, you feel like tapas (given that when you see an amazing tpas restaurant you feel like having tapas!)*). In this case, the consequent can be the modal statement or, if the speaker decides to endorse A's deduction from what they are witnessing, the plain assertion.[30] Notice that, in this case, the utterance is an HC and consequent entailment is the result of the *if*-construction being a factual conditional (one in which the antecedent is taken to be true).

What if the dependence is not between *realizing* that it is a good tapas restaurant and feeling like tapas but simply that you are in front of a great tapas restaurant (even though you are not consciously aware of that) and feeling like tapas. Can the speaker utter (27) to mean convey that the restaurant is a great tapas restaurant (no matter what)?

(27) If you feel like having tapas right now (which I'm not sure of), this is a good tapas restaurant.

(27) cannot be interpreted as merely conveying that the restaurant is a good tapas restaurant if we take into consideration the dependence that *if it is a good tapas restaurant, you feel like tapas*. If we evaluate (27) with this generalization in mind, it would be equivalent to (28), which can never be interpreted as the speaker trying to convey that the restaurant is a good tapas restaurant no matter what:

(28) If you feel like tapas right now, this is a good tapas restaurant and you feel like tapas right now.

This said, the technical implementation of Veltman's proposal adopted here may have problems accounting for detective reasoning because it is not clear how the doxastic inference or assumption that the information

[29] Chisholm (1946) describes this detective reasoning as the deliberations regarding what is the case when something is the case. Chisholm refers to this 'detective reasoning' in the context of *would*-conditionals, but the same 'deliberative use' can be seen in (26).

[30] See e.g. Karttunen (1972); von Fintel and Gillies (2010) for discussion regarding the contrast between plain declaratives (*this is an amazing restaurant*) and the *must*-modalized version (*it must be an amazing restaurant*).

in the antecedent is evidence for the consequent is to be derived within this system.

3 Interpreting *if*-constructions in discourse

Let us consider a run of the mill *if*-construction: *If it rains today, we cancel the picnic*. Semantically, the *if*-construction asserts that the selected worlds in which it rains today are worlds in which we cancel the picnic. That is, in uttering the *if*-construction, the speaker asks us to consider temporarily a context set that is a subset of the current *cs*: to assume temporarily that the only worlds that matter are those worlds in the *cs* in which the antecedent proposition is true. These worlds alone are the ones in which (conventionally) subsequent updates take place. In the running example, we are asked to temporarily assume that all the worlds that matter are those selected worlds in which it rains today, and then the addressee is asked to accept that those worlds are also worlds in which we cancel the picnic. Accepting the assertion about those worlds amounts then to eliminating from the temporary context the worlds in which we do not cancel the picnic. Once we accept the utterance, we lift/pop the assumption and go back to considering all the worlds that have survived and loose all the ones that were lost: we loose all worlds in which it rains today and we do not cancel the picnic, and keep the worlds in which it rains and we cancel as well as all worlds in which it does not rain today (regardless of whether we cancel or not the picnic).[31] We can represent this process in the context change potential (CCP) sketched below for context c and sentences ϕ and ψ. We provide a detailed mechanisms later in this section:

(29) $c + \ulcorner \text{ASSERT}(\text{if } \phi,\ \psi) \urcorner = c + (\ulcorner \text{ASSUME } \phi \urcorner + \ulcorner \text{ASSERT } \psi \urcorner)$

In the running example, we could finish here (although one still needs to derive how is it that we come to understand that it is because it rains that we cancel the picnic, see below). In the resulting context, learning that it rains today leads us to conclude that we cancel the picnic (modus ponens) and, conversely, learning that we don't cancel the picnic will lead to learning that it doesn't rain today (modus tollens). That is, the updated *cs* encodes an informational dependence. This is fine, since we can accept that they are not factually independent and hence the resulting cs_F does not reflect and informational dependence running against our assumptions of factual dependence encoded in L (i.e. the mirror constraint in (12) is obeyed). Later (communal) considerations on how the world works and the correlations learned may lead to incorporating a dependence and L will evolve to contain only worlds in which this dependence holds. However, things are different in the case of BCs.

Let us consider the stereotypical BC *if you are hungry, there are biscuits on the sideboard.* Our CCP above would lead us to an impossible cs_F, i.e. a cs_F that presents information dependencies that are inconsistent with the what is encoded in L: the regular update alone delivers a cs_F in which learning that you are hungry makes us conclude that there are biscuits on the sideboard and, learning that there are no biscuits on the sideboard leads us to the conclusion that you are not hungry (!). This is incompatible with L, where there are no worlds in which these dependences are built (participants do not consider that the existence of biscuits on the sideboard and the addressee's hunger are connected, i.e. in the worlds in L the intersection of their base facts is empty). More concretely, the simple update results in a cs_F in which the mirror constraint in (12) is not obeyed: in the resulting cs_F represents an informational dependence that goes against our assumptions about independencies. In order to update the context with a BC in the same fashion as any other *if*-construction while obeying the mirror constraint, something else needs to be done: we need to repair the

[31] This is effectively the context change potential in Heim (1983):

(i) *If*-construction with matrix declarative update: Where $M \backslash N = M \cap (W - N)$
$c + If\ p, q = c \setminus (c + p \setminus c + p + q)$, where p and q are declarative clauses.

resulting cs_F so it doesn't present an informational dependence running against the factual independence encoded in L (i.e., a cs_F that obeys the mirror constraint). In §3.1 we spell out this process. The proposal has at its core Franke's (2009) solution for the GUP but with an important caveat. When identifying that antecedent and consequent are presupposed to be independent (as encoded in L), in updating the context set the interpreter doesn't eliminate only worlds in which you are hungry and there are no biscuits (in our running example), but also worlds in which there are no biscuits altogether. The caveat introduced in this paper is that this is because L is stable with respect to the dependencies that are discarded (independence is stable across information updates; if participants discard a dependence between two propositions, posterior informational updates obey the mirror constraint and cs_F can't represent informational dependencies going against assumptions about factual dependencies represented in L). At the end, L enforces the shape of cs_F. We spell out this in §3.1. However, this is only part of the job. We still need to derive other meanings triggered by *if*-constructions if we want to have a full account of BCs.

In §3.2 we target how the dynamic model proposed can also explain how the 'inferences puzzle'. That is, we want to be able to explain how we understand, for example, that the speaker is giving permission to the addressee to eat the biscuits in uttering *if you are hungry, there are biscuits on the sideobard*, or that it is because it rains that we cancel the picnic arising upon the utterance of the HC *if it rains, we cancel the picnic*. We argue that both are the result of how the context updates and of how we reason about that update. In order to derive this result, we follow current discourse models arguing that utterances are embedded in an intentional discourse structure and are interpreted as answering a (implicit) question or positing one (see e.g. Roberts 1996; Büring 2003; Beaver and Clark 2008). These models follow much literature in assuming that the goal of conversation is a communal inquiry. Adopting the Q(uestion) U(nder) D(iscussion) model and integrating it in the dynamic model, we argue (following previous literaterature) that *if*-constructions not only ask that assumptions are made and then propose an update with those assumptions in place, *If*-constructions are special in that they make explicit the question that is being addressed in discourse while also providing the answer, or a path towards it.[32] We argue that inferences triggered by *if*-constructions, be it e.g. 'causality' or permission are born the same way: they are the result of reasoning regarding how the response relates to the question set up in the *if*-construction. That is, they are the result of reasoning about how the response signals/identifies the answer to the question that participants are set to answer. Differences regarding inferences between BCs and HCs stem from assumptions of factual independence and from how these assumptions affect speakers's reasoning regarding the discursive question-answer relation.

The upshot of taking into consideration constraints on the update process explaining the GUP and the mapping of *if*-constructions to discourse is an account of BCs that does not complicate the semantics of *if*-constructions. At the heart of the proposal is the view that the particular way in which a BC is embedded into a discourse structure can be responsible for generating many of the 'enriched' meanings that have proved puzzling in the literature: these are the result of discourse-subordination resulting from the mapping of the *if*-construction into discourse. The proposal shifts the burden of accounting for special BC-inferences to discourse dynamics in a model in which *if*-constructions are mapped to question-answer pairs. The analysis provided in this section will thus include a fine-grained account of the discourse dynamics of a QUD model. When the facts about independence between antecedent and consequent are put together with a proposal to map *if*-constructions to question-answer pairs, the result is pragmatic enrichment driven by the imperative of discourse well-formedness. In §3.2.4 we run an example illustrating how the system works.

[32] There are also BC-questions: *if I'm hungry, are there biscuits on the sideboard?*. The question is ultimately asking whether there are biscuits on the sideboard (independently of the hunger). See Sano and Hara (2014), who derive this result within Franke's (2009) proposal of independence. Their result translates to the system presented here.

3.1 A dynamic model for the interpretation of *if*-constructions and the GUP

The dynamic model offered here assumes that utterances are proposals to update the context (see Stalnaker 1978, see also Farkas and Bruce 2010 on assertions, Starr 2016 on imperatives and Biezma and Rawlins 2017 on questions). The formal details follow more closely Biezma and Rawlins (2017) for ease of exposition.

In order to track how context changes with *if*-constructions, we need to consider the following elements: a (Stalnakerian) context set *cs* encoding what speakers mutually accept. From our discussion above, we know that how the context set evolves is constrained by speakers' assumptions on what are possible dependencies, which is encoded in L. Hence, $cs = \langle cs_F, L\rangle$. We know that *if*-constructions encode temporary assumptions. The update with the matrix clause only affects those worlds compatible with the assumption introduced by the antecedent. We need then an element to keep track of those assumptions telling us what the 'visible' worlds for subsequent updates are. In Rawlins (2010a) the a-slot in c (see (30)) tracks temporary assumptions (we will make the simplifying assumption that *cs* is marked when an assumption is made, see (40)). In addition, following Biezma and Rawlins (2017), the context also keeps track of what is the question in discourse that participants try to address. This is the question stack Q (or QUD) in Roberts (1996) a.o. Finally, to characterize the proposal nature of utterances, the model also considers a 'waiting room' where proposals are recorded and await to be dealt with. That is, an utterance doesn't update, e.g., the context set in a given context c (cs_c) directly, but makes a proposal that is recorded in $\mathscr{F}$. $\mathscr{F}$ is, hence, either empty (there is nothing that has been proposed and awaits evaluation, as in discourse initial situations), or encodes a copy of the current a_c, cs_c and Q_c (let us call this the 'local context') together with the modification proposed. This leads us to the defintion in (30) (in what follows we only use subscripts when disambiguation is necessary, e.g. $cs_{\mathscr{F}_c}$ is the *cs* in the projected context of a context c):

(30) A *context* c is a tuple $\langle a, cs, Q, \mathscr{F}\rangle$ whose elements are characterized as:
  a. $l_c = \langle a, cs, Q\rangle$ is a local context.
  b. $\mathscr{F}_c$ is either a local context or $\emptyset$. Call $\mathscr{F}_c$ the *projected context*.

(31) A local context l is a tuple $\langle a, cs, Q\rangle$ such that:
  a. $a \subseteq W$ is the *view* on the context. For an unrestricted view, $a = W$
  b. *cs* is the (Veltmanian) context set (or Information Store; see above), $cs = \langle cs_F, L\rangle$:
    (i) cs_F the Stalnakerian context set ($cs_F \subseteq W$)
    (ii) L is the set containing the worlds in which all presupposed laws/factual dependencies hold. At all times: $cs_F \subseteq L$.
  c. Q is a stack of sets of propositions (the QUD stack)

We need to define how context updates proceed. Let us illustrate this with (a simplistic view of) the update with declaratives. Consider the sentence *We cancel the picnic*. Utterances of declaratives (which denote propositions) are assertions, i.e. their sentential force is to propose to update *cs*, (signaled by $\oplus$), whose effect is the standard *cs* update in which we dispel of the worlds not compatible with the new proposition. This is what is recorded in $\mathscr{F}$ (we simplify for now and assume that the QUD in c has been explicitly accepted to be $[\![$What does John play?$]\!]$; see below for discussion):

(32) $c + {}^{\ulcorner}\text{Assert}(\phi)^{\urcorner} = \langle a_c, cs_c, Q_c, l_c \oplus {}^{\ulcorner}\phi^{\urcorner}\rangle$.
Constraints: a. $\mathscr{F}_c = \emptyset$ (proposals can only be made when there is nothing pending evaluation); b. $l_c \oplus {}^{\ulcorner}\phi^{\urcorner}$ is felicitous (see (35)).

(33) $c + {}^{\ulcorner}\text{Assert(We cancel the picnic)}^{\urcorner} = \langle a_c, cs_c, Q_c, l_c \oplus [\![\text{We cancel the picnic}]\!]\rangle$
Constraint: $\mathscr{F}_c = \emptyset$ and $l_c \oplus {}^{\ulcorner}$we cancel the picnic$^{\urcorner}$ is felicitous (see (35)).

'$\oplus$' in (35) targets cs_F by making use of the intersection defined in (34). The definition in (36) is what establishes felicity conditions: an utterances of an indicative clause is only felicitous if there are worlds in the context set in which such proposition is true. The process is exemplified in (37).

(34) Given a context $cs = \langle cs_F, L\rangle$ and a proposition ψ, $\langle cs_F, L\rangle \underset{\text{fact}}{\cap} \psi \underset{\text{def}}{=} \langle cs_F \cap \psi, L\rangle$

(35) Let l be a local context, $l = \langle a, cs, Q\rangle$, and ϕ a declarative denoting a proposition, $l \oplus \ulcorner \phi \urcorner = \langle a, cs \underset{\text{fact}}{\cap} [\![\phi]\!], Q\rangle$, felicitous only if $[\![\phi]\!]$ is compatible with cs_F.

(36) A proposition ψ is compatible with a set of worlds C iff $\exists w \in C$ s.t. $\psi(w) = 1$.

(37) $l_c \oplus \ulcorner$We cancel the picnic$\urcorner = \langle a_c, cs_c \underset{\text{fact}}{\cap} [\![$We cancel the picnic$]\!], Q_c\rangle$,
felicitous only if $[\![$We cancel the picnic$]\!]$ is compatible with cs_{F_c}.

If the addressee accepts the proposal, the projected context becomes the actual context and the $\mathscr{F}$-slot is emptied:

(38) $c + \ulcorner$ Accept$_x\urcorner = \langle a_{\mathscr{F}_c}, cs_{\mathscr{F}_c}, Q_{\mathscr{F}_c}, \emptyset\rangle$ where x is the participant accepting the proposal.

At the end of the update, cs has changed to eliminate the worlds in which we do not cancel the picnic. (We disregard for now maintenance operations regarding Q: once the QUD is resolved it is dispelled. We'll get back to this below.)

Let us consider now the update by the *if*-construction *if it rains, we cancel the picnic*. The idea (following Rawlins 2010a, who builds on Heim 1983), is that *if*-constructions update the assumption slot in the context, a_c (this is the operation '$\circledcirc$' in (40) below). This triggers a 'domain limited' update (following Kaufmann 2000): only the worlds in cs_{F_c} compatible with the new assumption r in a_c are updated by subsequent updates. The worlds in cs_c that are not compatible with the new assumption added to a_c won't be affected. That is, the context is marked, (39), and cs_{F_c} is partitioned in two non-overlapping sets that together form a disjoint cover of the original cs_{F_c}.[33] We call $cs^r_{F_{c_{active}}}$ the member of this cover, a subset of cs_c, that will be affected by subsequent updates, and $cs^r_{F_{c_{passive}}}$ the other member of the cover. This limited update for marked contexts is defined in (41). We can always recover the unmarked context with the union of the sets in the cover. The definition in (42) allows us to do that. [We drop the subscript c below when no ambiguity arises.]

(39) Let $cs = \langle cs_F, L\rangle$ and r a proposition presenting a temporary assumption. We define the *marked context* of cs, cs^r s.t.
$cs^r = \langle cs^r_F, L\rangle$ where $cs^r_F = \{cs^r_{F_{passive}}, cs^r_{F_{active}}\}$ is a disjoint cover of cs_F s.t. $cs^r_{F_{active}} \underset{\text{def}}{=} cs_F \cap r$ and $cs^r_{F_{passive}} \underset{\text{def}}{=} cs_F - cs^r_{F_{active}}$ (we write below $cs^r_{F_{passive}} = cs_F \cap \bar{r}$)
Subsequent conventionally encoded updates only affect $cs^r_{F_{active}}$.

(40) Let l be a local context, $l = \langle a, cs, Q\rangle$, and r the proposition denoted by a clause r signalling a temporary assumption,[34] $l \circledcirc \ulcorner \mathrm{r} \urcorner = \langle a \cap r, cs^r, Q\rangle$, felicitous only if $cs^r_{F_{active}} \neq \emptyset$

Once we have a marked context, we can proceed with subsequent updates.

(41) Let cs^r be a marked context, $cs^r = \langle cs^r_F, L\rangle$,
$cs^r \underset{\text{fact}}{\cap} \psi = \langle cs^r_F, L\rangle \underset{\text{fact}}{\cap} \psi \underset{\text{def}}{=} \langle \{cs^r_{F_{passive}}, cs^r_{F_{active}} \cap \psi\}, L\rangle$

[33] See e.g. Simons (2005) fn. 8: A set of sets C is a cover of a set S iff: (i) Every member of C is a subset of S. (ii) Every member of S belongs to some member of C. (iii) The empty set is not in C. A cover is disjoint if its members are disjoint from each other.

[34] E.g., r is the proposition denoted by the *if*-clauses.

(42) $cs = \bigcup_{\text{unmark}} cs^r = \langle \bigcup cs^r_F, L \rangle$

Assumptions, then, target a_c and trigger a marked cs_c, cs^a_c, while L stays the same. The assumption in the antecedent in *if*-constructions is a temporary one, just assumed for the subsequent (immediate) update. Once the next update takes place, it will be lifted and the set of assumptions will be left as it was before.[35] However, the original cs_c has changed:

(43) $c + \ulcorner$Assert(if it rains, we cancel the picnic)$\urcorner =$
$c + (\ulcorner$Assume (it rains)$\urcorner + \ulcorner$Assert(we cancel the picnic)$\urcorner) =$
$\langle a_c, cs_c, Q_c, (l_c \oslash \ulcorner$it rains$\urcorner) \oplus \ulcorner$we cancel the picnic$\urcorner \rangle$

(44) $l_c \oslash \ulcorner$it rains$\urcorner = l'_c = \langle a_c \cap [\![\text{it rains}]\!], cs^r_c, Q_c \rangle$, (see (40))
where $cs^r_c = \langle \{cs_{F_c} \cap \overline{[\![\text{it rains}]\!]}, cs_{F_c} \cap [\![\text{it rains}]\!]\}, L \rangle = \langle \{cs^r_{F_{c_{passive}}}, cs^r_{F_{c_{active}}}\}, L \rangle$,
felicitous only if $[\![\text{it rains}]\!]$ is compatible with cs_{F_c}; posterior updates only operate on $cs^r_{F_{c_{active}}}$

The assumption itself is not the proposal made by the utterance of the *if*-construction. The proposal is an assertion intended to affect the worlds now in view: the worlds in which it rains. In our running example, we hence need to encode the assertion that in the worlds in view, it rains (see (41)):

(45) $l'_c \oplus \ulcorner$we cancel the picnic$\urcorner = \langle a_c \cap [\![\text{it rains}]\!], cs^r_c \cap_{\text{fact}} [\![\text{we cancel the picnic}]\!], Q_c \rangle$, felicitous only if
$[\![\text{we cancel the picnic}]\!]$ is compatible with $cs^r_{F_{c_{active}}}$ and the mirror constraint is obeyed.
$cs^r_c \cap_{\text{fact}} [\![\text{we cancel the picnic}]\!] = \langle \{cs^r_{F_{c_{passive}}}, cs^r_{F_{c_{active}}} \cap [\![\text{we cancel the picnic}]\!]\}, L \rangle =$
$\langle \{cs_{F_c} \cap \overline{[\![\text{it rains}]\!]}, cs_{F_c} \cap [\![\text{it rains}]\!] \cap [\![\text{we cancel the picnic}]\!]\}, L \rangle$

Notice that the update proposed is possible because the resulting context set obeys the constraint that it be a subset of L_c ($cs_{F_c} \subseteq L_c$) and that obeys the Mirror Constraint (see (12)). That is, in the resulting context set, when we learn that it rains, we automatically learn that we cancel the picnic, and if we learn that we don't cancel the picnic, we automatically learn that it doesn't rain. This is compatible with L_c, which doestn't discard this dependency, i.e. a dependency is compatible with L_c.

Accepting the update results in the actual update of the context and then we lift the temporary assumption: the resulting context set stops being marked for subsequent updates.

(46) a. Acceptance: $\langle a_c \cap [\![\text{it rains}]\!], cs^r_c \cap_{\text{fact}} [\![\text{we cancel the picnic}]\!], Q_c, \emptyset \rangle = c_2$
b. Lifting assumption: $c_2 + \text{AsPop} = \langle W, cs_{c_2}, Q_c, \emptyset \rangle$, where $cs_{c_2} = \bigcup_{\text{unmark}} (cs^r_c \cap_{\text{fact}} [\![\text{we cancel the picnic}]\!])$
(i.e. the active/passive distinction is lost).

Notice that in this update we have not changed L. We would like to argue that changes of L are not encoded in the dynamics of *if*-constructions. In accepting an *if*-construction one learns about a correlation. It is in reasoning about how the world works and taking into consideration the correlations learned that L may change. This is not, however, simply the result of accepting the *if*-construction alone and is not encoded in its dynamics.

Let us turn now to the case of BCs. If we proceed as above, we crash. The assumption proceeds without problem, (47a), but the felicity conditions licensing the update by the matrix clause are not met, (47b):

[35] Isaacs and Rawlins (2008) point out that it is not always clear when assumptions are lifted: *A: If it rains today, we cancel the picnic; B: And everybody stays home.* In this example, B's utterance still considers the assumption that it rains today. We do not dwell on this here and leave it for future research. Notice however that linguistic cues often help to identify whether assumptions are lifted. B's utterance above is more natural with *and*, indicating that the proposition is to be understood in conjunction to the matrix clause in the previous utterance (we cancel the picnic and everybody stays home) and hence should be evaluated under the same assumptions.

(47) $c + \ulcorner$Assert (if you are hungry, there are biscuits on the sideboard)$\urcorner =$
$c + (\ulcorner$Assume (you are hungry)$\urcorner + \ulcorner$Assert (there are biscuits on the sideboard)$\urcorner) =$
$\langle a_c, cs_c, Q_c, (l_c \oslash \ulcorner$you are hungry$\urcorner) \oplus \ulcorner$there are biscuits on the sideboard$\urcorner\rangle$

a. $l_c \oslash \ulcorner$you are hungry$\urcorner = l'_c = \langle a_c \cap [\![$you are hungry$]\!], cs^r_c, Q_c\rangle$ where $cs^r_c = \langle cs^r_{F_c}, L_c\rangle$ and $cs^r_{F_c} = \{cs_{F_c} \cap \overline{[\![\text{you are hungry}]\!]}, cs_{F_c} \cap [\![\text{you are hungry}]\!]\} = \{cs_{F_{c_{passive}}}, cs_{F_{c_{active}}}\}$,
felicitous only if $[\![$you are hungry$]\!]$ is compatible with cs_{F_c}; posterior updates only operate on $cs_{F_{c_{active}}}$

b. $l'_c \oplus \ulcorner$there are biscuits on the sideboard$\urcorner =$
$\langle a_c \cap [\![$you are hungry$]\!], cs^r_c \cap [\![$there are biscuits on the sideboard$]\!], Q_c\rangle$,
felicitous only if $[\![$there are biscuits on the sideboard$]\!]$ is compatible with $cs^r_{F_{c_{active}}}$ and the mirror constraint is obeyed.

$cs^r_c \underset{\text{fact}}{\cap} [\![$there are biscuits on the sideboard$]\!] =$
$\langle \{cs_{F_c} \cap \overline{[\![\text{you are hungry}]\!]}), cs_{F_c} \cap [\![$you are hungry$]\!] \cap [\![$there are biscuits on the sideboard$]\!]\}, L\rangle$

The conventional update in (47b) is not felicitous because it does not obey the Mirror Constraint in (12): the *cs* resulting from eliminating only the worlds in which you are hungry and there are no biscuits on the sideboard from cs_c leads to a context set reflecting informational dependencies in cs_F violating our assumptions of factual independence encoded in L. The resulting context set is one in which if you learn that in the actual world there are no biscuits, you learn that you are in a world in which you are not hungry, conversely, if you learn that you are hungry, you learn that there are biscuits. The question is how to proceed in this case.

In principle, we have two options to proceed with incorporating the assertion encoded in the BC without violating the mirror constraint: (i) we could conclude that the speaker is indicating that the independence assumption represented in L is wrong (concluding that the speaker didn't share it), or (ii) we could proceed with minimal modifications in the update in a way that does not reflect an informational dependence in cs_F that goes against the assumptions in L and that is still compatible with the semantics of the *if*-construction.

Following option (i) leads to amending L and involves a revision that is not lightly accepted (speakers are not prepared to give up on what they consider to be general laws, see Veltman 2005, pg. 166). The only option left is then (ii). What is a minimal modification that allows us to avoid discrepancies with L? We can update the context by not only eliminating worlds in which you are hungry and there are no biscuits from cs_{F_c}, but all worlds in which there are no biscuits (this is what Franke 2009 proposes). This means that we widen the domain of the update and obtain in return a stronger claim:

(48) **Domain Widening Update $\underset{\text{wide}}{\cap}$:** For any cs_{c_2} resulting from a domain limited update with ψ, $cs^r_{c_2} = cs^r_{c_1} \cap \psi = \langle \{cs_{F_{c_{1\text{passive}}}}, cs_{F_{c_{1\text{active}}}} \cap \psi\}, L\rangle$, s.t. $\bigcup_{\text{unmark}} cs^a_{c_2}$ violates the mirror constraint, widen the domain of the update to a new $cs^{r\prime}_{c_2}$ s.t. $cs^{r\prime}_{c_2} = \langle cs^r_{F_{c_{1\text{passive}}}} \cap \psi, cs^r_{F_{c_{1\text{active}}}} \cap \psi, L\rangle = cs^r_{c_1} \underset{\text{wide}}{\cap} \psi$
(i.e., if the resulting cs_{c_2} violates the mirror constraint, update both the passive and active factual context set).

By widening the domain when antecedent and consequent are independent we end up with a context set in which there are always biscuits but you may or may not be hungry: learning that there are biscuits doesn't lead to learning whether you are hungry and the mirror constraint is obeyed.

Notice that this domain widening is triggered to avoid the 'false' inference that antecedent and consequent are factually dependent in L: if nothing is done, the update by the *if*-construction is one that leads to a cs_F reflecting a dependency that would (have to) correspond to a factual dependency encoded in L (or else we would be violating the mirror constraint). That is, overall, the result would be the inference that our

assumptions regarding the dependency between antecedent and consequent were wrong. When we are sure that this is not the case, and that all participants are aware of it (we do not want to revise L), we are willing to widen the domain and update the consequent over the entire cs_F (this is compatible with the semantics of the *if*-construction). This domain widening strategy is not only observed in the case of BCs. Domain widening is also claimed to be a strategy to avoid false implicatures in the case of negative polarity items (see Kratzer and Shimoyama 2002).[36]

Notice that, importantly, the update triggered by the *if*-construction identified as a BC (due to factual independence) is what leads to eliminating all non-consequent worlds (i.e. $[\![\text{there are biscuits on the sideboar}]\!]$-worlds) and hence triggering consequent entailment: consequent entailment is the result of trying to preserve a coherent picture between cs_F and L (obeying the mirror constraint). In the end, the dynamic update with the *if*-construction is the same as the update made by the utterance of the matrix clause alone with respect to the information conveyed by consequent clause alone:[37] we learn that $[\![\text{there are biscuits on the sideboard}]\!]$ is true in cs_F. In this way, consequent entailment is not a property of BCs but the result of striving for coherence between what is assumed to be the case and our assumptions about what depends on what.

In factual conditionals, we do not see this struggle to maintain a coherent picture. Remember that factual *if*-constructions are *if*-constructions in which the antecedent is already taken to be true. We saw above how trying to apply Franke's independence proposal in a predictive fashion would lead to the conclusion, contra speakers' intuitions, that all factual *if*-constructions are BCs. With factual *if*-constructions, at the time the *if*-construction-update takes place, we have already accepted that all worlds in cs_F are worlds in which the antecedent is true (e.g. in all worlds in cs_F you are hungry in the case of the factual *if you are hungry, there are biscuits on the sideboard*, or, e.g., in all worlds it rains, in the case of the factual *if it rains, we cancel the picnic*). The update with the *if*-construction merely proposes that all those worlds are also worlds in which the consequent is true (e.g., worlds in which there are also biscuits on the sideboard or, e.g., worlds in which we also cancel the picnic). The result is a cs_F in which both antecedent and consequent are true. It is important to notice that what explains our intuitions on whether these factual conditionals are BCs or HCs is L: before the *if*-construction is accepted participants have already accepted that the antecedent is true but the consequent could be true or false. This is compatible with a BC-reading or a HC-reading because it is compatible with an L that encodes independence of antecedent and consequent (the intersection of the base facts of antecedent and consequent is empty and, hence, while all the worlds are worlds in which the antecedent is true, we find in L worlds in which the antecedent is true but the consequent isn't and worlds in which the antecedent is true and the consequent is also true) and with an L in which antecedent and consequent are taken to be dependent. Learning that the consequent is true will still keep all options available in L if factual independence is assumed, but it leads to a cs_F in which there are only worlds in which antecedent and consequent are true. This cs_F is still compatible with an L in which independence is assumed (obeying the mirror constraint), since those worlds can all be worlds in which the intersection of the base facts of antecedent and consequent is empty, leading to a BC-reading of the *if*-construction. An HC-reading is brought about when we recognize that L contains worlds in which the intersection of the base facts of antecedent and consequent is not empty. That is, it is the difference in L (which preserves our assumptions regarding dependencies independently of the information gained and stored in cs_F) what is responsible for differences in speakers' intuitions between HC- and BC-readings of factual conditionals.

Let us take stock. So far we have (i) argued that what makes us interpret an *if*-construction as a BC are our presuppositions regarding factual independence, and (ii) provided a model of information update that, together with participants' presuppositions of factual independence, explains the global update observed

[36] Proposals to explain N(egative) P(olarity) I(tems) following Kadmon and Landman 1993 argue that domain widening is encoded in the lexical entry of NPIs like *any*. Kratzer and Shimoyama (2002) argue that the choice of an NPI instead of regular indefinites may be driven by the attempt to avoid false implicatures. In the case of NPIs, domain widening is encoded lexically, in the case of BCs, it is not, but is compatible with the semantic meaning of the *if*-construction.

[37] We discuss other differences between the utterance of BCs and the consequent alone in §3.2.2.

in BCs. This is the first property of BCs that we wished to account for. Our proposal predicts that most BCs trigger a global update, and this is triggered in order to keep a coherent context (see below for some cases in which such strengthening is not necessary in some BCs), but notice that it does not predict that all *if*-constructions triggering a global update are BCs.[38]

It is important to emphasize that in our proposal, the only factor guiding the interpretation of *if*-constructions as either a BC or an HC are the assumptions regarding factual independence. There may, of course, be linguistic devices that highlight what those assumptions may be (see discussion in §2.4). For example, most biscuit conditionals mentioned in the literature contain stative predicates in the consequent (e.g. *if you are hungry, there are biscuits on the sideboard*). Stative predicates favor a biscuit reading merely because it is easier to interpret that the time of the event of the consequent overlaps with the time of the event in the antecedent and that there is no dependence between the antecedent and the consequent. Dependence-readings are easier to obtain when we interpret that the event in the matrix clause follows the event in the antecedent. Salient dependencies are often structured in this way.[39] But even with stative predicates, the ultimate interpretation relies on our actual presuppositions regarding independence (see (4) above).

In the reminder of the paper we set ourselves the task of explaining the 'inference puzzle'. As we have already previewed, our claim is that such inferences are not conventionally encoded in the semantics of BCs; they are discourse effects that should be kept separate from the semantics (and syntax) of BCs. We argue that the inferences are triggered by the mapping of *if*-constructions into discourse. The prediction is that if the same mapping were achieved via a different route, we should see the same inferences. We show that this prediction is indeed borne out.

3.2 The QUD stack in the dynamic system

Our views on discourse structure are guided by Roberts (1996) (see also Büring 2003; Beaver and Clark 2008). Roberts (1996) follows much work in the literature in philosophy by taking discourse to be a communal inquiry in which speakers agree to investigate the ways things might be (alternatives) in order to understand the way things are. In the idealized model proposed by Roberts, discourse is characterized as a partially ordered set of moves. Utterances are understood either as establishing a new question under discussion (QUD) (*setup* moves), or as providing a (complete or partial) answer to the (possibly implicit) question participants agreed upon (*payoff* moves). Both overt and implicit QUDs are treated semantically as questions in a Hamblin-framework, and so denote the set of possible answers to the question.

The QUD model posits an interaction between sentence-level meaning and discourse: the sentential level allows us to understand speakers' intentions by identifying the question under discussion that is being asked. In the words of Roberts (1996): "[a]ll that is given at the sentential level, conventionally, are certain sorts of presuppositions about the place and function of the utterance in the [intentional structure] of the discourse in which it occurs."[40] There are linguistic cues in sentences that serve to indicate what is the QUD being addressed, and thus the intentional structures in which the utterance may be embedded. We will argue that this is of great importance in a pragmatic account of the interpretations of BCs (and for the interpretation of *if*-constructions in general). By providing a theory of how to recover speaker intentions

[38] This is a good property of our proposal: it allows us to explain why there are *if*-constructions that we (intuitively) interpret as HCs that still trigger a global update (although, arguably, through a different route).

(i) This is the best book of the month if not of the year.

The regular update of *if*-constructions together with our assumptions that the best book of the year has to be the best book of the month it appears in is what derives the global update in this case. It is a different process than the one we saw in BCs.

[39] It has been pointed out that it is usually the case that events causally depend on earlier events (see, e.g., Lewis 1979).

[40] Roberts (1996) uses the term *information structure* instead of *intentional structure*. However, given that the term is generally used to refer to the information category of a given constituent within a sentence, Roberts (2012) offers to use the term *intentional structure* instead.

from sentence-level cues, the QUD model will allow us to spell out an account of the numerous shades of meaning available to BCs as inferences derived on the basis of assumptions regarding the QUD.

3.2.1 The update of Q

In our dynamic system Q, the QUD-stack (a stack of sets of propositions), is key to determining felicity in discourse. In the QUD-model discourse participants are taken to commit to solving the current QUD (the question on the top of the stack, $top(Q)$). Utterances are taken to either attempt to answer the question or to posit a question on the top of the stack (a new current QUD). The relation between questions and answers is crucial in our reasoning about what is meant by the utterance of an *if*-constructions and it is in this sense that it is crucial to understand what is the (implicit) question that the utterance of an *if*-construction is addressing. We address this question at length in §3.2.2 while in 3.2.1.1 we establish the basic notions from the QUD model needed for our purposes. Our goal in this section is twofold: (i) we first address how Q is explicitly updated in context and, (ii) we address how participants identify what the current QUD/$top(Q_l)$ is when it is not explicit.

3.2.1.1 Q and utterances of interrogatives

Intuitively, the QUD stack/Q is an ordered set of questions (with new questions being added to the top of the stack). The current/immediate QUD in the context (the question participants are committed to addressing) is the question at the top of the stack, i.e. given the stack of questions in a context c, Q, the current QUD is $top(Q)$. While declaratives are proposals to update cs_F, interrogatives are proposals to update Q. Such stacks are familiar from earlier literature and we assume the standard *push*, *pop* and *top* operations on stacks (see Kaufmann 2000; Isaacs and Rawlins 2008), notating the empty stack as $Q = \langle\rangle$.[41]

Following Biezma and Rawlins (2017), we define an interrogative update ($\oslash$) to capture the effect of interrogatives on the context. Imagine that the utterance in the context is *what does John play?*, syntactically an interrogative denoting a set of propositions (the set of its possible answers). As such, its sentential force is to update Q. We first provide the definitions and exemplify in (51)

(49) $c + \ulcorner \text{Question}(\phi) \urcorner = \langle a_c, cs_c, Q_c, l_c \oslash \ulcorner \phi \urcorner \rangle$. **Question**
Constraints: a. $\mathscr{F}_c = \emptyset$; b. $l_c \oslash \ulcorner \phi \urcorner$ is felicitous (see (50)).

The effect of (49) is to change the projected context to the one that results from the interrogative update of the local context with the question. The operation is felicitous only if nothing was 'pending' earlier in the local projected context (i.e. $\mathscr{F}_c = \emptyset$) and the update of Q is relevant as defined in (50).

(50) Let l be a local context, $l = \langle a, cs, Q \rangle$, and ϕ and interrogative sentence denoting a set of propositions, $l \oslash \ulcorner \phi \urcorner = \langle a_l, cs_l, push(Q_l, [\![\phi]\!]) \rangle$, felicitous only if
  a. cs_l is compatible with $\{w \mid \exists p \in [\![\phi]\!] : p(w)\}$ (answerability)
  b. $[\![\phi]\!]$ is relevant to $top(Q_l)$ or $Q_l = \langle\rangle$. (relevance)

(51) $l \oslash \ulcorner \text{what does John play?} \urcorner = \langle a_l, cs_l, push(Q_l, [\![\text{what does John play?}]\!]) \rangle$ [Interrogative update]
Felicity constraints:
  a. cs_l is compatible with $\{w \mid \exists p \in [\![\text{what does John play?}]\!] : p(w)\}$. (answerability)
  b. $[\![\text{what does John play?}]\!]$ is relevant to $top(Q_l)$ or $Q_l = \langle\rangle$ (relevance)

The result of the interrogative update is to push the question to the top of the local QUD stack. If accepted, this will be the question that conversation participants are committed to answering. An interrogative update will only be felicitous if the context set is compatible with at least one of the propositions that are members of the question (an 'answerability' presupposition), and if the question move is discourse initial or is relevant to

[41] Given a stack s, $push(s,x)$ delivers the stack resulting from adding x to the top of s. Conversely, $pop(s)$ delivers a stack in which the top element of s has been removed. Finally, $top(s)$ just establishes what's the top element on the stack.

the question at the top of the local QUD stack Q_l. Relevance is invoked in defining both licensing conditions for the utterance of interrogatives and for assertions (the definitions below are adapted from the notion of Relevance in Roberts 1996[42]):

(52) **Question licensing**: a question is relevant in Q_c only if $Q_c = \langle\rangle$, or it is (part of) a strategy to answer $top(Q_c)$ (where a strategy is a sequence of subquestions that together answer a given question, Roberts 1996).

(53) **Answerhood licensing**: an assertion is relevant to $top(Q_c)$ only if it entails, either positively or negatively, the resolution of at least one alternative in $top(Q_c)$.

Relevance is an organizational principle of discourse that guarantees coherence: participants are assumed to be relevant when making a move. Even though responses are not always answers (since participants can opt out), when speakers do not in fact opt out, we interpret their responses as answers even if they are so only indirectly (and we actually arrive at an answer via pragmatic enrichment in an attempt to make the response relevant).

Questions in in the QUD stack (Q) can be eliminated, e.g. when they are resolved. A maintenance operation (Pop) does this by popping the QUD from the stack:

(54) $c + \ulcorner \text{Pop} \urcorner = \langle a_c, cs_c, pop(Q_c), \mathscr{F}_c \rangle$ **QUD resolution**
Constraints: a. $\mathscr{F}_c = \emptyset$ b. $Q_c \neq \langle\rangle$

The effect of Pop is a new QUD stack in which the QUD previously at the top has been eliminated. There are two constraints on this operation: there should be no previous updates pending evaluation (i.e. the projected context slot $\mathscr{F}_c$ should be empty), and the QUD stack itself should not be empty (there must be a question to pop). Once a question is resolved, it pops automatically.

3.2.1.2 Updating Q implicitly

The explanatory power of the QUD model comes from the predictions it makes about well-formed discourse structures, which crucially depend on the QUD being addressed. Different kinds of constraints guide participants in identifying the QUD when it is not explicit, and thus in identifying the speaker's intentions. Linguistic cues allow us to determine what the current QUD the speaker is trying to answer is when this is not explicit. The main cue is provided by the information structure of the utterance, in particular by focus.[43] More generally, focus helps to determine what is 'at issue' (the *main point* of the utterance, according to Potts 2005) and, hence, to identify what the current QUD is. However, what is at issue can also be encoded in the syntactic structure. This is what we argue happens in *if*-constructions (§3.2.2): upon the utterance of an *if*-construction, the *if*-clause very often establishes what the question addressed by the matrix clause is (the matrix clause presents the at issue meaning while the *if*-clause is not at issue). While this can be turned around in some cases, we argue in §3.2.3 that in the case of BCs the consequent is always at issue (provides the answer) to the question indicated by the *if*-clause. Before discussing the mapping of *if*-constructions to discourse, we start by providing an overview of how the relation of utterances to discourse plays out in our dynamic model in the general case.

Explicit questions and answers stand in a congruence relation: a sentence with a particular F(ocus)-marking can be the answer to a question whose meaning is formed by a set of live propositions resulting from substituting the focus element by other contextually salient alternatives (below we take prosody to mark what the focus constituent is). This explains intuitions on the contrast in (55):

[42] See Büring (2003) for a more relaxed notion of answerhood. The differences do not matter for our purposes.

[43] Following Rooth (1985, 1992), the focus constituent in an utterance is the constituent evoking alternatives relevant for the interpretation. Different languages conventionally mark constituents in different ways. In English, prosodic marking is very commonly used.

(55) A: Who plays soccer?
B_1: $[\text{JOHN}]_F$ plays soccer.
B_2: #John plays $[\text{SOCCER}]_F$

Appealing to the Roothian tradition (Rooth 1985, 1992, 1996) of associating both an ordinary semantic value ($[\![\cdot]\!]^o$) and a focus semantic value ($[\![\cdot]\!]^f$) with an utterance, the focus value of B_1's utterance is the set of propositions {that John plays soccer, that Susan plays soccer, ...}, while the focus value of B_2's utterance is the set {that John plays soccer, that John plays basketball...}. Even though the proposition that John plays soccer is relevant to the question of who plays soccer, B_2's move in (55) is not felicitous because the alternatives relevant for the interpretation it evokes (the focus alternatives) and the alternatives relevant in the context (the set of alternatives that make up the meaning of the question) do not align. That is, the focus-structure is wrong given the question asked. B_2's utterance in (55) is interpreted, contrary to fact, to provide an answer to a question of the form *what does John play?*[44]

This constraint in question-answer pairs is the *congruence constraint*, an information-structure constraint that modulates the relation between focus-marking (F-marking) in an utterance and the questions that the utterance answers:

(56) (Question-Answer) Congruence: An utterance U with F-marking answers a question containing ≥ 2 alternatives from the set $[\![U]\!]^f$.

Given Congruence, F-marking on an utterance is linked to alternatives corresponding a previous question, and is thus anaphoric to previous discourse (see Rooth 1985, 1992, 1996 and work after him, e.g. Roberts 1996). This anaphora guides conversation participants in the identification of the QUD when it is implicit.

Let us quickly illustrate the model at play with a simple example. Assume the utterance in (57) out of the blue (i.e. there is no explicit question this is an answer to).

(57) John plays $[\text{SOCCER}]_F$.

Given the Congruence constraint and focus marking, the utterance in (57) will be felicitous only if there is a question in discourse of the form *What does John play?* Incorporating Congruence into the model of dynamic update amounts to conveying that the utterance in (57) triggers the presupposition that the current QUD/$top(Q)$ is a question of the form *What does John play?* In the absence of an explicit question, this will need to be accommodated. Following Biezma and Rawlins (2017), accommodation is characterized as in (58):

(58) **Accommodation**. If φ presupposes ψ and ψ is not satisfied in l, first update l so that ψ is satisfied.

For our example in (57), this means that before proceeding with the dynamic update triggered by the utterance, participants need to accommodate that the question at the top of the stack is a question of the form *What does John play?*, (59a-i). Once this is done, we can proceed with the dynamic update of the declarative. The declarative proposes that the $cs_{F_{l_c}}$ in the context resulting after the accommodation be updated with the information that John plays soccer, (59a-ii). Upon acceptance, $top(Q'_c)$ is resolved and hence the question is popped ($pop(Q'_c)$). The resulting question stack is then as it was before the (declarative) move was made, (59b) ($Q_{c_2} = Q_c$) (details here are from Biezma 2019, 2020).

(59) Let $c = \langle a, cs, Q, \emptyset \rangle$ be the initial context:
a. $c + {}^{\ulcorner}\text{ASSERT}(\text{John plays } [\text{soccer}]_F)^{\urcorner}$

[44] In Rooth's framework this focus presupposition is formalized by making use of the '$\sim$' operator. We simplify here and do not introduce this additional formalism in an attempt to keep things as simple as possible. See Biezma (2019) for more details on the update process.

(i) Accommodate that the local context is $\langle a_c, cs_c, Q'_c\rangle = l'_c$ (Focus anaphora)
s.t. $Q'_c = push(Q_c, [\![\text{what does John play?}]\!]^o)$, i.e. $top(Q'_c) = [\![\text{what does John play?}]\!]^o$

(ii) Propose the update of cs_c (with the answer) (Assertion)
$\langle a_c, cs_c, Q'_c, \langle l_{c'} \oplus \ulcorner \text{John plays } [\text{Soccer}]_F \urcorner\rangle\rangle$
$l_{c'} \oplus \ulcorner \text{John plays } [\text{Soccer}]_F \urcorner = \langle cs_c \underset{\text{fact}}{\cap} [\![\text{John plays } [\text{Soccer}]_F]\!], Q'_c\rangle$

b. Acceptance: Accept the proposed future context and $pop(Q'_c)$:
$c_2 = \langle a_c, cs_c \underset{\text{fact}}{\cap} [\![\text{John plays } [\text{Soccer}]_F]\!]^o), Q_c, \emptyset\rangle$

While Q underwent some changes during the update, at the end of the process the only change we appreciate with the update of this simple declarative is in cs (there is no trace left of the intermediate accommodation of the question presupposed via focus anaphora).

Focus structure is one of the main cues to identify what the current QUD is (what is 'at issue'). While focus structure is often conveyed prosodically in English, this can also be done syntactically. This is what we observe in *if*-constructions, complex constructions with two clauses. How do speakers identify what is 'at issue' upon the utterance of an *if*-construction? Following previous literature, we argue below that in *if*-constructions the syntactic structure also conveys information of what is at issue. To make this precise, we need a more general notion of at-issueness. The characterization of a proposition as being *at issue* (the *main point* of the utterance, according to Potts 2005) depends on the recognized speaker's intentions regarding the QUD (*what is not-at-issue* is identified by opposition to what is at-issue). In Roberts's (1996) model, the QUD addressed by an utterance is identified with the not-at issue meaning of the utterance. More concretely, Simons et al. (2011) propose the following definition of at-issueness:

(60) Definition of at-issueness (Simons et al. 2011, pg. 323, ex. (26))

a. A proposition p is *at-issue* iff the speaker intends to address the QUD via the polar question with content proposition p, $?p$.

b. An intention to address the QUD via $?p$ is *felicitous* only if:
(i) $?p$ is relevant to the QUD, and
(ii) the speaker can reasonably expect the addressee to recognize this intention.

The characterization of a proposition as being 'at issue' thus guides the conversation participants in the identification of the QUD. Grammatical devices that contribute to identify what is or is not at issue contribute towards this goal. We discuss how this works for *if*-constructions in the following section where we address the mapping between *if*-constructions and discourse structure within the running model. Our proposal will appeal to Roberts's characterization of the QUD as 'not at issue' meaning of an utterance and will draw on 'Relevance' and 'Congruence' to capture the special effects associated with BCs.

3.2.2 Mapping *if*-constructions to discourse

In our proposal the key to an account of the 'special effects' obtained with BCs is a good understanding of how they map to discourse structure and the inferences that can be drawn from that mapping. Starr (2014b) already pointed out that the interaction between BCs and discourse is important in their overall interpretation (see also Ippolito 2016 for additional points). In this section we investigate the mapping of *if*-constructions to discourse, for both BCs and HCs, and exploit it as the source of the inferences triggered.

Our views regarding the mapping of BCs into discourse can be seen as a continuation of a tradition that has established a link between *if*-clauses and questions (see for example Larson 1985; Kayne 1991; Cheng and Huang 1996; Lasersohn 1996; Romero 2000 for links between conditionals and questions at the structural and at the interpretational level), which has seen recent developments in e.g. von Fintel (2001, 2009) on the topic of conditional perfection, Biezma (2011b,a) on optativity, Arregui and Biezma (2016) on backtracking, and Ippolito (2016) on the identification of premises relevant in the interpretation of counterfactuals. By characterizing the utterance of an *if*-construction as a complex discourse move involving

a question and its answer, our proposal appeals to constraints on discourse structure to derive the different 'flavors' of BCs discussed in the literature without a BC-specific semantics: these flavors are the result of pragmatic reasoning.

In considering our understanding of *if*-constructions, the literature has long recognized an asymmetry between antecedents and consequents in terms of information structure and discourse status. It has been argued since Haiman (1978) that the *if*-clause is usually understood as the *topic* of the utterance, with the consequent being the 'focus' (see also Ebert et al. 2014 a.o.). In terms of a theory of discourse as presented in §3.2, the *if*-clause would correspond to 'not at issue' content, to be characterized as the QUD in Roberts's model (as seen in (60) above). This means that when speakers map the utterance of an *if*-construction to discourse, the antecedent is by default understood as identifying the QUD that is addressed by the consequent ('at issue' content). Understanding that the consequent in an *if*-construction is what is at issue triggers a presupposition regarding $top(Q)$, identified by the antecedent. From this perspective, the utterance of an *if*-construction constitutes a complex move by which the speaker both sets up a QUD and answers it. In this sense, it overtly specifies the discourse question to which the answer is subordinated.[45] The mapping between *if*-clauses and QUDs (establishing what $top(Q)$ is), as well as the mapping between consequents and answers (addressing $top(Q)$), is considered a default mapping. It has been noted in the literature that both the context of utterance as well as linguistic devices (e.g. focus particles) can reverse the mapping (see a.o. von Fintel 2009, Biezma 2011b,a). However, as we will see in §3.2.3, only this default mapping to discourse is available to BCs.

What is the QUD set up by the antecedent *if*-clause? Le us consider first the semantics we have given: in terms of the semantics of an *if*-construction (*if* p, q), the consequent spells out a property common to all antecedent worlds: all antecedent worlds have the property of being worlds where the consequent is true. The QUD set up by the antecedent in *if* p, q will thus be about a property that all antecedent worlds (selected p-worlds) have. We can intuitively characterize it as *'What do the selected p-worlds look like?'* / *'What is true at the selected p-worlds?'*. In what follows we take the shortcut of paraphrasing the question as *what if p?*, although this is not always a suitable overt paraphrase and the overt question may also introduce additional inferences (see Rawlins 2010b; **?**). Here is a simple illustration of mapping to discourse with an HC *if*-construction (sketching the view that the question corresponds to the set of possible answers, modeled as propositions):

(61) *If p, q*
QUD: What do the selected worlds in which p is true look like? / $\{r$: for all selected p-worlds w, $r(w)\}$
Answer: They are q worlds./ q

(62) If it rains, I wear my hat.
QUD: What do the selected worlds in which it rains look like? ("What if it rains?")
Answer: I wear my hat.

As it stands, the question introduced by the antecedent appears very vague. The antecedent worlds have many properties, they 'look like' many different things. We certainly do not take an utterance of an *if*-construction to be a question about all of them (we do not take the proposition that I wear my hat in (62) to be the only true proposition in all the selected worlds in which it rains). However, constraints on discourse structure guide our identification of the specific QUD posed by the antecedent. This is because as well as spelling out the QUD and thus raising an issue, a speaker who utters an *if*-construction provides the

[45] That this is done via syntactic structure and not prosody (as seen in the example above in (57)) may seem odd, but *if*-constructions are not different from other linguistic devices that serve such purpose. See for example *Regarding the concern about adverse ecological impacts, AFCD advises that cropping activities could co-exist with conservation*. Other similar cases include *With respect to…*, *in relation to…*, which serve a similar purpose.

answer and thus the at-issue content. General constraints on discourse structure such as Relevance, as encoded in (53) and (52) above, and Congruence guide our interpretation allowing us to enrich the QUD. Understanding that the consequent provides the answer allows us to understand the speaker's intention in placing the question. For an example like (62), understanding that the information the speaker wears their hat solves the question raised by the antecedent allows us to understand that the intended question involved how the speaker is protected from the rain (*What do the selected worlds in which it rains look like in terms of how I protect myself from the rain?*) not just the general question what do the selected worlds in which the antecedent is true look like: by indicating that the consequent proposition is a possible answer and assuming that all answers in the denotation are related, we narrow down/can identify the meaning of the question. In this way, discourse felicity constraints allow us to recover the specific goals the speaker had in mind in setting up a (in principle) rather vague QUD.[46]

Let us consider now the case of BCs, beginning with the classic example:

(63) If you are hungry, there are biscuits on the sideboard.
QUD: What do the selected worlds in which you are hungry look like? ("What if you're hungry?")
Answer: There are biscuits on the sideboard.

As in the case of other *if*-constructions, the felicitous utterance of the BC requires that we understand that (discourse) Relevance is obeyed. That is, the consequent must provide an answer (if indirectly) to the question set up by the antecedent. As in the previous example, that the consequent provides an answer guides us in identifying the QUD - the issue that the speaker has the intention of addressing. The fact that the answer is a statement regarding where food can immediately be found by the addressee indicates that the antecedent is understood as a QUD regarding selected worlds in which the addressee is hungry and wishes to find food, presumably to remedy the problem of being hungry. The fact that the consequent is provided as an answer to that question allows it to be easily understood as a suggestion by the speaker that the addressee take the biscuits. The 'suggestion' flavor of the BC is derived from our efforts to reconstruct the consequent as a (discourse) relevant answer to the QUD posed by the antecedent. That the utterance of the BC is understood as a suggestion is not conventionalized, i.e. built into the semantics, of BCs, but arises as a case of pragmatic enrichment derived from independently justified constraints on discourse structure.

Many factors affect the inferences drawn regarding the consequent and contextual knowledge will play a very important role in the reconstruction of a relevance relation between antecedent and consequent, allowing the same *if*-clause to be used to introduce different issues (i.e. different sets of possible answers, which amounts to overall different QUDs). Imagine a scenario in which a patient is given a prescription for a drug that will make him hungry and a specific treatment has to be initiated when this effect manifests itself. Since it is very difficult to anticipate when that may be, the addressee is sent home until that moment arrives. The nurse tells the addressee:

(64) Go home, and if you are hungry in a couple of hours, the doctor's number is jotted on the prescription.
QUD: What do the selected worlds in which you are hungry and wish to communicate this to the doctor look like?
Answer: The doctor's number is jotted on the prescription.

Here, a different inference arises with the *if*-clause *if you are hungry*. The message is not that the doctor is

[46] The mechanisms at play are somewhat similar to those proposed in Roberts (1996); Büring (2003); Biezma and Rawlins (2012), where it is noted that a question may be followed up by a sub-question as a way of clarifying the speaker's goal regarding the original question, e.g. *How was your date? Was the food good?* vs. *How was your date? Was the man handsome?*. In the case of BCs, as well as HCs wit the default mapping to discourse, it is the answer to the question what allows us to identify the QUD targeted by the speaker, not a subquestion.

going to solve the hunger or that calling the doctor would solve it (nor that the patient eat the doctor's phone number!). Given the QUD recovered in this context, the consequent is interpreted in an entirely different way: as a command to call the doctor so the treatment can start as soon as the symptoms start manifesting themselves.

Given our proposal to link BC inferences to discourse-felicity, the immediate prediction is that the inferences we associate with BCs will be triggered with parallel discourse-structures that may arise with regular question-answer pairs. This is indeed borne out:

(65) A's father, B, is going out tonight:
B: I'm leaving!
A: Wait! You didn't prepare me any dinner. What if I'm hungry?
B: There are biscuits on the sideboard.
⇝ I suggest/allow you to eat the biscuits on the sideboard.

As (65) illustrates, the suggestion inference associated with the answer to the QUD arises independently of the BC *if*-construction. Indeed, it is possible to reproduce the observed range of BC inferences with discourses consisting of regular question-answer pairs (e.g. (67a)) or any other exchange in which similar goals can be reconstructed (e.g. (66), (67b)):[47]

(66) A: I'm hungry.
B: There are biscuits on the sideboard.
⇝ I suggest/allow you to eat the biscuits on the sideboard.

(67) If they ask you how old you are, you are four.
⇝ I command you to say that you are four
a. Son: Dad, what if they ask me how old I am?
Dad: You are four.
⇝ I command you to say that you are four.
b. Son: The ticket collector is coming.
Dad: You are four (remember).
⇝ I command you to say that you are four.

The fact that the types of inferences / flavors associated with BCs are similar to those that arise in parallel discourse configurations in spite of differences in structure suggests that a common discourse-level explanation can be found for the effects across the board (independently of the BC structure). A characteristic feature of the Relevance-triggered inferences in all such cases is that they appear to become part of the common ground and cannot (easily) be cancelled.[48] This is illustrated below. Suppose that A eats the biscuits following B's utterance in (68). It would be odd for B to scold her afterwards:

(68) A: I'm hungry.
B: There are biscuits on the sideboard.
[A goes to the kitchen and eats the biscuits.]

[47] That the conditional form gives rise to the same inferences as the distributed fragments has already been observed in (Starr 2014b, 18). There are, however, several differences between Starr's (2014b) proposals and the one in this paper. Most importantly, Starr establishes in the semantics of the *if*-constructions that the antecedent signals the question being addressed. It is not clear to us whether his proposal can be modified to allow for the required flexibility in the mapping between *if*-constructions and discourse necessary to derive cases of classic conditional perfection à la von Fintel (2009) (see example (71) below).

[48] See Biezma et al. (2012); Arregui and Biezma (2016) for a discussion on discourse manners and non-cancellable implicatures in conditionals and Lauer (2014) for a discussion on "mandatory implicatures" in general and why they result in infelicity or oddness if the implicature is known to be false.

B: You ate the biscuits!! #Why did you do that?!/# Who gave you permission?!

The inference could have been cancelled if it had been done right away: *If you are hungry, there are biscuits on the sideboard. But they are not mine, you should inquire whether you can eat them*. In this case, the speaker is making clear that even though they are reporting that there are biscuits on the sideboard, and conveying that they can potentially solve the hunger problem, they are in no position to decide what can be done with them and hence is cancelling the permission inference that would have been triggered otherwise. Crucially, the same is observed in (65) and (66): cancelation is possible if it is done right away, but not a while afterwards. If not cancelled, it becomes part of the update.

Notice that the fact that *if*-constructions have this additional discourse mapping makes BCs different from the utterance of the matrix clause alone: the utterance of the BC helps to establish relevance in a way that the utterance of the matrix clause alone can't. The following example (adapted from Franke 2009, pg. 275) illustrates the point:

(69) B has been helping A to pack for a trip by handing him stuff, and is obviously tired:

A: There are biscuits on the sideboard.
[B hands out the cookies to A who starts laughing. A explains that he was just suggesting that B eat them since he looks tired and sugar would do him good.]

Un utterance of the BC *if you are hungry, there are biscuits on the sideboard* would have also led to learning that there are biscuits on the sideboard and would have avoided the confusion. Notice that examples like this support the claim that the *if*-clause in BCs (and also in many non-BC*if*-constructions) helps to establish the QUD while the consequent presents the at-issue meaning (provides the answer).[49]

Our proposal links the interpretation of BCs to general theories of discourse coherence and pragmatic enrichment arising from the identification of the speaker's intentional goals. The proposal is that we should map BCs to discourse as a complex question-answer move and understand the associated inferences as enrichment in the same manner. We strive to build a relation between antecedent and consequent that will allow us to understand the consequent as an answer relevant to the QUD raised by the antecedent. When we are not capable of building such a relation, we find both *if*-constructions and question-answer pairs infelicitous (as expected). Consider the *if*-construction (from Sano and Hara 2014) and dialogue examples in (70):

(70) a. If France is hexagonal, there is beer in the fridge.

b. A: What if France is hexagonal?
B: There is beer in the fridge.

Imagine that we do not know whether France is hexagonal. Our interpretation of (70a) would normally be a BC-interpretation: our cs_F contains both worlds in which France is hexagonal and worlds in which it is not, and whether there is beer in the fridge or not will be factually independent (L only contains worlds in which these facts are traced to different bases). However, an utterance of (70a) (as well as B's response in

[49] Notice that this is not always necessary. That is, BCs are not only uttered when relevance needs to be established:

(i) A: Oh look at the weather! It's probably going to rain. Poor Betsy is still out there. She will get completely soaked.
B: Don't worry. She has her umbrella.
A: But the poor child! This is terrible! Dreadful!
B: Stop exaggerating. If it rains, she has her umbrella.

B's point in uttering the BC is to emphasize that Mary has her umbrella. Relevance was already established and the speaker could have uttered the declarative alone, but by uttering the *if*-construction the speaker further makes the point that the question 'what if it rains?' has already been fully answered by the statement that Betsy has her umbrella and is time to move on (the matrix clause is intended to convey an exhaustive answer).

(70b)) would be infelicitous in most contexts (though even in those contexts the addressee would learn that there is beer in the fridge, regardless of their perplexity). Why? Sano and Hara 2014 leave the question of infelicitous BCs unanswered. The reason for the infelicity, according to our proposal, is that it is very hard to understand how that there is beer in the fridge can be understood as providing an answer to the question it is taken to address: *What do the selected worlds in which France is hexagonal look like?* (no matter how hard we try with pragmatic enrichment). Of course, with the right context, it could work. Imagine that we are playing a game in which you have to guess the various shapes of countries and beer is the prize that will be in the fridge if you get them right. In this scenario, the examples in (70a) and (70b) become felicitous.

Our discussion so far has focused on inferences regarding the status of the consequent in BCs. We have noted that the range of possible inferences is quite rich (permissions, commands, suggestions, etc.) and that they can be rather indirect, depending on our ability to reconstruct a relation of relevance between the consequent and a QUD posed by the antecedent (note that while we have appealed to relevance, the issue of how the relevance relation itself is built is beyond the scope of this paper). In our proposal, indirect speech acts are derived by a mechanism of pragmatic enrichment. There are potentially different ways to spell this out (e.g. within Asher and Lascarides's (2001) discourse relations framework or in a decision theoretical approach). While we do not commit to a specific proposal here, we favor an approach to indirect speech acts that makes use of tools from decision theory (see van Rooy 2003; Benz and van Rooij 2007; Benz 2006 and especially Stevens et al. 2014). According to these proposals indirect speech acts have to be considered as indirect answers that pertain to decision problems. We take the central insight to be that preferences that are elements of agent's goals are a central element in deriving the specific force of an utterance, which is e.g. implemented in **?**. In a slightly different setting, this insight is also used in Condoravdi and Lauer (2011, 2012, 2017) to derive the different forces of imperatives. In a dynamic setting, Murray and Starr (2018) have also pointed to the role of preferences in deriving force. (While we cannot go into this issue further here, see Goebel (2019) for an elaboration on the mechanism of pragmatic enrichment in BCs.)

Let us point out that inferences also arise regarding the status of the consequent in the case of HC *if*-constructions '*if p*, *q*', in which we infer that the antecedent and consequent are dependent. In such cases, the inference that is triggered may be that *q* is a consequence of *p* (as in (62)). Given that the dependence relation is the result of our assumptions about factual dependencies, the inference of dependence (e.g., causality) is easier to arrive at and impossible to avoid. In the case of BCs, inferences are less 'direct': given that we discard a factual dependency relation between antecedent and consequent, we need to build a discourse relevance relation between the question presented by the antecedent and the answer provided by the consequent by taking into account the utterance situation and our assumptions about the likely goal the speaker may be pursuing.[50]

[50] Ippolito (2016) also considers the mapping of BCs into discourse and their differences in interpretation with HCs in a short note on relevance conditionals, although her overall proposal is rather different. Ippolito (2016) proposes that *if*-constructions of the form *if* ϕ, ψ address a 'conditional question' of the form *if* ϕ, Q?, where ψ is a possible answer to Q. The BC in (1), for example, is taken to address an ongoing QUD that can be paraphrased by 'If you are hungry, is there anything to eat?'. The BC addresses this question by offering the 'premise' in the consequent that, indirectly, answers it. It is not clear to us how this question is identified in Ippolito's system, i.e. what are the conventional cues in the information structure of the utterance identifying that such is the inquiry being addressed, which is essential within the QUD model. In addition, given the arbitrary choice of question, it is not clear to us how this system would account for cases of 'classic' conditional perfection in HCs like (71), or cases of 'biscuit perfection' (see Biezma and Goebel 2016), which are explained by assuming a mapping to discourse that does not involve conditional questions but a classic information-structural division of labor between antecedent and consequent like the one explained above and adopted in this paper. Indeed, as we will see, classic conditional perfection require the system to be flexible enough to allow the opposite mapping, one in which the consequent provides the QUD and the antecedent provides the answer. In addition, Ippolito (2016, 56) also aims to offer an explanation as to why some *if*-constructions have a 'causal' interpretations while others don't: "The proposal that I would like to make is that the difference between causal and non causal counterfactuals lies in their relation to the [QUD]. A causal counterfactual answers the [QUD] *directly*, whereas a non-causal counterfactual answers de [QUD] *indirectly* by spelling out a premise assuming which the [QUD] is then answered." In our system, causality is also an inference, but it does not result from the utterance providing a direct answer. In our account, that the HC is taken to provide a *direct* answer to a QUD is the byproduct

3.2.3 The other mapping

We have accounted for the special flavors of BCs on the basis of a default mapping for *if*-constructions according to which the consequent answers a QUD posed by the antecedent. However, there being a default does not rule out other options. So far, nothing prevents *if*-constructions with independent antecedent and consequent from having a different mapping to discourse. To claim that the default mapping is one in which the *if*-clause introduces a QUD merely means that in order to obtain a different mapping, one in which the at-issue content is the proposition denoted by the *if*-clause, we would need help from context (von Fintel 2009) or, alternatively, to force it linguistically, e.g. by using focus particles (Biezma 2011a,b). The following example illustrates the former strategy:[51]

(71) A: When would you give me $5?
B: If you mow the lawn, I'll give you $5.
⇝ If you don't mow the lawn, I won't give you $5.

In (71) the context establishes that we are wondering about the circumstances in which B receives $5, and hence the QUD is in the consequent. Following von Fintel (2009), when the antecedent is understood as providing an exhaustive answer to the consequent question, we obtain (classic) perfection, i.e. a strengthening inference that the antecedent provides not just sufficient conditions but also necessary conditions.[52]

What about BCs? It has been already claimed in the literature (without further explanation) that BCs do not trigger classical inferences of conditional perfection (Francez 2015). Why is this? The answer, in short, and assuming that classic perfection is triggered as proposed by von Fintel (2009), is that BCs can never convey exhaustive answers to such questions: given that in BCs we conclude that the consequent is true (and hence cs_F only includes worlds in which the consequent is true), even if an *if*-construction with BC interpretation were felicitous as an answer to a question about the consequent, the antecedent could never be understood as providing the only circumstances in which the consequent is true. Hence, classic perfection could never be obtained.

That BCs do not perfect only means that the answer provided by the antecedent could not be interpreted exhaustively, not that the mapping of BCs to discourse would not be one in which the antecedent provides the answer to a QUD introduced by the consequent. So, why wouldn't BCs allow the non-default mapping into discourse? Given that non-BCs allow for this mapping to discourse, the answer should be obtained from the particularities of *if*-constructions when they are interpreted as BCs, i.e. from the fact that antecedent and consequent are taken to be factually independent and from the fact that the context update by the consequent in BCs affects the entire context set and is not limited to the temporary context in which there are only antecedent-worlds.

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of there being a dependence relation between antecedent and consequent.

Overall, Ippolito (2016) is not devoted to BCs but aims to explain how context dependence allows us to identify the premises relevant in the interpretation of counterfactuals. We leave for future research the investigation of her claims with the mapping between *if*-constructions and discourse proposed here.

[51] It is not clear to us why the default mapping is one in which the *if*-clause introduces the QUD. It may be due to the fact that the antecedent is the restrictor of the modal, and restricting the domain of quantification is usually thought as previously agreed upon. Alternatively, it may be the result of understanding the main clause as usually conveying the main-point of the utterance (the at-issue meaning), while adjuncts are more easily understood as constraining the main claim. What is important is that this is a tendency, not something that is conventionally indicated by the linguistic form, and hence it can be transgressed.

[52] Given our view that discourse-driven effects can replicate across constructions, it is interesting to see that we find instances of 'perfection' in other types of quantificational statements (not only conditionals). Consider (i) (from the movie *Logan*, 2017):

(i) A: Everyone I care about dies.
B: Well, then I should be perfectly safe.

In B's response we understand that they have perfected A's claim to understand that only the people A cares about dies.

Let's start by establishing what would be the QUD that the utterance of a BC *if p*, *q* would be addressing if we were to assume that the mapping were the non-default one. Given the semantics of *if*-constructions, the QUD would be asking 'what are the propositions *p* such that for all selected worlds in which *p* is true, *q* is true?' There are in principle different propositions. This is the reading that we paraphrase by *when q?*, and this is the reading we take the question in (71) to encode. (Notice however that this linguistic counterpart of this specific (discourse) inquiry may not always be suitable, as noted above with the "what if?" paraphrase.) Let's imagine the spelled out question/answer pair that the non-default mapping of the *if*-construction would indicate:

(72) A: When are there biscuits on the sideboard?
B: #If you are hungry, there are biscuits on the sideboard.

When what we want to learn is which worlds are such that there are biscuits on the sideboard, it is relevant to learn whether in all worlds in the selected domain (cs_F) there are biscuits on the sideboard or whether that is not the case, and if the latter, it is relevant to learn what are the worlds in which there are biscuits on the sideboard. The response (which can be paraphrased roughly by "the (selected) worlds in which you are hungry are worlds in which there are biscuits on the sideboard") only provides the information indirectly, i.e. we only learn that all the worlds are such that there are biscuits on the sideboard via the strengthening process observed in BCs that we described above. The only advantage of uttering the *if*-construction in (72) over the bare matrix clause plainly stating that there are always biscuits on the sideboard is to provide further information regarding the context set, i.e. providing the information that in particular the worlds in which you are hungry are worlds in which there are biscuits on the sideboard, but this is not information that was asked for or that is necessarily relevant to the addressee to begin with. The plain declarative *there are biscuits on the sideboard (right now)* would have been enough. We can then convey the same information in a simpler way without anything being gained by uttering the more complex form. In this situation the more complex expression is blocked (this can be derived in a number of different ways within a neo-Gricean framework, see Potts 2006 and references therein, and see Biezma et al. 2012; Lauer 2014; Nouwen 2015 for a similar argument).

3.2.4 The mapping of *if*-constructions in a dynamic model

We overviewed above in §3.1 the dynamic carried by HCs and BCs without considering the (implicit) update of *Q*. The discussion in §3.2.2 and §3.2.3 led to the conclusion that in uttering a BC the speaker is addressing the (implicit) question set up by the antecedent while the matrix clause addresses that question. In the case of HCs, this is the default mapping of *if*-constructions to discourse, but it can be reversed sometimes. One important claim is that the overall meanings arising from HCs and BCs (be it, e.g., causality in HCs or permission, order, suggestions in BCs), if there are any, arise from understanding the interaction between the question set up and the answer. To simplify matters, we do not attempt to represent here the full update and only consider the information gain that the speaker, e.g., made a suggestion (or, in the case of HCs, that the speaker, e.g., considers that the antecedent causes the consequent). For our purposes we need to represent how what triggers that inference (i.e., that it is result of the discourse presupposition triggered by information structure that there is a question that participants have accepted to address, and the actual addressing of such question, as discussed in §3.2.1, §3.2.2 and §3.2.3), as well as representing that participants incorporate the information that the speaker made a suggestion. This is, however, incomplete. Future research should address how the suggestion itself updates the context.[53] We illustrate the complete

[53] Commands, suggestions or advises are proposals to update an element we have not introduced in the toy model used here: participants' preferences (see e.g. Starr 2016). Developing all the details here goes beyond the scope of this paper and is left here for future research. It suffices to us to encode the *cs* update triggered by the manifest event. We can accept both the information and the suggestion made, but things are more complicated. A full model for the dynamic update should be able to derive that while participants learn that a suggestion has been made (unless this is cancelled immediately), the suggestion itself can be rejected while

update with a BC in (73).

There were two steps missing in (47) above, where we already addressed the strengthening process of the *if*-construction claim due to the Mirror Constraint. The first one is the accommodation of the presupposed QUD that the utterance of the *if*-construction addresses (in the case of BCs the one set up by the antecedent; recall that we express the QUD posed by *if*-clauses as a *what if?* question; see discussion in §3.2.2 how this question does not correspond to the actual utterance of *what if* questions). This is (73a). The second one is the inference triggered by reasoning on how the matrix clause addresses the QUD in the context via relevance, (73f). The relevance update of cs is global[54] and will take place even if the proposal is rejected, e.g., one may protest that there are biscuits on the sideboard and reject the claim, but that the speaker suggested that the addressee eat the biscuits happened (see ftn. 54) and it doesn't need to undergo the acceptance process. Notice that while we have placed this update after acceptance in (73), it could have been placed earlier without any overall difference to the final result. At this point, considering that the question has been addressed, a maintenance operation takes place and the question on the top of Q is popped (since it has been solved). If the QUD had been accommodated, the result is the original (prior to accomodation) Q_c, (73g).

(73) $c + \ulcorner$ASSERT (if you are hungry, there are biscuits on the sideboard)$\urcorner =$
$c + (\ulcorner$ASSUME (you are hungry)$\urcorner + \ulcorner$ASSERT (there are biscuits on the sideboard)$\urcorner) =$
$\langle a_c, cs_c, Q_c, (l_c \oslash \ulcorner$you are hungry$\urcorner) \oplus \ulcorner$there are biscuits on the sideboard$\urcorner\rangle$

a. **Accommodate** that the local context is $\langle a_c, cs_c, Q'_c\rangle = l'_c$ (discourse mapping)
s.t. $Q'_c = push(Q_c, [\![\text{what if the addressee is hungry?}]\!]^o)$, i.e. $top(Q'_c) =$
$[\![\text{what if the addressee is hungry?}]\!]^o$

b. $l'_c \oslash \ulcorner$you are hungry$\urcorner = l''_c = \langle a_c \cap [\![\text{you are hungry}]\!], cs^r_c, Q'_c\rangle$ where $cs^r_c = \langle cs^r_{F_c}, L_c\rangle$ and
$cs^a_{F_c} = \{cs_{F_c} \cap \overline{[\![\text{you are hungry}]\!]}, cs_{F_c} \cap [\![\text{you are hungry}]\!]) = \{cs^r_{F_{c_{passive}}}, cs^r_{F_{c_{active}}}\}$;
felicitous only if $[\![\text{you are hungry}]\!]$ is compatible with cs_{F_c}; posterior updates only operate on $cs^r_{F_{c_{active}}}$

c. $l''_c \oplus \ulcorner$there are biscuits on the sideboard$\urcorner =$
$\langle a_c \cap [\![\text{you are hungry}]\!], cs^r_c \cap [\![\text{there are biscuits on the sideboard}]\!], Q'_c\rangle$
felicitous only if $[\![\text{there are biscuits on the sideboard}]\!]$ is compatible with $cs^r_{F_{c_{active}}}$ and the mirror constraint is obeyed;
$cs^r_c \cap [\![\text{there are biscuits on the sideboard}]\!] = \langle cs^r_{F_c} \cap [\![\text{there are biscuits on the sideboard}]\!], L_c\rangle$;
$cs^r_{F_c} \cap [\![\text{there are biscuits on the sideboard}]\!] =$
$\{cs^r_{F_{c_{\text{passive}}}}, cs^r_{F_{c_{\text{active}}}} \cap [\![\text{there are biscuits on the sideboard}]\!]\} =$
$\{cs_{F_c} \cap \overline{[\![\text{you are hungry}]\!]}), cs_{F_c} \cap [\![\text{you are hungry}]\!] \cap [\![\text{there are biscuits on the sideboard}]\!]\}$

the information that there are biscuits be accepted, (iB_1). We can also accept the suggestion to solve the hunger by eating biscuits while rejecting the information that there are biscuits on the sideobard, (iB_2):

(i) A: If you are hungry, there are biscuits on the sideboard.
B_0: Thanks! I really need to eat something.
B_1: I saw them, but they are Jane's! She may be reserving them for something.
B_2: Thanks for the suggestion, but they are not on the sideboard anymore. I'll ask Jane where she put them.

To build a model that predicts these possibilities would complicate matters greatly and goes beyond the scope of this paper.

[54] By establishing the QUD and its response with an *if*-construction, the speaker triggers an inference knowing that the addressee is going to recognize it. Utterances are manifest events of the speech kind (see e.g. Stalnaker 2014 for discussion) and the inference triggered (if not immediately cancelled) can be taken to automatically update *cs* globally. For example, after the utterance of *if you are hungry, there are biscuits on the sideboard* addressed to a kid that we take to be looking for a snack, the automatic update is that the speaker suggested that the kid eat biscuits to calm their hungry. While we take it that this is right, this is certainly not the whole story (see the concerns expressed in ftn. 53).

[Given the mirror constraint, the update is widen: $cs^a_c \underset{\text{wide}}{\cap} [\![\text{there are biscuit on the sideboard}]\!]$, see discussion in §3.1]

d. Acceptance: $c_2 = \langle a_c \cap [\![\text{you are hungry}]\!], cs^r_c \underset{\text{wide}}{\cap} [\![\text{there are biscuits on the sideboard}]\!], Q'_c, \emptyset\rangle$

e. $c_2 + \text{AsPop} = \langle W, \underset{\text{unmark}}{\bigcup} cs^a_{c_2}, Q_{c_2}, \emptyset\rangle$

f. **Relevance inference**: The speaker suggests that addressee eats biscuits to solve the hunger ($= p$):

$$c_2 + \text{Inference} = c'_2 = \langle W, cs_{c_2} \cap p, Q_{c_2}, \emptyset\rangle$$

g. **QUD resolution**: $c'_2 + \ulcorner\text{Pop}\urcorner = \langle W, cs_{c_2} \cap p, pop(Q_{c_2}), \emptyset\rangle = \langle W, cs_{c_2} \cap p, Q_c, \emptyset\rangle$

At the end of the update we have learned both that there are biscuits on the sideboard (informational update) and that the speaker is suggesting that one eats the biscuits to solve the hunger (relevance update). Notice that the relevance update takes place independently of whether we accept or reject the proposal made by uttering the *if*-construction. At the end, the speaker made that suggestion even if we challenge it later on (see ftn. 53). In the case of an HC like *if it rains, we cancel the picnic*, the relevance update would be that the canceling of the picnic is due to the rain. It would be, in any case, the result of relevance.

3.3 Interim conclusion

We have accounted for the 'inferences puzzle' by arguing that inferences triggered by the utterance of *if*-constructions (whether they are permission, orders, etc. in BCs, or causality in HCs) are the result of the mapping into discourse as well as considerations regarding the relation between the antecedent and the consequent. We have seen that the same inferences are triggered when we have the equivalent question/answer pair.

The recurring underlying claim in the previous section has been that discourse mapping provides a species of discourse-subordination. Given the lack of dependence between antecedent and consequent (or rather, the presupposition of independence), what we learn from the utterance is the quantificational claim conveyed in the semantics of the *if*-construction and the additional inferences provided by discourse interpretation.

4 Comparison with syntactic-driven accounts of BCs: V2, *Then* and commands

There are several proposals in the literature that argue that the interpretation of *if*-constructions is guided by syntactic clues (see Köpcke and Panther 1989; Ebert et al. 2014). This work is supported by data found in German, a V2 language, where it appears to be a syntactic difference between BCs and HCs (examples from Ebert et al. 2014):

(74) Wenn Du mich fragst, was ich von Dir denke, (dann) bist Du ein Idiot.
if you me ask what I of you think then are you a idiot
'If you ask me what I think of you, then you are an idiot.'

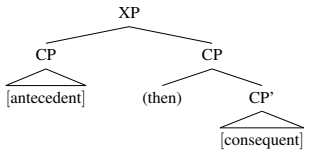
(75) Wenn Du mich fragst, was ich von Dir denke, Du bist ein Idiot.
if you me ask what I of you think you are a idiot
'If you ask me what I think of you, you are an idiot.'

Ebert et al. (2014) (henceforth EEH) argue that the interpretation of (74) is unambiguously that the speaker's attitude depends on whether the addressee has asked what is thought of him, whereas (75) always conveys that the speaker thinks that the addressee is an idiot (independently of whether he asked or not). Crucially, in (74) the consequent exhibits V1 (i.e., German is a V2 language and in (74) the verb is the first word of

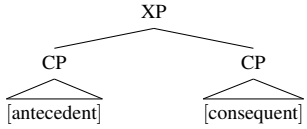
the consequent, making the antecedent to count as the first constituent of the clause), whereas in (75) the consequent has the verb as the second word, indicating that the consequent is syntactically detached from the antecedent and forms an independent clause. Looking at this difference, EEH propose a unified account of the interpretation of *if*-constructions that generates the differences between BCs and HCs by assuming two different LFs. In EEH's proposal, all *if*-constructions have an interpretation in which the *if*-clause is analyzed as introducing a discourse referent by performing a referential speech act (a speech act that introduces a discourse referent) while the matrix CP introduces a different speech act (either an assertion, a question, etc.). The difference between BCs and HCs is at the level of integration between the two speech acts (encoded in their different LFs): in the case of BCs, the antecedent and the consequent are claimed not to have any further (interpretative) relation than the fact that they are uttered consecutively, whereas in the case of HCs the discourse referent is an argument of the interpretation of the consequent, i.e. the relation between antecedent and consequent in HCs is that of predication (the reader is referred to EEH for further details).

EEH assume that what we observe in German is also what we find in English. According to EEH, the fact that BCs and HCs also have a different LF in English can be seen in the distribution of *then*, which is claimed to be possible in HCs but not in BCs. EEH assume that *then* is merely a proform (following the literature that treats conditionals as correlatives, see Bhatt and Pancheva 2006 for an overview) and its presence/absence at LF (*then* can also be covert) determines whether the consequent is evaluated in the worlds introduced by the antecedent or in the actual world. In EEH's approach *then* merely indicates that the worlds of evaluation of the consequent speech act are the worlds in which the antecedent is true and its presence is what delivers the HCs. EEH propose the following LFs for HCs and BCs (leaving out the speech-act operators):

(76) HCs



(77) BCs



In BCs the speech act introduced by the consequent is semantically independent from the referential speech act in the antecedent, i.e. there is no (covert) *then*, and hence the truth of the consequent is independently asserted from the truth of the proposition in the antecedent.[55]

EEH extend their proposal regarding the data from German to other languages, concluding that in languages like English it is also the case that there are two LFs available, with different levels of syntactic integration, and that the interpretation of *if*-constructions as BCs correspond to the LF with less integration.

It is easy to see how EEH's account would derive that the content proposition in the consequent is updated in the entire context set (consequent entailment), since the speech act of the consequent is performed in the actual world and not in the worlds identified by the antecedent. In addition, in EEH's proposal different flavors in BCs arise by stipulating different speech act operators heading the clause.

4.1 Word order is not a definitive criterion

A prediction from EEH's proposal is that all V2 *if*-constructions are interpreted as BCs whereas all V1 are interpreted as HCs. However, as it has been pointed out in the literature, this prediction is not borne out (see Köpcke and Panther 1989; Franke 2009; Csipak 2015, a.o.). The (b) examples below are V2 *if*-constructions with HCs readings just like the reading of their V1 counterpart in (a) (examples below are from Köpcke and Panther 1989; Franke 2009 and Csipak 2015 respectively):

[55] EEH also link the presence of *then* to 'causality' in passing, but they do not explain where the 'causal' meaning is coming from: *then* is only a proform in their account.

(78) a. Wenn er das erfährt, gibt es Ärger.
if he this realizes gives it trouble
b. Wenn er das erfährt, das gibt Ärger.
if he this realizes it gives trouble
'If he finds this out, there will be trouble.'

(79) a. Wenn du auch nur in die Nähe, meines Autos kommst, spuck ich dir in deine Suppe.
if you also only in the vicinity my car come spit I you in your soup
b. Wenn du auch nur in die Nähe, meines Autos kommst, ich spuck dir in deine Suppe.
if you also only in the vicinity my car come I spit you in your soup
'If you come anywhere close to my car, I'm going to spit in your soup'

(80) a. Wenn du ihm davon erzählst, hau ich dir eine.
if you him about tell beat I you one
b. Wenn du ihm davon erzählst, ich hau dir eine.
if you him about tell I beat you one
'If you tell him about it, I'll beat you!'

The fact that German speakers have no problem understanding the V2 constructions above as HCs indicates that the interpretation of *if*-constructions as HCs or BCs is not tied to the syntactic structure (and hence to different LFs). In fact, we can also find the flip side of the coin, cases of V1 *if*-constructions with BC interpretations:

(81) a. Wenn du Hunger hast, da ist Pizza im Kühlschrank.
if you hunger have there is pizza in the fridge
b. Wenn du Hunger hast, ist da Pizza im Kühlschrank.
if you hunger have is there pizza in the fridge
'If you are hungry, there is pizza in the fridge.'

Notice also that the V1 and V2 alternation only applies to declarative matrix clauses. In interpreting *if*-constructions with a question in the matrix clause we cannot rely on such alternation, (83). This is puzzling for EEH's theory given that in German, as in English, it is possible to raise a question by using a rising declarative, (82), and one would expect that this could be exploited to encode BC reading, but that is not borne out. *If*-constructions with questions do not depend on word order to be identified as BC-questions, as shown in (85), where we necessarily find V1 order but a BC-question interpretation.

(82) a. Bleibst du zu Hause? Interrogative clause
stay.2.sg you at home
'Do you stay at home?'
b. Du bleibst zu Hause? Rising declarative
You stay at home?
'You stay at home?'

(83) a. Wenn John verreist, bleibst Du zu Hause?
if John travels stay.2.sg you at home
b. *Wenn John verreist, Du bleibst zu Hause?
if John travles you stay.2.sg at home
'If John goes on a trip, do you stay at home?

(84) If I'm hungry, is there pizza in the fridge?/ there is pizza in the fridge?

(85) a. Wenn ich Hunger habe, Gibt es Pizza im Kühlschrank?
if I huger have give.3sg it pizza in fridge

b. *Wenn ich Hunger habe, es Gibt Pizza im Kühlschrank?
if I huger have it give.3sg pizza in fridge
'If I'm hungry, is there pizza in the fridge?

The conclusion from this section is that word order does not determine whether an *if*-construction is a BC or an HCs. Word order does not dictate the reading obtained. It seems that in these cases, the only thing we have to go on is the dependence relation between antecedent and consequent, or the lack of it.[56] This said, explaining why V2 in German *if*-constructions have a preferred interpretation as BCs is a very interesting question, but one that is beyond the scope of this paper.

4.2 *Then* is possible in BCs

It has been repeated in the literature that one way to distinguish whether an *if*-construction is a HC or a BC is to see whether it is possible to add *then*. The claim in the literature is that *if*-constructions with a HC-interpretation can have *then*, but that this is not the case with BCs. In EEH's account, (covert) *then* is a proform that links the antecedent proposition to the matrix clause by establishing that the worlds in which the matrix clause is interpreted are the worlds in which the antecedent is true.[57] This interpretation needs to be avoided in order to obtain a BC reading in their system.

A problem arises for EEH's proposal because, despite the often repeated claim, *then* is actually possible in BCs, though there is variability in acceptance. Some English speakers agree with the claim that (86) is marked while its *then*-less version is perfectly fine. However, other English speakers have no problem accepting (86).

(86) If you are hungry, then there are biscuits on the sideboard.

Speakers who accept (86) take away similar information as the one extracted from the *then*-less *if*-construction: the speaker uttering (86) is informing the addressee of the fact that there are biscuits on the sideboard in case they wanted to eat some. These speakers concede that the magical reading in which biscuits will appear as the result of your being hungry could also be conveyed by uttering (86). This reading is however discarded on the basis of implausibility (it would, of course, be possible in a magical world such as a Harry Potter movie). The paraphrase speakers provide to the utterance of (86) is as follows: I am giving you the information that there are biscuits on the sideboard because you may be hungry. This is the paraphrase that is most easily obtained for (87), which even speakers who find (86) marked find perfectly acceptable:

(87) Well, if you insist on knowing my opinion, then I think you are making a mistake marrying that guy.

And here is another example from Davies (2011-):

(88) Steffy: Well, **if that's it, then I am late for another meeting, so...**
Hope: Yeah, I think we covered just about everything.

[56] EEH offer the following example of a BC question:

(i) If I may ask a stupid question, did Miles Davis ever play in a combo that was led by Thelonious Monk?

In justifying that (i) is a BC they argue that "the speaker is not just asking for the truth of the proposition Miles Davis played in a combo led by Thelonious Monk in the maximal plurality of worlds where she may ask a stupid question, but she performs this question unconditionally in the actual world." Notice that this explanation has nothing to do with syntax or how the processor identifies that syntactically the *if*-construction is a BC. In fact, the speaker has no way of telling via the syntax whether the question is to be understood as a BC or a HC.

[57] Notice however that, even though EEH only treat *then* as a proform, they also make a connection between the presence of *then* and causality (see EEH pg. 374). Nothing is said, however, about how the causal meaning is brought about.

Steffy: Okay. (SOAP)

In (87) and (88) we do not have a HC: we do not understand that the proposition in the antecedent and in the consequent are dependent. We also take away that the consequent proposition is true across the board. Both are BCs according to our theory, and we think this is a welcome result since it allows us to explain similarities between utterances like (87) and (88) and their *then*-less counterparts. What *then* does in these examples is to bring about the meaning that "my (discourse) move of stating that you are making a mistake is the result of your insistence on knowing my opinion" in (87),[58] and that "my (discourse) move of stating that I'm late for another meeting is the result of the understanding that we have already finished our current meeting and this is the reason why I'm leaving right away" in (88). This reading, that the speaker's move is the result of the antecedent being true, can be cashed out with an account for *then* along the lines of Biezma (2014). In Biezma (2014) *then* is a discourse marker indicating that two elements are in a 'causal explanatory claim'-relation in which one (the antecedent) provides the 'reasons' for the other (the consequent). These two elements can be the propositional content of the antecedent and consequent of the *if*-construction or the making of the particular (discourse) move. This proposal can be implemented in the model of factual dependencies spelled out in §2 and allows us to explain that 'then' signals a 'causal' relation when there is a factual dependence relation between antecedent and consequent, but has to relate different elements when there is no factual dependence relation. *Then* can be used to indicate that the subsequent move (e.g. that the speaker is saying that they think that you are making a mistake) is the consequence of/ explanatorily linked to something discursively preceding it (e.g., in (87) what precedes it is the assumption that you insist on knowing their opinion). Notice that this means that *then* is possible when we can rescue that interpretation, regardless of considerations about whether antecedent and consequent propositions are or not factually dependent and, hence, of the interpretation of the *if*-construction as BC or HC.

Much more needs to be said regarding *then* and speaker variability, which we must leave for future research. What is important for us is that the availability/impossibility of *then* is not a deal breaker to determine whether the *if*-construction is or not a BC, and this is a problem for EEH's proposal. The proposal presented in this paper allows for enough flexibility to make the right predictions: whether the *if*-construction is taken to be a BC or a HC is related merely to the participants presuppositions regarding the (in)dependence of the propositional content of antecedent and consequent.

4.3 Utterances with command inferences and no imperative form

One of the most problematic examples for a speech act theory of BCs is (3) (Siegel 2006):

(3) If they ask you how old you are, you are four.

The problem presented by the example is that it can be uttered in a context in which all participants are aware of the fact that the addressee is not four (imagine, for example, that (3) is uttered by a father, who doesn't want to pay the mandatory bus fare for kids older than four, to his kid, the addressee).

Siegel (2006) used the example in (3) to argue against previous accounts proposing that BCs entail the consequent, and was a direct criticism against theories arguing that the consequent presents a speech act that is performed (see e.g. DeRose and Grandy 1999; Ebert et al. 2014).[59] However, EEH claim that the speech act performed by the consequent is a command, explaining this way also the overall interpretation. EEH's

[58] The HC interpretation could also be brought about with this utterance, namely that my thinking that you are making a mistake is the result of you wanting to know my opinion, and we can design contexts in which this is available, but the point here is that the most prominent reading in uttering these *if*-constructions with *then* is similar to what we obtain in the *then*-less utterance and we arrive at it by considering the propositional content in the antecedent and matrix clause and their dependence relation or lack of it.

[59] McCready (2014) also argues that BCs and HCs have different semantics and that, unlike in HCs, in BCs the consequent is asserted. Support for this claim, he argues, comes from the contrast between (i) and (ii):

(i) If a farmer owns a big piece of property, he usually keeps a donkey. #It lives a free and easy life.

proposal is that we interpret that the consequent is a command because at LF there is a COMMAND speech act heading the consequent. In (3) we understand that the order is that the addressee say that they are four.[60]

There are several concerns regarding this approach. First of all, in EEH's account the prediction is, counter to speakers' intuitions, that the addressee would fulfill/ comply with the suggestion only if they go on and tell the ticket-collector that they are four, not only if/when they are asked. This is so because the only function of the antecedent is to draw the addressee's attention towards the worlds in which the antecedent is true, but the command (in EEH's proposal) is to be fulfilled in the actual world.

A second problem arises regarding what the speech-act operator would look like. Let us look at the example in (89):

(89) If they ask you how old you are, you are at most four.

The interpretation of (89) in most contexts is not that of a command/request to the addressee to say that they are at most four, but a command not to say that they are an age above four. If we want to use a single COMMAND operator that derives the meaning in (3) and the meaning in (89) we are going to have to make it sensitive to context and to the speaker's goals in discourse, i.e., we want it to make use of a mechanism similar to the one argued for in this paper and that derives all the meanings of BCs without the need of the extra semantic machinery. An alternative to insisting on the COMMAND operator responsible for the interpretation of (3), while trying to keep EEH's spirit, is to argue that the consequent introduces a speech act of assertion and claim that the command interpretation is the result of an indirect speech act (see also Krifka 2014).[61] However, in this latter approach two questions would remain open. The first one concerns

(ii) a. If you're hungry, there are some$_1$ cookies on the table. They$_1$ are ginger snaps.
b. If you're free, I'm going to a$_1$ party tonight. It$_1$ starts at midnight.

McCready argues that (i) illustrates that in HCs non-specific indefinites introduced in a conditional consequent cannot serve as antecedents for anaphora while the examples in (ii) show that in BCs this is possible.

There are several problems with this argument. First, (i) and (ii) are not a minimal pairs. In (i) the indefinite in the consequent covaries with farmer-owning-property cases (this reading is helped by the presence of *usually*) whereas the examples in (ii) do not run in such problem. Differences in judgments are due to this fact. Consider (iii) instead:

(iii) a. If the farmer sees the plowing is going slow, he buys a new donkey. It must be young so it can help the older ones.
b. Around here, if a fisherman wants to catch a chinook, he brings a red Marabou. He usually sticks it in his hatband.

The examples in (iii) are HCs and are good. The only problem is that the indefinites in the consequent in these examples do not receive a non-specific interpretation. However, notice that contrary to McCready's claim, it doesn't seem that the indefinites in the consequent in the BCs in (ii) or (iii) are non-specific either:

(iv) a. If you're free, I'm going to a party tonight, either the one at Joe's or the one at Sue's. # It starts at midnight.
b. If you're free Tuesday or Wednesday, I'm going to a party. # It starts at midnight.

If they were non-specific, we would expect the utterances of (iv) to be felicitous, but they are not. Hence, (iii) and (ii) form a minimal pair and both behave alike leaving us with no argument to support that they have different semantics (and hence with no argument supporting that in the case of BCs the consequent is asserted whereas in HCs it isn't). For the shake of completeness consider (v), a variant of the HC in (i) in which the indefinite in the consequent doesn't covary with farmer-owning-properties and is clearly specific.

(v) If a farmer owns a big piece of property, he usually feeds a donkey, Platero. It lives a free and easy life.

As expected, (v) is now fine.

[60] This is a possibility that Siegel had already dismissed, since (3) doesn't behave like an imperative. In particular, the addressee cannot respond to (3) with *No, I won't!* However, further considerations of the data led EEH to argue that Siegel's data-point regarding the response patterns only shows that (3) does not provide an antecedent for VP ellipsis: *No, I won't say that* is actually a possible response to (3). Notice however that EEH are careful to signal in ftn. 8 that this is not sufficient to claim that the consequent performs a command speech act.

[61] Indeed, if one were to adopt a speech act account of BCs, this would be a better approach. One of the main problems of this

the speech act introduced by the consequent, since it cannot be the speech act of ASSERTION (the speaker in (3) is not committing to the addressee being four!). The second question is concerned with how to explain that we infer that the speaker is giving the addressee an order if the speech act is that of assertion.

In our proposal, that the speaker in (3) is ordering the addressee to say that they are four upon being asked (and only when being asked) is an inference triggered by understanding the consequent as providing an answer to the question indicated by the antecedent (see (67) above): the pragmatic enrichment necessary to fulfill relevance will deliver the inference. In the case in which all participants are aware of the addressee's age and this is older than four, there is no information update. To see this, imagine that all participants know that the addressee is five. The utterance of the *if*-construction presupposes that there are worlds in the context set in which the addressee is asked about their age. To proceed with the update with the *if*-construction we create a temporary context in which there are only worlds in which the addressee is asked how old they are and where subsequent updates will take place. At this point we update the temporary context ($cs^{r}_{F_{active}}$) with the consequent, but the proposition in the context is incompatible: in all the worlds in the context set the addressee is older than four. Even if we decided to override the felicity constraint of compatibility, the resulting *cs* would be one in which we have ditched all the worlds in the temporary context (all the worlds in which the ticket collector asks about the kid's age) because in all those worlds the addressee is five and is not ready to give up that they are five (and takes it to be common ground that they are five). The consequence is that the resulting *cs* is incompatible with the ticket collectors asking for the kid's age (the actual world would be one in which the kids is not four and the kid's age is not asked about by the ticket collector). Notice also that even though we may accept that antecedent and consequent are independent, we do not obtain here consequent entailment (we do not assume that the speaker is claiming that the addressee is four across the board). This is predicted by the proposal here: if we were to accept the update as proposed literally by the *if*-construction, we would end up with a *cs* in which there are only worlds in which the ticket collector doesn't ask about the kid's age and in which the kid is not four, which doesn't reflect an informational dependence against the factual dependences in *L*. Hence, no further strengthening is required.

Given that it is apparent to all participants that the ticket collector is asking all kids, this update is not acceptable. Since the (literal) update proposed is not viable (and all accept that this inviability is common ground), we need to reason about why the speaker proposed it (since we assume the speaker is being cooperative). Considering the mapping between *if*-constructions and discourse, and taking relevance between questions and answers as a guiding principle, the addressee understands that the speaker is indicating what to respond when the ticket collector asks about their age (relevance update): upon the ticket collector's asking, the kid's response is ordered/suggested to be that they are four (relevance update), which everybody accepts is not true. Hence, the speaker is commanding the addressee to lie and say that they are four when responding, i.e. only in the case they are asked.[62] This 'relevance'-update is the only update that can be

approach to BCs is how to constrain when speakers have to process one speech act or another, or how many different speech-acts there are. For example, in order to explain BCs like *if you want to hear a big fat lie, George W. and Condi Rice are secretly married* (example from Siegel 2006), EEH need to appeal to a speech act that is not "a run of the mill assertion", it is a speech act that involves a 'false assertion'.

[62] The following is a similar example from Siegel (2006):

(i) If you want to hear a big fat lie, George W. and Condi Rice are secretly married.

Siegel used this example to argue against speech-act operator accounts arguing that the matrix clause in BCs was headed by an assertion operator. Certainly the speaker is not asserting the matrix clause, rather, the speaker is saying that the proposition denoted by the matrix clause is not true. That the matrix clause is a lie is derived in our system in the same way it is derived in (i) that the speaker is suggesting that the addressee lies. Notice that in this cases there is a common denominator helping to trigger the inference: the *if*-clause has a verbum dicendi or refer in some way to an utterance. The matrix clause is easily interpreted as the response or the utterance being predicated about.

It has been claimed in the literature that these BCs, unlike others canonical BCs, cannot shift to the past (see Csipak 2015):

accepted.[63]

In the end, an indirect speech act proposal would need an additional pragmatic mechanism similar to the one proposed in this paper. However, if we are relying on pragmatic reasoning to arrive at the final interpretation, what we actually lack is a justification to posit further semantic machinery.[64]

5 Conclusion

This paper aims to make a contribution to our understanding of BCs along various dimensions. Our goal has been to capture BC-interpretation within a unified account of the semantics of *if*-constructions. We have aimed to do so with a relatively sparse semantics, allowing pragmatic enrichment to play a crucial role.

(ii) a. If you are hungry, there is pizza in the fridge.
b. If you were hungry yesterday, there was pizza in the fridge.

(iii) a. If you ask me, Alex is getting ready to leave.
b. #If you asked me yesterday, Alex was getting ready to leave.

(iv) a. If I'm being frank, you look tired.
b. ?If I was being frank yesterday, you looked tired.

Notice however, that this observation is not quite right. The matrix clause is interpreted as the response to the antecedent, and hence it is anchored at the time of the utterance. When we cannot understand that the response provided in the matrix clause was what was provided at the time of the event int he matrix clause, we get oddity. However, when the times match, we still can get a BC even if in the past:

(v) Everybody was very liberal and went to bars in those days. If they asked us how old we were, we were twenty one.

(vi) Alex was always complaining and saying that she was done with her partner. I was worried and,
a. if you asked me those days, she was ready to split.
b. when asked, if I was being frank, she was ready to split.

More research is needed to understand and formalize what is behind the contrast between the infelicitous (iiib) and (ivb) vs the perfectly fine (v) and (vi). This is beyond the scope of this paper and we leave it here for future research.

[63] Notice that in this reasoning it is important that we consider that there are antecedent worlds in *cs*: the ticket collector may certainly ask about the kid's age. This assumption is what leads to look for a different interpretation for the update proposed by the matrix clause. However, in other contexts, we may conclude that the update proposed is in fact the literal update even though the resulting *cs* is one in which nor antecedent nor consequent is actually true! This is what we observe with extreme cases in which the update proposes is incompatible with what we accept to be the case (this kind of examples have been dubbed 'Dracula conditionals' (Akatsuka 1991) or 'monkey's uncle conditionals' (Franke 2009)):

(i) If I pass the calculus exam tomorrow, elephants fly.

(ii) A: Why did she leave me? I'm such a good guy!
B: If you are a good guy, I'm Marilyn Monroe.

The consequent in both cases is incompatible with $cs^{r}_{Fc_{active}}$, assuming that we all accept that elephants don't fly or that the speaker is not Marilyn Monroe. The effect, again, is similar to that triggered by examples of vacuos quantification utterances (e.g. *all my Ferraris are in the garage* uttered by someone who has no Ferraris). If we proceed with the regular update of the *if*-construction nevertheless, it leads to a *cs* in which the speaker does not pass the exam and elephants don't fly or in which the the addressee is not a good guy and the speaker is not Marilyn Monroe either. This is indeed what is intended. Again, in these cases we do not obtain consequent entailment even though these *if*-constructions are BCs: the resulting *cs* doesn't reflect an informational dependence running against the factual-dependence assumptions in *L* and hence no strengthening is necessary.

[64] In fact, speech act accounts like EEH's would have to rely on those pragmatic mechanisms to explain why *If you are hungry, there are biscuits on the sideboard* is a suggestion/invitation to the addressee to eat the biscuits, not just an assertion of the presence of biscuits on the sideboard. Otherwise they would have to speculate that the interpretation involves simultaneously two speech act operators, one an ASSERTION operator and one a SUGGESTION operator.

One of our contributions has been to put forward an account of the notion of independence that is relevant to obtain a BC-interpretation for *if*-constructions. Our discussion here has targeted the dynamics of *if*-constructions and the role played by independence in explaining the context-change brought about by BCs. Another contribution has been to distinguish the literal content of BCs from the enriched meanings, providing an account of the latter on the basis of well-formedness constraints on discourse-structure.

The guiding hypothesis has been that different aspects of the overall meaning of BCs arise due to properties corresponding to different systems (e.g. quantificational semantics, dynamics of information update given independence, relevance and congruence in discourse structure). We have shown that the phenomena observed in BCs are in fact more general and can be also observed elsewhere. Inferences triggered in BCs are observed also in question answer pairs and so is the causality inference triggered in HCs. Importantly, what we observe in the interpretation of *if*-constructions is also observed in other quantificational structures. A quantificational utterance such as *every time you talk I cry* can be interpreted as conveying that the speaker crying depends on the addressee's talking, but *every time I go to school there is a strike* is often not interpreted that way. As with *if*-constructions, whether one reading or the other is triggered depends on the assumptions made by conversation participants, not special syntax (and hence semantics). Here is a quantificational example:

(90) There is a well-known if dubious story that claims that at a concert in Glasgow Bono began a slow hand-clap. He is supposed to have announced: "Every time I clap my hands, a child in Africa dies." Whereupon someone in the audience shouted: "Well fucking stop doing that then."
(George Monbiot, *The Guardian*, Monday, June 17, 2013)

We understand this as a joke. Why?, because there is no plausible (factual) dependence between Bono clapping and children dying: our assumptions discard (factual) dependence between the two facts, i.e. they are factually independent. The speaker making the joke is pretending to ignore that dependence was implausible (knowingly going against the audience's assumptions). The response reveals that they are acting as if Bono's claim could be used to establish a dependence. It is a joke because they know that everybody is aware of the fact that that interpretation is not possible giving our usual assumptions regarding how the world works.

The punch-line is that by considering the contributions made by the different "layers" to the overall interpretation, it is possible to give an account of the overall meaning of BCs without adding ad-hoc complexity to any one layer.

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