

Being pragmatic about biscuits*

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Abstract In this paper we argue for a unified semantics for hypothetical conditionals, HCs, e.g. *if it rains, we'll cancel the picnic*, and biscuit conditionals, BCs, e.g., *if you are hungry, there are biscuits on the sideboard*. We side with recent literature in proposing that differences in the interpretation are related to (in)dependence between antecedent and consequent, but we move beyond current accounts in spelling out a characterization of independence that is actually predictive. We further establish a systematic link between *if*-constructions and discourse structure, providing a dynamic update model that integrates the QUD, and thus the intentional discourse-structure. We argue that in BCs the antecedent sets up the question that is addressed by the consequent, and show that rescuing (Gricean) relevance in face of independence gives rise to implicatures corresponding to the different flavors associated with BCs. Crucially, we argue, this is the same mechanism responsible for our understanding that in the HC above, for example, it is the rain that will cause the cancellation of the picnic. Along the way we notice how the phenomena observed in *if*-constructions are also replicated in other quantificational structures. Ultimately, there is not much that is biscuit-specific. Their interpretation is the result of a conspiracy among semantics, dynamic update and intentional discourse-structure.

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

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|-----|---|----|
| (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 salient difference is that in BCs like (1) the truth of the consequent is not taken to depend on the truth of the antecedent, i.e., from the utterance of (1) we learn that there are biscuits on the sideboard regardless of whether or not the addressee is hungry. In the most prominent

*This paper has evolved over time thanks to the insights of our reviewers and the handling editor. Arno had to leave the project midway, but §2, which was his main focus, still has at its core the main ideas in Goebel (2017). Its shape and the formal apparatus presented, however, has changed to address the issues raised during the review process. All reminding errors in its current form are María's. This paper would not have been possible without the comments and insights from three anonymous reviewers and the handling editor, Regine Eckardt. Ana Arregui also deserves immeasurable gratitude for her comments and encouragement throughout the development of this project. Thanks also to Justin Bledin, Eva Csipak, Sven Lauer, Kyle Rawlins, Maribel Romero, Wolfgang Spohn, Eric Swanson, Andreas Walker and the members of the DFG Research Unit *Was wäre wenn*. Research in this paper was partially funded by the project DFG 1836.1-1 awarded to María Biezma.

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

reading, however, an utterance of (2) leads us to conclude that the speaker may not make biscuits if the addressee is not hungry.

Standard analyses of indicative HCs along Stalnakerian lines predict that in uttering an *if*-construction *if* ϕ , ψ the consequent is claimed to be true only in the selected subset of worlds in the context set in which the antecedent is true.² However, the utterance of a BC leads us to learn that the consequent is true in all the worlds in the (posterior) context set, not just in the selected antecedent worlds. This is a central issue in the interpretation of BCs, and we will call it the *Global Update Puzzle* (GUP). In addition to explaining the GUP, a theory of BCs should also be able to explain inferences frequently arising with BCs (the *Inferences Puzzle*, IP). As an example, consider (1) again. From (1) we not only learn that there are biscuits on the sideboard, but also that the speaker is giving the addressee permission to eat those biscuits (a *permission* inference). Another example of an inference associated with a BC is provided in (3) (we spell out a natural scenario for a famous BC from Siegel 2006):

- (3) Scenario: an adult is travelling by bus with a child. They see a ticket collector who is going around checking that children above four have paid full fare.
Parent: If they ask you how old you are, you are four.

The *if*-construction in (3) is a BC: the age of the addressee does not depend on whether or not they are asked about it.³ The example is particularly interesting because an utterance of (3) is perfectly natural in a scenario in which the speaker is not actually committing to the truth of the addressee being four but rather wants to convey a request for the addressee to lie (a *request* inference). A theory of BCs has to explain such inferences, as well as the fact that some BCs don't trigger a global update. For example, in (3) the speaker is not claiming that addressee is four, nor requesting that the addressee tell the ticket collector that they are four without being asked.

There are (roughly) two lines of research in BCs: *semantic approaches* that derive the differences between BCs and HCs by appealing to differences at LF or in the semantic make-up; and *pragmatic approaches* that try 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 and hardwire the inferences in the IP (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 a different take within a pragmatic proposal and Rawlins (2020) for an overview of the alternatives). The pragmatic literature proposes accounts of the GUP within a logical system, but has not fleshed out a solution to the IP.

In this paper we build on pragmatic theories to defend a pragmatic account of BCs. Our proposal is a *conspiracy theory*: BC interpretations arise, given a standard semantics for *if*-constructions, when there is a mismatch between the information provided by the *if*-construction and contextual assumptions about factual independence between antecedent and consequent. The various inferences associated with BCs, the various 'flavors' that BCs can take, arise as result of pragmatic reasoning that aims to satisfy relevance in face of an antecedent and consequent that are presupposed to be factually independent. Our account draws on theoretical frameworks and proposals that have been independently motivated. At the end of the day, we will argue, there is very little that is BC-specific. The inferences that we find associated with BCs

²In this paper we do not address subjunctive biscuit conditionals (see, e.g., Swanson 2013; Romero and Csipak 2019). However, we hope that the model presented here could be extended to subjunctives

³Through 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 overview on the matter.

arise in other quantificational constructions, as well as in independent discourse, and the notion of factual independence that is needed to predict BC interpretations has been argued for with respect to completely different phenomena (counterfactual conditionals). Since our account draws on many strands of earlier work, it will be necessary to present a rich theoretical background. Our strategy has been to do this in two stages: in §2 we present a predictive notion of independence and in §3 we use this notion of independence to explain the GUP and IP.

In §2 we investigate independence in BCs and the contextual assumptions that trigger their particular interpretation. The focus here is on the information in the context set. We argue that an *if*-construction is understood as a BC whenever, and because, participants presuppose that antecedent and consequent are factually independent. We build on previous literature (in particular Franke 2007, 2009) to characterize a precise notion of independence that allows 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 both to define BCs and to characterize their behavior 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 amendment also provides the notion of independence with predictive power. In §3 we move on to our final goal: a pragmatic theory of BCs that can predict their impact on context. To achieve this we embed the characterization of the context set argued for in §2 within a more articulated view of context, one which distinguishes information shared by conversational participants about what the world is like from information about how the conversation is progressing. In our proposal, a context is represented using a tuple with multiple slots, tracking information update by means of a context set, temporary assumptions, questions under discussion and proposals awaiting evaluation. Making distinctions in the information tracked by context in this way will permit us to be precise about the context-update effects triggered by *if*-constructions and develop an account of BCs that is robust enough to be predictive without ad-hoc stipulations about syntax or semantics. We argue 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 between BCs and discourse structure can account for the variety of inferences often associated with BCs, explaining a wide range of data without unnecessary BC-specific complications in the system. The two sections of the paper are deeply connected. The special properties of BCs are derived as a consequence of maintaining discourse relevance in face of a presupposition of factual independence between antecedent and consequent. In order for a pragmatic proposal to be robust, it must build both on a characterization of independence that makes predictions about when an *if*-construction will be interpreted as a BC, and on an explicit theory of discourse dynamics that predicts the strategies to be deployed to maintain discourse coherence and relevance. Presupposed independence drives pragmatic enrichment and inferences arise as a result of participant's reasoning when trying to maintain relevance in face of factual independence. 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 have argued are sufficient on their own to account for the intuitions surrounding BCs. Our discussion will challenge their empirical support and in addition provide an overview of the issues that arise when BCs don't trigger global update, as we noted above regarding (3). 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* ϕ , ψ makes a (quantificational) claim about selected ϕ -worlds: they are all ψ -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 for *if* ϕ , ψ arise when and only when the following conditions hold:

- Condition 1: One of the following two options is true: (i) the interpreter doesn't believe that ψ is true across the board at the time of the utterance⁴ and is agnostic about other participants' beliefs or; (ii) it is common ground that the speaker doesn't believe that ψ is true across the board (i.e., it is common ground that either the speaker is agnostic or that they believe that ψ is not true across the board).
- Condition 2: 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 (accounting for the IP).

2 Presupposing factual independence: A model of information update

In the pragmatics literature, *independence* between antecedent and consequent has been claimed to be a contextual property of *if*-constructions 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. Focusing on the proposal in Franke (2007, 2009), we argue that the characterization of independence in the literature is not sufficient to predict when an *if*-construction is interpreted as a BC (indeed, it was never meant to be predictive). However, our assumptions about independence do affect when an *if*-construction is interpreted as a BC, and a theory of BCs should capture that. As a quick illustration, consider (4):

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

Whether or not (4) is understood as a BC or an HC depends on assumptions in the context. 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 (an HC interpretation). However, in a context in which the dress has already been bought without consulting the addressee about the color, and we know that the color can't be changed, (4) will be understood as a BC (the speaker is probably hoping for a happy coincidence). Our assumptions about whether the consequent can or cannot 'depend' on the antecedent will determine the interpretation we reach.

The central idea in our proposal about independence is 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 (whether they are part of the same web of dependencies), 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 dependence. This

⁴This is not as strong as saying that the addressee believes that the consequent is not true across the board, but includes these cases too.

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). We propose that the relation between *informational* (in)dependence and *factual* (in)dependence is mediated by the *Mirror Constraint*.

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 *if*-constructions are interpreted as BCs, does not make the right predictions because it loses track of our intuitions about what speakers accept to be possible/impossible dependencies. For instance, as we will see in §2.1, if we attempted to use Franke’s notion of independence in a predictive manner, we would predict that all factual conditionals (*if*-constructions in which the antecedent is accepted to be true) are BCs.⁵ 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. Our account builds on the view of factual dependence in Veltman (2005) and we characterize a notion of *context set* (*cs*) that incorporates assumptions of factual dependence.⁶ In our proposal, factual independence between two propositions is a stable and transcontextual property of information states.⁷ In §2.3 we spell out the predictions made by factual independence and introduce the *Mirror Constraint*. As we show more formally in §3, it is factual independence that is crucial in our interpretation of *if*-constructions as BCs (solving the GUP and IP). While the proposal presented here builds on previous pragmatic accounts of BCs relying on a notion of independence, 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, and defend our proposal against his challenges.

2.1 Previous notions of independence

According to 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.⁸ Within his approach, independence is established between propositions in relation to an information state (which is characterized as a set of possible worlds).⁹ It can be viewed as a notion of *informational independence*.¹⁰

- (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

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

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

Here is an illustration with the propositions corresponding to *If you are hungry, there are biscuits on the sideboard*, where as indicated above $\diamond_{\sigma} P$ signals the compatibility between proposition P and the information

⁵Factual 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., (8) below. We take this label to be descriptive and not to affect the semantics of *if*-constructions.

⁶Following Arregui (2011) we simplify Veltman’s original presentation, which targeted the context update of counterfactuals.

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

⁸Franke (2009) argues, following van Rooij (2007), that this notion of independence is equivalent to Lewis’s (1988) notion of orthogonality of subject matters.

⁹See (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.

¹⁰Franke calls this notion of independence *epistemic independence*. We thank Cleo Condoravdi for this alternative denomination.

state σ :

- (6) Given an information state σ , the proposition that you are hungry (ϕ) and the proposition that there are biscuits on the sideboard (ψ) are *orthogonal/informationally independent* iff:
- a. if $\diamond_{\sigma}\phi$ and $\diamond_{\sigma}\psi$, then $\diamond_{\sigma}(\phi \cap \psi)$
 - b. if $\diamond_{\sigma}\bar{\phi}$ and $\diamond_{\sigma}\psi$, then $\diamond_{\sigma}(\bar{\phi} \cap \psi)$
 - c. if $\diamond_{\sigma}\phi$ and $\diamond_{\sigma}\bar{\psi}$, then $\diamond_{\sigma}(\phi \cap \bar{\psi})$
 - d. if $\diamond_{\sigma}\bar{\phi}$ and $\diamond_{\sigma}\bar{\psi}$, then $\diamond_{\sigma}(\bar{\phi} \cap \bar{\psi})$

In short, following Franke, we say that two propositions are independent in relation to an information state when the state is such that it places no restrictions on how they may co-vary: if two propositions are possible (as described above), their combination will also be possible. As far as the agent of the information state is concerned, there are no dependencies amongst them.

Let us turn now to the GUP and consequent entailment. When an *if*-construction *if* ϕ, ψ is uttered, the addressee reasons about the speaker's (S) information state σ_S (where Σ_{σ_S} stands for the set corresponding to the σ_S -candidates under consideration by the interpreter). Franke (2009) predicts that if the addressee assumes informational independence between antecedent and consequent, consequent entailment will follow. Here are the steps: (i) When interpreting a BC (e.g., *if you are hungry, there are biscuits on the sideboard*), the addressee assumes informational independence between antecedent and consequent in the information states σ_S under consideration (as in (5)). (ii) In addition, the semantics of the *if*-construction (a claim about all antecedent worlds) allows the addressee to learn $\neg\diamond_{\sigma_S}(\phi \cap \bar{\psi})$; that is, that σ_S is inconsistent with the intersection of the antecedent proposition (*you are hungry*) and the negation of the consequent proposition (i.e., *there aren't biscuits on the sideboard*). (iii) However, given the presuppositions of the *if*-construction (which may be accommodated), the addressee also learns that S 's information state is compatible with the antecedent proposition, that is \diamond_{σ_S} *you are hungry*. The only information states that satisfy informational independence between ϕ and ψ and capture the information learned from the utterance of the *if*-construction are those in which ψ (*there are biscuits on the sideboard*) is true in all worlds in σ_S (i.e., $\neg\diamond_{\sigma}(\bar{\psi})$). Under the assumption that informational independence has to be maintained across updates, consequent entailment in a BC is the unavoidable result of orthogonality coupled with the information conveyed by the *if*-construction.

Discussion Franke's characterization of independence was meant to derive consequent entailment taking as a starting point that an *if*-construction is interpreted as a BC. However, if we try to use this notion of independence in a predictive manner to figure out when or whether an *if*-construction is interpreted as a BC, we run into trouble. There are two types of concerns. The first is that Franke's notion of independence was not actually intended to be predictive: it describes the update process for *if*-constructions identified as BCs, but not how it is that we know that that is the update to be implemented (in other words, the proposal does not explain how participants decide whether they should keep orthogonality between antecedent and consequent in the update process, or give up on orthogonality altogether and with it consequent entailment). The second problem arises because the conditional statement of (5), formulated by Franke as a conjunction of material implications, makes incorrect predictions when the antecedent in an *if*-construction is assumed to be true relative to an information state. Below we will spell out below both concerns 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.¹¹ Consider the propositions denoted by utterances of *Morgan is going to the party* and *Taylor is going to the party*. If these propositions (or their negations) are not common ground, and there is no information about dependencies amongst them, the information state of a participant will have worlds where Morgan goes and Taylor doesn't, worlds where Morgan goes and Taylor goes, worlds

¹¹See also Mandelkern and Rothschild 2019 for discussion on this problem and for a version of (7).

where Morgan doesn't go and Taylor does, and worlds where neither Morgan nor Taylor go. Such an information state satisfies informational independence/orthogonality as characterized in (5). Imagine that in this scenario, a speaker utters the *if*-construction in (7)

(7) If Taylor is going to the party, Morgan is going to the party.

If we were to use (5) in a predictive fashion, we would expect (7) to be understood as a BC maintaining orthogonality. Correspondingly, we would predict that the update conveyed by the *if*-construction would be strengthened, giving rise to consequent entailment. However, a plausible outcome from (7) would be for participants to be willing to learn a generalization about the two propositions and that Morgan's going to the party depends on Taylor's going. Franke's proposal, when attempted to be used in a predictive fashion, does not address this. The proposal, as it stands, does not account for the fact that in examples like this, conversation participants can eventually give up orthogonality and learn a dependence (or maintain orthogonality and obtain a BC interpretation).

The second concern is about the predictions made when a proposition is mutually accepted (common ground). The issue can be illustrated with so-called *factual conditionals*, exemplified below:

(8) Chris has come to visit their grampa, who lives very far away:

Chris: Hi Grampa! I'm starving!

Grampa: I can imagine! It's been a long trip! If you are hungry, I will make some biscuits.

The importance of (8) is that even though we can understand that the antecedent of the *if*-construction is in the common ground, Grampa's utterance can be interpreted as an HC (conveying that it is Chris' hunger that would prompt him to make biscuits).¹² This is contra the prediction that Franke's proposal would make when attempted to be used in a predictive fashion. Franke's notion of independence in (5) is stated as a conjunction of material implications and it would predict that only a BC interpretation would be available in this case. Consider ϕ as the (accepted) antecedent in Grampa's *if*-construction, and ψ as the consequent (providing new information). The propositions will be independent (in an information state σ) iff:

- (9) a. If $\diamond_{\sigma}\phi$ and $\diamond_{\sigma}\psi$, then $\diamond_{\sigma}(\phi \cap \psi)$
 b. If $\diamond_{\sigma}\phi$ and $\diamond_{\sigma}\bar{\psi}$, then $\diamond_{\sigma}(\phi \cap \bar{\psi})$
 c. If $\diamond_{\sigma}\bar{\phi}$ and $\diamond_{\sigma}\psi$, then $\diamond_{\sigma}(\bar{\phi} \cap \psi)$
 d. If $\diamond_{\sigma}\bar{\phi}$ and $\diamond_{\sigma}\bar{\psi}$, then $\diamond_{\sigma}(\bar{\phi} \cap \bar{\psi})$

Given the truth of ϕ relative to the conversational state ($\Box_{\sigma}\phi$), and ignorance regarding ψ ($\diamond_{\sigma}\psi$ and $\diamond_{\sigma}\bar{\psi}$), both (9a) and (9b) hold. But the truth of ϕ also makes the conditionals in (9c) and (9d) 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 the truth of a proposition, we lose the ability to track dependencies with other propositions. The established proposition just becomes independent from any other proposition.

2.2 Severing informational independence from factual independence

As we noted, Franke's characterization of independence targets informational independence. It seeks to answer a question about the agent's information state (intuitively: *Are propositions independent in the information state?*) But there is also a different notion of independence that has been the subject of much discussion in the literature on *if*-constructions: factual independence. It has been noted particularly in the literature on counterfactuals that dependencies between facts plays an important role in their interpretation.

¹²Though the BC-reading is also available and would be even more prominent with reversed temporal order, as in *Grampa2: I can imagine! It's been a long trip! If you are hungry, I just made some biscuits. They are on the sideboard.*

Facts often ‘stand or fall together’ (Kratzer 1981, see also Veltman 2005, a.o.), and tracking such dependencies is crucial to getting the interpretation of counterfactuals right. The literature on counterfactuals provides us with insights about how to characterize dependencies between facts that arise because of laws and regularities in the world (the *web of dependencies* between facts) and we build on this literature to characterize a notion of *factual independence* between propositions. It is an important stepping stone towards our explanation of the difference between HC cases (where a dependence can be learned) vs. BC cases where a dependence cannot be learned (and Franke-style strengthening leads to consequent entailment).

We base our proposal on a premise-semantics account put forward in Veltman (2005) for the interpretation of counterfactuals in a dynamic setting. 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 characterize 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 one of the main points in this paper across: to explain how participants interpret *if*-constructions we need to take into account not only what participants accept as true, but also their assumptions about how facts are interconnected.

Veltman (2005) aims to account for the role of ‘laws’ in the interpretation of counterfactuals. In general Veltman (2005) characterizes laws as being assumptions about dependencies between facts that discourse participants are not prepared to give up (pg. 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. Dependencies often stem from generalizations like *whenever it rains, Jones takes his hat*. Notice that what is considered to be a (Veltmanian) law by a discourse participant 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 agent takes to be normal, though this is not formally represented in Veltman’s framework (what is represented is the fixed world view in specific circumstances at a specific moment).¹³ In what follows we spell out the basic formal details of this model, in which laws/generalizations are encoded indirectly.¹⁴

We assume, following Veltman, that possible worlds are complete valuation functions from a (finite) set of atomic sentences of a language \mathcal{L} to the truth-values $\{0, 1\}$. To express that an atomic sentence p is true at a world w we write $\langle p, 1 \rangle \in w$ or $w(p) = 1$, similarly for 0. This underlies our informal talk of facts being true or false in a world. We take situations to be subsets of worlds, $s \subseteq w$ (a partial function from \mathcal{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 $\llbracket p \rrbracket$ (so: $\llbracket p \rrbracket(w) = 1$ iff $w(p) = 1$).

Dependencies between facts are established in relation to possible worlds (e.g., there may be a dependence between the weather and Jones’s hat wearing habits in the actual world, but not in some other world). While Veltman’s original proposal in a dynamic framework captured dependencies in terms of the ‘universe’

¹³This 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.

¹⁴In Veltman’s (2005) propositional framework generalizations are encoded 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. In previous work (Veltman 1976), laws are prejudices in a morally neutral, theoretical way. In a way, they constitute the world view or the ideology (or, in Quine’s terms, what is at the core of the web of beliefs).

of a cognitive state, we follow Arregui (2011) in making a simplification to the framework, and associate a *law horizon* with each world. Given a world w , the *law horizon* of w , represented as U_w , is the set of possible worlds that obey the laws of w . The law horizon of w provides an indirect representation of the laws in effect in w (a similar effect to that obtained by Veltman’s ‘universe’): if there is a ‘law-like dependence’ between p and q in w , the corresponding material conditional will be true throughout the worlds in U_w . Given a possible world that consists of independent and dependent facts, the independent facts together with the laws will be enough to determine the complete world. The definitions below characterize the independent facts in a world as a *base set* for a world:

- (10) 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 dependence in w linking bad weather and Jones wearing a hat, it is a dependent fact in w that Jones is wearing his hat. The table in (11) illustrates this proposal. In this toy example we consider sentences $p = \textit{The weather is bad}$, $q = \textit{Jones is wearing a hat}$, and a random sentence $r = \textit{Lake Constance is 63 km long}$; $w_{@}$ is the actual world where Jones’ wearing a hat depends on bad weather. This dependence is formally captured by the fact that the corresponding material implication holds throughout the worlds in $U_{w_{@}}$. 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 (in our example, these are the worlds in which the weather is bad and Jones doesn’t wear his hat).

(11)

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

$U_{w_{@}} = \{w_{@}, w_1, w_3, w_4\}$ represents the permutations of facts that are in line with the factual dependencies holding at $w_{@}$. The base for each world is as follows: $s_{w_{@}} = \{\langle p, 1 \rangle, \langle r, 1 \rangle\}$, $s_{w_1} = \{\langle p, 1 \rangle, \langle r, 0 \rangle\}$, $s_{w_3} = \{\langle p, 0 \rangle, \langle r, 1 \rangle\}$, $s_{w_4} = \{\langle p, 0 \rangle, \langle r, 0 \rangle\}$ (given that Veltman uses material implication to characterize laws, the system in principle allows multiple bases for a given world; however, we circumvent the problems that this generates by assuming that in an utterance situation context settles that there is a unique base).^{15,16} The dependent fact, q , is not in the base of any world in $U_{w_{@}}$, since it is a dependent fact in all of them.

The 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., p and r are independent in our example. However, we also want to be able to say whether non-base facts are independent with respect to each other, e.g., in our toy example q and r are independent. 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

¹⁵As 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.

¹⁶Systems 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).

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. We also have to consider what 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) proposal there can be disjunctive laws/dependencies (for example, $(p \vee q) \rightarrow r$).¹⁷ In order to track factual dependencies in the Veltmanian 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 seeing whether the sets of base facts overlap.

For the sake of explicitness, 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) (12). We then characterize factual independence between propositions in terms of situations that minimally force the propositions (13b).

- (12) a. A situation s forces a proposition $\llbracket p \rrbracket$ within U_w iff for every world w' in U_w such that $s \subseteq w'$, $w' \in \llbracket p \rrbracket$.
- b. A situation s minimally forces a proposition $\llbracket p \rrbracket$ within U_w iff s forces $\llbracket p \rrbracket$, $s \subseteq s'$, where s' is the base set of w , and there is no $s'' \subset s$ that forces $\llbracket p \rrbracket$.

(13) **Factual Independence**

Two propositions $\llbracket p \rrbracket$ and $\llbracket q \rrbracket$ 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 $\llbracket p \rrbracket$ does not overlap with the set of all facts f'' that are elements of situations $s'' \in U_w$ that minimally force $\llbracket q \rrbracket$,
 $\{f' \mid f' \in s', \text{ s.t. } s' \text{ minimally forces } \llbracket p \rrbracket\} \cap \{f'' \mid f'' \in s'', \text{ s.t. } s'' \text{ minimally forces } \llbracket q \rrbracket\} = \emptyset$
 and the following conditions are satisfied

- a. there exist such s' and s'' (non-emptiness)
- b. $\llbracket p \rrbracket \neq \llbracket q \rrbracket$, i.e., the facts that are factually independent are not identical

The definitions above provide 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 satisfied or not 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 in addition to Franke's understanding of independence, accounting for such 'worldly' relations amongst facts in worlds allows us to predict BC and HC readings.

2.3 Tracking (in)dependence in conversation

Our goal is to develop a framework that predicts when we are unwilling to give up on orthogonality in interpreting an *if*-construction, leaving only a BC interpretation available, and when we are willing to give up on orthogonality and there is room for a new dependence. How do our assumptions about independence play out in the dynamic interpretation of *if*-constructions? How does conversational update interact with our assumptions about our world ($w_{@}$) and its laws? Our proposal augments a Stalnaker-style view of

¹⁷We thank an anonymous reviewer for this observation.

context update by considering context sets to be formed by the usual Stalnakerian context set together with considerations about the laws governing the worlds in it (cf. Isaacs and Rawlins' 2008 *Information Store*, which encodes modal information that can be used to evaluate counterfactual claims). This move allows us to track different types of information. The complex cs includes both conversation participants' shared assumptions about facts in the world, and shared assumptions about its laws, i.e., about how facts interact.

We consider context sets (cs) to be sets of tuples $\langle w, U_w \rangle$ where w is a member of the intersection of the propositions mutually accepted in discourse, while U_w is a law horizon associated with w . Since it may not be settled in discourse what are the laws corresponding to a complete set of facts, cs may include tuples in which a particular world is associated with more than one law-horizon (e.g., $\langle w, U_w^i \rangle, \langle w, U_w^j \rangle$). The natural assumption is that for any $\langle w, U_w \rangle$ -tuple in cs , $w \in U_w$. This conceptualization of cs allows us to track information growth both at the level of 'plain' facts and at the level of laws. A simple factual update will lead to the elimination of $\langle w, U_w \rangle$ -tuples in which w is incompatible with the asserted proposition (e.g., coming to learn that *the weather is bad* will remove from cs those $\langle w, U_w \rangle$ -tuples in which $\llbracket \text{the weather is bad} \rrbracket(w) = 0$). The acceptance of a new law will remove from cs all $\langle w, U_w \rangle$ -tuples with worlds in U_w that do not satisfy the law (e.g., coming to learn that there is a correlation between the weather being bad and Jones wearing his hat will remove from cs those $\langle w, U_w \rangle$ -tuples in which U_w includes worlds in which the weather is bad and Jones does not wear his hat).

Against this background, we can incorporate Franke's insights about informational independence, as well as a distinct characterization of *presupposed factual independence*, as follows:

(14) **Informational independence** (repeated from (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

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

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

(15) **Presupposed factual independence** (building on (13b)):

Two propositions are presupposed to be factually independent if they are factually independent in every $\langle w, U_w \rangle$ -tuple in cs .

As before, two propositions are *informationally independent* (in a context set cs) iff they are orthogonal as in Franke's characterization. The context set is such that updating with either of the propositions will not change the status of the other one. Two propositions are *presupposed to be factually independent* when the context set is such that it is not possible for there to be a law-like dependence amongst them (in other words, it is impossible for cs to be updated in such a way that a law-like dependence is learned, there is no U_w amongst the cs tuples that satisfies the corresponding law).

There will, naturally, be connections between the set of actual-world candidates in cs (i.e., the set of w s in the $\langle w, U_w \rangle$ -tuples) and the set of possible laws (i.e., the set of U_w s in the $\langle w, U_w \rangle$ -tuples). We expect the update to the set of actual-world candidates in cs that is brought about by an *if*-construction to be compatible with the possible factual dependencies contemplated in the discourse. If the law horizons in cs ban a certain dependence between p and q , then the update to cs brought about by an *if*-construction cannot informationally predict it. We capture this congruence with the *Mirror Constraint*:

(16) **Mirror Constraint**:

If two propositions are presupposed to be factually independent in cs , then they cannot be informationally dependent in cs .

Intuitively: if our understanding of possible laws is such that we have ruled out any dependence between two facts, then our information state cannot be such that we predict that learning about one of them will lead

us to learn about the other.

The key difference between BC examples like *If you are hungry, there are biscuits on the sideboard* and examples like *If Taylor is going to the party, Morgan is going to the party* is that in the latter case, we are willing /able to learn a new law (a dependence between Taylor going to the party and Morgan going to the party), whereas in the first case we are not. Given our assumptions, we do not contemplate a factual dependence between you being hungry and there being biscuits on the sideboard (they do not spring up there when you are hungry). Our proposal cashes out this contrast with a difference at the level of *cs*. A dependence between hunger and biscuits on the sideboard is not a possible law. There is no $\langle w, U_w \rangle$ -tuple in *cs* such that the corresponding material implication holds throughout U_w . It is presupposed in *cs* that the two facts are independent. Context update with the *if*-construction *if you are hungry, there are biscuits on the sideboard* cannot result in a *cs* that predicts a dependence. Things are different for *If Taylor is going to the party, Morgan is going to the party*. In this case, a dependence between antecedent and consequent is a possible law. There will be $\langle w, U_w \rangle$ -tuples in *cs* such that the corresponding material implication is true throughout U_w . Those will be the tuples that survive when and if eventually orthogonality is given up and a dependence is learned.

How do we derive consequent entailment in BCs and avoid deriving it in HCs? In other words, how do we resolve the GUP? Let us walk through some examples, beginning with a case in which a dependence has not been discarded. Consider the utterance of *If Taylor is going to the party, Morgan is going to the party* in a context that initially contains both worlds where Taylor goes to the party (+T) and worlds where Morgan goes to the party (+M), as well as worlds where they don't go (-T worlds and -M worlds). Context in this case does not rule out a dependence, and there will be $\langle w, U_w \rangle$ -tuples in the context set in which U_w encodes a law-like dependence between the two facts (i.e., tuples in which U_w does not include +T -M worlds). We informally discuss some examples here, leaving the explicit formulation of update effects to §3. Let us informally grant that if we do not know whether the antecedent is true, the context set will include worlds in which it is true and worlds in which it is false (e.g., Stalnaker 1968), and, (following Heim 1983, 1992), that the acceptance of an *if*-construction in a context results in the removal of worlds from the context set in which the antecedent is true and the consequent false. Here is a very schematic representation of the context update brought about by *if*-construction involving only the context set (*cs*) (see §3 for the general update model):

- (17) If Taylor is going to the party (+T), Morgan is going to the party (+M).
- a. $cs_1: \{ \langle w_{1+T,+M}, U_{w_1} \rangle, \langle w_{2+T,-M}, U_{w_2} \rangle, \langle w_{3-T,-M}, U_{w_3} \rangle, \langle w_{4-T,+M}, U_{w_4} \rangle, \dots \}$
 - b. $cs_2: \{ \langle w_{1+T,+M}, U_{w_1} \rangle, \langle w_{3-T,-M}, U_{w_3} \rangle, \langle w_{4-T,+M}, U_{w_4} \rangle, \dots \}$

Updating cs_1 with the *if*-construction will result in cs_2 . Tuples in cs_1 that include worlds like w_2 , in which Taylor is going to the party and Morgan is not going to the party, will be eliminated in cs_2 . cs_2 has changed with respect to the previous context: there is now informational dependence between the propositions. At this point, learning that Taylor is going to the party (eliminating worlds like w_3 and w_4) will lead to learning that Morgan is going to the party. There is not, however, a presupposition about factual (in)dependence. Such a dependence has not been ruled out, but neither has it been established. It would be possible, at this point, to strengthen the interpretation of (17) and remove from *cs* all $\langle w, U_w \rangle$ -tuples such that U_w includes +T -M worlds. This would amount to learning a factual dependence.¹⁸

Consider now the case of our BC: *If you are hungry, there are biscuits on the sideboard*. As before, we start out with a context set that includes worlds in which you are hungry (+H worlds) and worlds in which

¹⁸Our proposal does not predict that we automatically strengthen an update to learn a factual dependence from informational dependence. The Mirror Principle is not symmetric. The prediction is that informational dependence merely requires that factual dependence be possible. In fact, our characterization of the update by *if*-constructions in §3 will not make any predictions about when new factual dependencies are learned.

you are not (-H worlds), as well as worlds where there are biscuits on the sideboard (+B worlds) and worlds where there are not (-B worlds). As in the previous case, the propositions are informationally independent in the sense of (14). Contrary to the previous case, however, it is now presupposed that the propositions are factually independent. There is no $\langle w, U_w \rangle$ -tuple in the context set such that U_w excludes all worlds in which the antecedent is true and the consequent false. In other words, for no world in the context set is the law horizon such that facts that force the antecedent overlap with facts that force the consequent. Consider now the transition from cs_1 to cs_2 :

- (18) If you are hungry (+H), there are biscuits on the sideboard (+B).
- a. $cs_1: \{ \langle w_{1+H,+B}, U_{w_1} \rangle, \langle w_{2+H,-B}, U_{w_2} \rangle, \langle w_{3-H,-B}, U_{w_3} \rangle, \langle w_{4-H,+B}, U_{w_4} \rangle, \dots \}$
 - b. $cs_2: \{ \langle w_{1+H,+B}, U_{w_1} \rangle, \langle w_{3-H,-B}, U_{w_3} \rangle, \langle w_{4-H,+B}, U_{w_4} \rangle, \dots \}$

Updating cs_1 with the *if*-construction will result in cs_2 , with the elimination of cs_1 -worlds like w_2 , in which you are hungry and there are no biscuits on the sideboard. In cs_2 , the proposition that you are hungry and that there are biscuits on the sideboard are not informationally independent. In this context set, it is possible that you are hungry (e.g., true in w_1), it is possible that you are not hungry (e.g., true in w_4), it is possible that there are biscuits on the sideboard (e.g., true in w_1), and it is possible that there aren't biscuits on the sideboard (e.g., true in w_3). However, it is not possible that you are hungry and there are no biscuits on the sideboard (because worlds like w_2 have been eliminated). The *if*-construction update has brought about informational dependence between you being hungry and there being biscuits on the sideboard. Learning that you are hungry in cs_2 will eliminate worlds like w_3 and w_4 and lead to learning that there are biscuits on the sideboard. However, this informational dependence is not a possible factual dependence according to the law-horizons of the worlds in the context set. There is no $\langle w, U_w \rangle$ -tuple such that the corresponding implication is true throughout the worlds in U_w (this is not a correlation that can be learned). In sum, the *if*-construction update, as it is, violates the Mirror Constraint.

How can this be avoided? In accordance with Franke, a strengthened update is carried out (we present the strengthened update explicitly in §3.1 and compare it with similar strategies independently argued for in the literature). In cs_2 , +H, -H, +B, and -B are all possible. In order to maintain informational independence and respect the Mirror Constraint, the update should preserve that learning one of them cannot lead to the other. However, the regular update doesn't provide the desired result: learning +H leads to learning that +B, and learning that -B leads to learning that -H. The update must be strengthened so one of those four propositions is no longer possible and we predict that only one option is consistent with all ancillary assumptions. The presence of +H and -H worlds in cs reflects the default assumptions for an indicative *if*-construction. Removal of +B-worlds (worlds like w_1 and w_4), would lead to a cs where only -H and -B are possible, violating the indicative presupposition that there are antecedent-worlds in cs . So, strengthening to remove +B-worlds will not rescue independence. The only worlds that can be removed in a way that respects the presuppositions and interpretation of the *if*-construction are -B worlds. The strengthened update will be cs'_2 :

- (19) $cs'_2: \{ \langle w_{1+H,+B}, U_{w_1} \rangle, \langle w_{4-H,+B}, U_{w_4} \rangle, \dots \}$

The result is consequent entailment. While we have not settled whether you are hungry, there are biscuits on the sideboard.

Having separate but connected representations for assumptions regarding factual dependencies and facts 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). Let us consider the example of the blue dress again in a context where the antecedent and consequent propositions are informationally independent:

(20) 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 factually independent, the Mirror Constraint predicts that it would be impossible for (20) to result in an update that violates informational independence/orthogonality. As a result, the update will be strengthened and (20) will be interpreted as a BC. If, on the other hand, we are in a context in which it is not known (or not established) whether or not the relevant facts are dependent, an utterance of (20) would lead to an update in which we have informational dependence. This is fine, since the horizons do not encode factual independence. The update leaves room to potentially accept/learn a *factual dependence* between these facts. What is presupposed ‘informationally’ about the facts before the utterance of (20) is the same in both cases (they are informationally independent). It is our assumptions about possible factual dependencies that will decide whether an HC interpretation is possible, or whether a BC-interpretation must be assigned, with factual independence remaining transcontextually stable. The extra layer of structure provided by the distinction between worlds and law-horizons within *cs* allows us to make sense of this difference.

What about cases like (8), in which the grandfather utters an *if*-construction in a context in which it is known that the antecedent is true? In this case, the initial context set cs_1 includes only worlds in which Chris (the grandchild) is hungry, with uncertainty about whether biscuits will be made. The context set that results from the *if*-construction update, cs_2 , doesn’t contain worlds like w_2 , in which Chris is hungry and no biscuits are made. The effect of the *if*-construction is to add the information that the grandfather will bake biscuits (the assumption is that context does not rule out factual dependence between the grandchild’s hunger and the grandfather’s baking):

(21) Grampa: If you are hungry (+H), I will make some biscuits (+B).

- a. $cs_1: \{\langle w_{1+H,+B,\dots}, U_{w_1} \rangle, \langle w_{2+H,-B,\dots}, U_{w_2} \rangle, \dots\}$
- b. $cs_2: \{\langle w_{1+H,+B,\dots}, U_{w_1} \rangle, \dots\}$

As we observed earlier regarding (8), the propositions that Chris is hungry and that the grandfather will make some biscuits are informationally independent in the initial context set cs_1 . They are also informationally independent in the derived context set cs_2 . Recall that Franke’s characterization of informational independence is stated in terms of relations between propositions that are possible (in the epistemic state/ *cs*). In cs_2 , both +H and +B are possible, and their conjunction is also possible (the conditions corresponding to -H and -B would also be met, trivially, given the characterization of informational independence in terms of material implication). Note that the fact that Franke’s definition predicts that if two propositions are entailed by the *cs* they will automatically be independent is important in making sure that the Mirror Constraint does not make incorrect predictions. If two factually independent propositions ϕ and ψ are entailed by *cs*, they will be informationally independent and will not generate conflict with the Mirror Constraint, even though $\phi \rightarrow \psi$ will also be entailed by *cs*.

Let us take stock. In this section we have characterized a notion of independence, *factual independence*, that allows us to distinguish speaker’s assumptions regarding what facts depend on other facts (stored in the law horizons associated with worlds in the context set) from informational (in)dependence. The Mirror Constraint provides a link between the two. The link restricts possible updates by *if*-constructions: an update by an *if*-construction cannot give rise to informational dependence in a context in which factual independence is presupposed. A strengthened update is a strategy to avoid violations of the Mirror Constraint, and the result is consequent entailment. As we have illustrated, the identification of *if*-constructions as BCs depends on assumptions about factual independence and in §3 we will see how this plays a role in explaining the inferences puzzle. As we have seen in §1, not all BCs challenge the Mirror Constraint (e.g., (3)) and we will come back to examples without consequent entailment in §4 (see also fn. 49). Before moving on, in §2.4 we discuss potential problems for the claim that independence is at the core of the interpretation of

if-constructions as BCs.

2.4 Challenges to independence-based biscuits

Not all pragmatic approaches to BCs build on independence. Swanson (2017), for example, points to a set of data that he considers problematic for independence-based accounts. Without attempting to do justice to Swanson's (2017) proposal, we review some of the potentially challenging examples below, starting with (22):

- (22) 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.

According to Swanson, (22) shows that consequent entailment in BCs is an implicature, contrary to what is predicted by independence-based accounts. As an implicature, it can be cancelled (22b) or reinforced (22a). We would like to offer another perspective on the example. First note that (22) will most naturally be interpreted as an HC (possibly a promise that arrival by swimming will lead to snacks). The interpretation is indeed reinforced by (22b) and will be possible only in a context in which it is not factually presupposed that antecedent and consequent are independent. If it is assumed that the antecedent and consequent are factually independent (less natural), then (22) will be interpreted as a BC. Given the possibility of ambiguity, the speaker can correct a potential misunderstanding with (22a). That (22a) 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 a recent discussion). In our analysis, the form of the *if*-construction does not conventionally convey whether the speaker intended a BC or HC interpretation (while conventional cues do not exist in languages like English and Spanish, we do not discard the possibility that in some languages (in)dependence/ biscuithood is indeed conventionally marked). Corrections such as (22a) can ward off misunderstandings arising from the misalignment between the speaker's presuppositions and those of the other discourse participants.

Grammatical factors may affect whether listener's identify a BC or HC reading as the speaker's intended interpretation (see also Merin 2007, pg 21).¹⁹ Future marking in the consequent, for example, favors a temporal order between antecedent and consequent often associated with causality (dependence). Classical BC examples in the literature typically have stative present oriented antecedents and consequents (disfavoring a causal interpretation). A stative present oriented version of (22) clearly favours a BC reading (23), making it strange both to try to disambiguate the intended interpretation, as shown in (23a), or to signal that a HC reading is intended, as in (23b):

- (23) If you go swimming, there are snacks on the other shore. . .
- a. . . . # in fact there'll be snacks however you get there.
 - b. . . . # but not if you kayak over.

While grammatical factors can favor one or the other reading, future marking doesn't necessarily trigger an HC 'promise'-interpretation. A promise-interpretation still depends on contextual factors. As (24) illustrates, if our contextual assumptions strongly favour factual independence (lions do not magically appear, the speaker does not have the power to produce lions on the other side, etc.), a BC reading will arise even in the presence of future marking.

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

¹⁹Merin (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."

In this case, future marking merely signals future overlap between our arrival at the shore and lions.

A second type of example brought up by Swanson (2017) as problematic for independence-based approaches to BCs is illustrated in (25):

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

Swanson (2017) argues that the *if*-construction in (25) triggers the inference that there are indeed biscuits on the sideboard no matter what, and that, *prima facie*, one would then say that it is a biscuit conditional. Given that the antecedent satisfies a presupposition of the consequent, Swanson's claim is that it is hard to actually argue that they are independent. We would like to highlight, however, that despite the intuition that there are biscuits no matter what, our proposal does not characterize (25) as a BC but as an *if*-construction in which the consequent is factually dependent on the antecedent (with the natural understanding that hunger can be alleviated by eating and that alleviating hunger depends on having it). Importantly, though (25) seems to give rise to an inference that there are biscuits on the sideboard no matter what, the inference does not behave in the same way as in BCs. Compare (26) with (27):

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

- (27) 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 a contrast between (26) and (25)/(27). The follow up in (26) is unacceptable (or acceptable only as a self-correction, which is irrelevant here), but this is not the case in (25)/(27). We take the contrast to show that there is a difference in the mechanisms by which the inferences become associated with the *if*-construction in the BC and the HC examples. Our proposal targets the BC examples, making correct predictions. We do not aim to extend our account of consequent entailment to general cases of presupposition projections in HCs, and do not consider that examples like (25) raise serious challenges to an independence based account of BCs (the reader is referred to Swanson (2017) for a proposal and additional examples).²⁰

²⁰ 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 truth of the antecedent. Notice, however, that the licensing conditions of *too* are of a different nature from our notion of independence: *Too* does not require 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*):

- (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.

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 the truth of the consequent leads to the truth of the antecedent. An illustration brought up is provided by (28) 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 *cs*). Speaker and addressee are now looking through the window of a tapas restaurant:

(28) If you feel like tapas right now (+T), this is an excellent tapas restaurant (+E).

The potential concern is that (i) we may accept that this is an excellent tapas restaurant across the board (predicted by a BC interpretation), but (ii) in principle the antecedent and consequent are dependent. Our take on this example is that there is a confound. The example in (28) is in its most prominent interpretation in fact a BC and conveys that this is an excellent tapas restaurant. That you feel like tapas right now and that this is an excellent tapas restaurant are in fact independent. However, (28) can be understood as a shorthand for (29):

(29) If you feel like tapas right now (+T), this is an excellent tapas restaurant and you know it (+EK).

(29) is an HC.²¹ We conclude that examples like (28) are deceiving and do not pose a challenge to our proposal.

3 Interpreting *if*-constructions in discourse

In the previous section we have seen that global update in BCs is the result of a strengthening process triggered by the need to obey the Mirror Constraint, which enforces a congruence relation between what is informationally predicted and what is assumed to be factually possible (we will come back to BCs in which this repair mechanism is not necessary in §4.3). In this section our goal is to account for the inferences triggered by BCs that are not (easily) found with HCs, addressing both the GUP and IP within a unified framework. We present a discourse model that actively incorporates the Q(uestion) U(nder) D(iscussion) approach, spelling out the dynamic update effect of *if*-constructions. This model will allow us to both capture global update and account for the various types of inferences (e.g. permission) associated with BCs. The key to the latter will be the proposal that *if*-constructions play a dual role in discourse, being responsible both for establishing a QUD and providing an answer. This will allow us to apply Gricean reasoning ‘within’ the sentence, deriving the various mysterious inferences in terms of relevance implicatures associated with the main clause understood as an answer to the antecedent QUD. Below we provide an overview of §3.1 and §3.2, where these goals are pursued.

In §3.1 we present a dynamic discourse model that accounts for the strengthened update on the basis of the system sketched in §2.3. As pointed out there, the proposal has at its core Franke’s (2009) solution for the GUP but with an important caveat. As in Franke’s proposal, when the antecedent and consequent are presupposed to be factually independent (as encoded in our framework in the law horizons in *cs*), the update is strengthened to eliminate all worlds in which there are no biscuits on the sideboard (our proposal is in (45)). The caveat is that in our proposal this is because *cs* is stable with respect to factual independence (as we have seen in §2, factual independence is stable across information updates). Our target in §3.1 will be

²¹Note that attempts to spell out (28) as a BC in contexts where the antecedent is accepted as true are not felicitous:

- (i) #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.

those aspects of context that track the making of temporary assumptions (the *a*-slot in the context structure we will adopt) and those aspects that track information growth (the *cs*-slot in the context structure).

In §3.2 we tackle the IP. We show how the different types of inferences associated with BCs are generated in our dynamic discourse model. The key, we argue, is that discourse context tracks not only information growth but also the QUD (see, e.g., Roberts 1996; Büring 2003; Beaver and Clark 2008). In QUD approaches utterances are embedded in an intentional discourse-structure and are interpreted as answering a (implicit) question or positing one. In our model the QUD will be tracked by our representation of context (via a dedicated *Q*-slot). QUD-models are concerned not only with information growth, but also with discourse coherence. Constraints of (discourse) relevance govern what sequences make well-formed discourses. Appealing to a QUD-model in the explanation of BCs will allow us to explore their interpretation with a toolkit that has been developed independently to track coherence across all types of discourse and will allow us to establish a link between *if*-constructions and discourse context by showing that antecedents and consequents stand in question-answer relations and are thus subject to relevance. The link between antecedent and consequent will be encoded appealing to the *Q*-slot in our model and we will refer to this as the “mapping” of *if*-constructions to discourse. Concretely, we will argue that *if*-constructions establish a QUD and address it. In the case of BCs antecedent and consequent are independent and the resulting variety of flavors (permission, suggestions, etc.) arises from trying to reason about the relevance of the consequent as a response to the QUD set up by the antecedent. The various ‘flavors’ of BCs are no more than relevance implicatures. In HCs the antecedent and consequent are dependent and it is easy to find out how one addresses the other (and often times we obtain inferences of causality). In sum, our view is that all inferences triggered by *if*-constructions -whether it be causality, permission or request- are born the same way: they are the result of reasoning about relevance between the question and response pair set up by the *if*-construction. Differences in the inferences associated with BCs and HCs stem from assumptions of factual (in)dependence and from how these assumptions affect speaker’s reasoning regarding the discursive question-response relation.²²

As we derive the IP from incorporating the QUD approach to our model, and explain the GUP from constraints in the update process, we can offer a very simple semantics for *if*-constructions. The proposal shifts the burden of accounting for special BC-features from BC-specific semantics to a conspiracy among a unified (simple) semantics for all *if*-constructions, contextual assumptions, dynamic updates and intentional discourse-structure.

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

Our dynamic model assumes that utterances are proposals to update the context (see Stalnaker 1978, see also Farkas and Bruce 2010 on assertions, Starr 2013/2020 on imperatives and Biezma and Rawlins 2017 on questions). The formal details follow more closely Biezma and Rawlins (2017). The goal of this section is to present the model, incorporating insights about the interaction between facts and laws obtained in §2, and characterize the strengthened update generated by BCs. We will start by (A) presenting the model, and then (B) characterize update for simple sentences, (C) characterize standard updates for *if*-constructions, and finally (D) address the case of BCs. Much of (A)-(C) is familiar from earlier literature, and readers may wish to skip ahead to (D) in pg. 23.

Let us first provide a preview of what is behind our account. Our model has its root in the well known dynamic update of *if*-constructions in Heim (1983, 1992). 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

²²There 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.

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 subsequent updates take place. In the running example, we are asked to assume that all the worlds that matter are those selected worlds in which it rains today and 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 lose all the ones that were lost: we lose 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 or not we cancel the picnic).²³ We can represent this process as in (30), with a *Context Change Potential* (CCP) for context c and sentences ϕ and ψ (we provide details later in this section):

$$(30) \quad c + \ulcorner \text{ASSERT}(\text{if } \phi, \psi) \urcorner = c + (\ulcorner \text{ASSUME } \phi \urcorner + \ulcorner \text{ASSERT } \psi \urcorner)$$

In the running example, we could stop here (although one still needs to derive how it is 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 will lead us to conclude that we cancel the picnic (modus ponens) and, conversely, learning that we don’t cancel the picnic will lead to learn that it doesn’t rain today (modus tollens). The updated cs encodes an informational dependence. This is fine, since the Mirror Constraint in (16) is obeyed (i.e., we can accept that they are not factually independent and hence the resulting cs does not reflect an informational dependence running against our assumptions of factual dependence encoded via the law-horizons in in cs). Later (communal) considerations regarding how the world works and the correlations learned may lead to incorporating a dependence, and cs will evolve to contain only worlds in which this dependence holds.

Things are different in the case of BCs. Let us consider the stereotypical BC *If you are hungry, there are biscuits on the sideboard*. The CCP above would lead us to an impossible cs , i.e., a cs that presents information dependencies inconsistent with assumptions of factual independence. More concretely, the simple update results in a cs in which the Mirror Constraint is not obeyed. As we saw in §2.3, in order to update the context with a BC in the same fashion as any other *if*-construction (the assumption behind a unified account) while obeying the Mirror Constraint, something else needs to be done: we need to repair the resulting cs so it doesn’t present an informational dependence running against the factual independence encoded in cs .

With the preview of what our model aims to do in mind, we can now start with (A): presenting the model. We build on Biezma and Rawlins (2017) and characterize a context c as a 4-place tuple. The tuple includes information about the context set: a cs -slot which encodes assumptions about facts and factual dependencies. The cs is characterized (as before) as a set of $\langle w, U_w \rangle$ tuples where w is a world in which the factual assumptions made in the context hold and U_w is its law horizon (§2). The context tuple also includes information about the question under discussion in the conversation (QUD): a Q -slot. The QUD will play a crucial role in solving the Inferences Puzzle (IP) and will be the focus of §3.2. It includes also a slot that tracks temporary assumptions: the a -slot (following Rawlins 2010a) (a view of context that allows temporary assumptions to be tracked explicitly will be helpful in dealing with the interpretation of *if*-constructions). Finally, the context tuple includes a slot to track proposals awaiting evaluation: the \mathcal{F} -slot. The model works with the assumption that utterances do not automatically update a context, but instead are update proposals, which need to be evaluated and resolved. The \mathcal{F} -slot is the ‘waiting’ room. It will be empty (if there is nothing awaiting evaluation, as in discourse initial situations), or encode a copy of the

²³This is effectively the context change potential in Heim (1983):

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

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 definition in (32) (in what follows we only use subscripts when disambiguation is necessary, e.g., $cs_{\mathcal{F}_c}$ is the cs in the projected context of a context c):

- (31) A local context l is a tuple $\langle a, cs, Q \rangle$ such that:
- $a \subseteq \mathcal{W}$ is the *view* on the context, where \mathcal{W} is the set of all possible tuples $\langle w, U_w \rangle$ (we ‘see’ only the a -tuples in \mathcal{W}). For an unrestricted view, $a = \mathcal{W}$
 - $cs = \{ \langle w, U_w \rangle : w \in \cap CG \text{ and } U_w \text{ is a law horizon associated with } w \}$, where CG is the Stalnakerian Common Ground (see §2)
 - Q is a stack of sets of propositions (the QUD stack)
- (32) A *context* c is a tuple $\langle a, cs, Q, \mathcal{F} \rangle$ whose elements are characterized as:
- $l_c = \langle a, cs, Q \rangle$ is a local context.
 - \mathcal{F}_c is either a local context or \emptyset . Call \mathcal{F}_c the *projected context*.

We turn now to (B) and define how context updates proceed. We illustrate this with (a simplistic view of) updates with declaratives (see Biezma 2020 for more details). 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 . The effect is the standard cs update in which worlds not compatible with the new proposition are removed (signaled by \oplus). This is what is recorded in \mathcal{F} (we set Q aside for the moment):

- (33) **ASSERT:**

$$c + \lceil \text{ASSERT}(\phi) \rceil = \langle a_c, cs_c, Q_c, l_c \oplus \lceil \phi \rceil \rangle$$

Constraints:

- $\mathcal{F}_c = \emptyset$ (proposals can only be made when there is nothing pending evaluation);
 - $l_c \oplus \lceil \phi \rceil$ is felicitous (see (35)).
- (34) **Example:**
- $$c + \lceil \text{ASSERT}(\text{We cancel the picnic}) \rceil = \langle a_c, cs_c, Q_c, l_c \oplus \llbracket \text{We cancel the picnic} \rrbracket \rangle$$
- Constraints:
- $\mathcal{F}_c = \emptyset$ and
 - $l_c \oplus \lceil \text{we cancel the picnic} \rceil$ is felicitous (see (35)).

Auxiliary definitions are offered below. ‘ \oplus ’ in (35b) targets cs by making use of the intersection defined in (35a). The definition in (35c) establishes felicity conditions: an utterance of an indicative clause is only felicitous if there are worlds in the context set in which such proposition is true (we leave aside *relevance* for the moment and return to it in (50)). The example in (34) is expanded in (36).

- (35) Auxiliary definitions:

- Given a cs and a proposition ψ ,

$$cs \sqcap \psi = \{ \langle w, U_w \rangle \in cs \text{ s.t. } \psi(w) = 1 \}$$

- \oplus -**operation** (to be revised in (41)):

Let l be a local context, $l = \langle a, cs, Q \rangle$, and ϕ a sentence denoting a proposition,

$$l \oplus \lceil \phi \rceil = \langle a, cs \sqcap \llbracket \phi \rrbracket, Q \rangle,$$

felicitous only if felicitous only if

- (i) $\llbracket \phi \rrbracket$ is compatible with cs_l .
- (ii) $\llbracket \phi \rrbracket$ is relevant.
- c. A proposition ψ is compatible with a set of world-horizon tuples K iff $\exists \langle w, U_w \rangle \in K$ s.t. $\psi(w) = 1$.

We can illustrate how these operations work as follows:

- (36) $l_c \oplus \ulcorner \text{We cancel the picnic} \urcorner = \langle a_c, cs_c \sqcap \llbracket \text{We cancel the picnic} \rrbracket, Q_c \rangle$,
 felicitous only if $\llbracket \text{We cancel the picnic} \rrbracket$ is compatible with cs_c and relevant.

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

- (37) $c + \ulcorner \text{ACCEPT}_x \urcorner = \langle a_{\mathcal{F}_c}, cs_{\mathcal{F}_c}, Q_{\mathcal{F}_c}, \emptyset \rangle$, where x is the participant accepting the proposal.

At the end of the update cs has changed to eliminate the $\langle w, U_w \rangle$ tuples where we do not cancel the picnic w .

We now turn to (C) and the update standardly brought about by *if*-constructions. As before, we illustrate the proposal with a simple example: *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 a_c (this is the operation ‘ \otimes ’ in (39) below) and only worlds compatible with the assumptions in a_c are updated by subsequent updates. The update corresponding to an *if*-construction is given in terms of *ASSUME* and *ASSERT*, as described below:

- (38) **ASSUME:**
 $c + \ulcorner \text{ASSUME}(\phi) \urcorner = \langle a_c, cs_c, Q_c, l_c \otimes \ulcorner \phi \urcorner \rangle$.
 Constraint: $l \otimes \ulcorner \phi \urcorner$ is felicitous.

- (39) **\otimes -operation:**
 Let l be a local context, $l = \langle a, cs, Q \rangle$,

$$l \otimes \ulcorner \phi \urcorner = \langle a \sqcap \llbracket \phi \rrbracket, cs, Q \rangle$$

when ϕ has indicative mood, $l \otimes \ulcorner \phi \urcorner$ is felicitous only if $cs \sqcap \llbracket \phi \rrbracket \neq \emptyset$

When no assumptions are made, $a = \mathcal{W}$.

- (40) **Example:**
 $c + \ulcorner \text{ASSUME}(\text{It rains}) \urcorner = \langle a_c, cs_c, Q_c, l_c \otimes \ulcorner \text{It rains} \urcorner \rangle$.
 Constraint: $l \otimes \ulcorner \text{It rains} \urcorner$ is felicitous, i.e., $cs \sqcap \llbracket \text{It rains} \rrbracket \neq \emptyset$

Rawlins (2010a) defines a ‘domain limited’ update that takes into account the assumptions stored in the context (inspired by Kaufmann’s 2000 ‘ \vdash ’ operator). The claim is that assertions only affect the worlds in the context that satisfy the assumptions that have been made, with the new characterization of \oplus given in (41). If no assumptions are registered, $a = \mathcal{W}$, and (41) will predict the same results as (35b).

- (41) **\oplus -operation (final):**
 Let l be a local context, $l = \langle a, cs, Q \rangle$, and ϕ a declarative sentence denoting a proposition,

$$l \oplus \ulcorner \phi \urcorner = \langle a, (cs \sqcap a \sqcap \llbracket \phi \rrbracket) \cup (cs \sqcap \bar{a}), Q \rangle$$

felicitous only if

- a. $\llbracket \phi \rrbracket$ is compatible with cs_l .
- b. $\llbracket \phi \rrbracket$ is relevant.

Assumptions, then, target a_c and delimit the domain of posterior declarative updates. Below we work out our example (leaving aside the role of Q and the IP until §3.2):

(42) **If it rains, we cancel the picnic**

- a. $c + \lceil \text{ASSERT}(\text{if it rains, we cancel the picnic}) \rceil =$
 $c + (\lceil \text{ASSUME}(\text{it rains}) \rceil + \lceil \text{ASSERT}(\text{we cancel the picnic}) \rceil) =$
 $\langle a_c, cs_c, Q_c, (l_c \otimes \lceil \text{it rains} \rceil) \oplus \lceil \text{we cancel the picnic} \rceil \rangle$
- b. $l_c \otimes \lceil \text{it rains} \rceil = l'_c = \langle a_c \sqcap \llbracket \text{it rains} \rrbracket, cs_c, Q_c \rangle,$ (see (38))
 felicitous only if $\llbracket \text{it rains} \rrbracket$ is compatible with cs_c .
- c. $l'_c \oplus \lceil \text{we cancel the picnic} \rceil = \langle a_c \sqcap \llbracket \text{it rains} \rrbracket, (cs_c \sqcap \llbracket \text{it rains} \rrbracket) \sqcap \llbracket \text{we cancel the picnic} \rrbracket \rangle \cup$
 $(cs_c \sqcap \overline{\llbracket \text{it rains} \rrbracket}), Q \rangle = l''_c,$
 felicitous only if (i) $\llbracket \text{we cancel the picnic} \rrbracket$ is compatible with $cs_c \sqcap \llbracket \text{it rains} \rrbracket$ and relevant,
 and (ii) the Mirror constraint is obeyed.

Notice that while we have broken down the dynamic update in different steps, we are not describing a “process” *per se*. The utterance of the *if*-construction is a proposal to update cs in the manner finally recorded in \mathcal{F} (e.g., l''_c in (42c)).

The assumption in the antecedent in *if*-constructions is a temporary one, just made for the purpose of the update. When the *if*-construction is accepted, the temporary assumption will be lifted (‘popped’) and a will be reset to \mathcal{W} :²⁴

- (43) a. **Acceptance:**
 $\langle a_c \sqcap \llbracket \text{it rains} \rrbracket, (cs_c \sqcap \llbracket \text{it rains} \rrbracket) \sqcap \llbracket \text{we cancel the picnic} \rrbracket \rangle \cup (cs_c \sqcap \overline{\llbracket \text{it rains} \rrbracket}), Q, \emptyset \rangle = c_2$
- b. **Lifting assumption:** $c_2 + \text{AsPop} = \langle \mathcal{W}, cs_{c_2}, Q, \emptyset \rangle.$

Once the update in (43a) is accepted, the antecedent and consequent propositions will not be informationally independent (learning the antecedent will lead to learning the consequent). However, (plausibly) it is not presupposed in the context that the propositions are factually independent. This means that the update brought about by *If it rains, we cancel the picnic* does not violate the Mirror Constraint. Note that the update characterized above will not lead to changes in the factual dependencies assumed in the context. We would like to argue that changes to the laws accepted in the context are not encoded in the dynamics of *if*-constructions. In accepting an *if*-construction one learns about a correlation. It is by reasoning about correlations and how the world works that our assumptions about laws may change. Changes in our assumptions about laws are not simply the result of accepting an *if*-construction.

We can finally address (D), the case of BCs, and will illustrate the proposal below with our familiar example. A derivation as in the previous case will crash: making the assumption itself will not give rise to problems, (44a), but the felicity conditions associated with the Mirror Constraint will not be met by the update corresponding to the matrix clause (44b):

(44) **Example:**

$$c + \lceil \text{ASSERT}(\text{if you are hungry, there are biscuits on the sideboard}) \rceil =$$

²⁴Isaacs 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.

- $$c + (\ulcorner \text{ASSUME (you are hungry)} \urcorner + \ulcorner \text{ASSERT (there are biscuits on the sideboard)} \urcorner) = \langle a_c, cs_c, Q_c, (l_c \otimes \ulcorner \text{you are hungry} \urcorner \oplus \ulcorner \text{there are biscuits on the sideboard} \urcorner) \rangle$$
- a. $l_c \otimes \ulcorner \text{you are hungry} \urcorner = l'_c = \langle a_c \sqcap \llbracket \text{you are hungry} \rrbracket, cs_c, Q_c \rangle$
felicitous only if $\llbracket \text{you are hungry} \rrbracket$ is compatible with cs_c .
- b. $l'_c \oplus \ulcorner \text{there are biscuits on the sideboard} \urcorner = \langle a_c \sqcap \llbracket \text{you are hungry} \rrbracket, (cs_c \sqcap \llbracket \text{you are hungry} \rrbracket) \sqcap \llbracket \text{there are biscuits on the sideboard} \rrbracket \cup (cs_c \sqcap \overline{\llbracket \text{you are hungry} \rrbracket}), Q_c \rangle$
felicitous only if (i) $\llbracket \text{there are biscuits on the sideboard} \rrbracket$ is compatible with $cs_c \sqcap \llbracket \text{you are hungry} \rrbracket$ and relevant, and (ii) the *Mirror Constraint* is obeyed.

The conventional update in (44b) is not possible because it does not obey the Mirror Constraint (see §2.3). The question is what to do. In principle, we have two options: (i) we could conclude that the speaker is indicating that the independence assumption represented in cs is wrong (the conclusion would be that the speaker didn't share it); or, as we saw in §2.3 above, (ii) we could proceed with minimal modifications in the update in a way that does not lead to a problematic informational dependence in cs and that is still compatible with the semantics of the *if*-construction.

Following option (i) leads to amending our assumptions about laws 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 the assumed laws? We can update the context by not only eliminating $\langle w, U_w \rangle$ tuples from cs_c in which you are hungry in w and there are no biscuits in w , but all $\langle w, U_w \rangle$ tuples in which there are no biscuits in w (as proposed by Franke 2009 and discussed in §2.3). This means that we widen the domain of the update (to include all worlds, not just antecedent-worlds) and obtain in return a stronger claim:

- (45) **Domain-Widening Update** \cap_{wide} : Let $cs_{c_1}^\phi$ be a context set resulting from making a temporary assumption ϕ in an original cs_c . Let cs_{c_2} be the update of $cs_{c_1}^\phi$ with ψ ($cs_{c_2} = (cs_{c_1} \sqcap \phi \sqcap \psi) \cup (cs_{c_1} \sqcap \bar{\phi})$). For any such cs_{c_2} that violates the mirror constraint, widen the domain of the update to a new cs'_{c_2} s.t. $cs'_{c_2} = (cs_{c_1} \sqcap \phi \sqcap \psi) \cup (cs_{c_1} \sqcap \bar{\phi} \sqcap \psi) = cs_{c_1}^\phi \cap_{\text{wide}} \psi$
PARAPHRASE: If the resulting cs_{c_2} violates the mirror constraint, update both the temporary context and its complement with the matrix clause).

By widening the domain when the antecedent and consequent are independent we end up with a context set in which there are biscuits in all worlds, whether you are hungry or not. The result is Global Update and the strengthened update offers a solution to the GUP. In this account, consequent entailment is not a property of BCs, but the result of striving for coherence between what is assumed to be the case and assumptions about possible dependences. Domain widening is triggered to avoid the false inference that factual dependence between the antecedent and consequent is possible in cs (to ensure that the Mirror Constraint is respected). Interestingly, the use of domain widening as a 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 free choice items (see Kratzer and Shimoyama 2002). While our proposal predicts that global update in BCs can be triggered in order to keep a coherent context, it does not predict that all *if*-constructions triggering a global update are BCs, which we take to be a good thing.²⁵ Having addressed the GUP, we turn to the IP in the next section.

²⁵It 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.

3.2 The IP: Putting the QUD stack on center stage of the construction of meaning

Our views on discourse structure are guided by Roberts (1996) (see also Büring 2003; Beaver and Clark 2008). 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 speaker's intentions by identifying the question under discussion that is being asked. In short, there are linguistic cues in sentences that serve to indicate what is the QUD being addressed and 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 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.

In our model of context, the Q -slot corresponds to the QUD-stack (a stack of sets of propositions) and is key to determining felicity in discourse. The information stored in Q determines discourse structure. In a QUD-model discourse participants are taken to commit to solving the current QUD (the question on the top of the stack, $top(Q)$) and 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*-construction 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 issue at length in §3.2.3 while in 3.2.1 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/ $top(Q_i)$ is when it is not explicit.

3.2.1 Q and the utterance of interrogatives

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 , 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), with the empty stack indicated as $Q = \langle \rangle$.²⁶

Following Biezma and Rawlins (2017), we define an interrogative update (\otimes) to capture the effect of interrogatives on the context. As before, we will present our proposal with the aid of an example. Consider the utterance of *What does Chris play?* in a context. Syntactically it is an interrogative, denoting a set of propositions (the set of its possible answers), and as such its sentential force is to update Q . We first provide the definitions and then an example in (48):

- (46) **QUESTION:**
 $c \uparrow \text{QUESTION}(\phi)^\top = \langle a_c, cs_c, Q_c, l_c \otimes \uparrow \phi^\top \rangle$.
 Constraints:
 a. $\mathcal{F}_c = \emptyset$.
 b. $l_c \otimes \uparrow \phi^\top$ is felicitous (see (47)).

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.

²⁶Given 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 effect of (46b) 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., $\mathcal{F}_c = \emptyset$) and the update of Q is relevant as defined in (49).

(47) **∅-operation:**

Let l be a local context, $l = \langle a, cs, Q \rangle$, and ϕ an interrogative sentence denoting a set of propositions, $l \oslash \ulcorner \phi \urcorner = \langle a_l, cs_l, push(Q_l, \llbracket \phi \rrbracket) \rangle$, felicitous only if

- a. cs_l is compatible with $\{w \mid \exists p \in \llbracket \phi \rrbracket : p(w)\}$ (answerability)
- b. $\llbracket \phi \rrbracket$ is relevant to $top(Q_l)$ or $Q_l = \langle \rangle$. (relevance)

(48) **Example:**

$l \oslash \ulcorner \text{What does Chris play?} \urcorner =$
 $\langle a_l, cs_l, push(Q_l, \llbracket \text{what does Chris play?} \rrbracket) \rangle$ [Interrogative update]

Felicity constraints:

- a. cs_l is compatible with $\{w \mid \exists p \in \llbracket \text{What does Chris play?} \rrbracket : p(w)\}$. (answerability)
- b. $\llbracket \text{What does Chris play?} \rrbracket$ 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 conversational participants are committed to answering. An interrogative update will be felicitous only 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 the question at the top of the local QUD stack Q_l . Relevance is invoked in defining licensing conditions both for the utterance of interrogatives and assertions. The licensing conditions for assertions (*answerhood licensing* in (50)) correspond to the notion of relevance referred to in the definition of ‘ \oplus ’ in (41) (the definitions below are adapted from the notion of Relevance in Roberts 1996²⁷):

(49) **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).

(50) **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 only so indirectly (and we actually arrive at an answer via pragmatic enrichment in an attempt to make the response relevant).

Questions 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:

(51) **QUD resolution:**

$c + \ulcorner \text{Pop} \urcorner = \langle a_c, cs_c, pop(Q_c), \mathcal{F}_c \rangle$

Constraints:

- a. $\mathcal{F}_c = \emptyset$
- 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

²⁷See Büring (2003) for a more relaxed notion of answerhood. The differences do not matter for our purposes.

context slot \mathcal{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.

3.2.2 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. The main linguistic cue is provided by the information structure of the utterance, in particular by focus.²⁸ Focus helps to determine what is 'at issue' (the *main point* of the utterance, according to Potts 2005) and to identify the current QUD. However, what is at issue can also be encoded in the syntactic structure. We argue that this is what happens in *if*-constructions (§3.2.3): given the utterance of an *if*-construction, the *if*-clause very often establishes the question to be addressed by the matrix clause (the matrix clause presents the at issue meaning while the *if*-clause is not at issue). While this can be reversed in some cases, we argue in §3.2.5 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 in the next section, we provide an overview of the relation of utterances to discourse in the simple general case in which prosodic focus marking is enough to indicate what is at issue. This will set up the basis for the more complicated case of *if*-constructions.

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, indicated by small caps, to mark what the focus constituent is). This explains intuitions on the contrast in (52):

- (52) A: Who plays soccer?
 B₁: [CHRIS]_F plays soccer.
 B₂: #Chris plays [SOCCER]_F

Appealing to the Roothian tradition (Rooth 1985, 1992, 1996) of associating both an ordinary semantic value ($\llbracket \cdot \rrbracket^o$) and a focus semantic value ($\llbracket \cdot \rrbracket^f$) with an utterance, the focus value of B₁'s utterance is the set of propositions {that Chris plays soccer, that Susan plays soccer, ...}, while the focus value of B₂'s utterance is the set {that Chris plays soccer, that Chris plays basketball...}. Even though the proposition that Chris plays soccer is relevant to the question of who plays soccer, B₂'s move in (52) 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. B₂'s utterance in (52) is interpreted, contrary to fact, to provide an answer to a question of the form *what does Chris play?*²⁹

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:

- (53) **(Question-Answer) Congruence:**
 An utterance U with F-marking answers a question containing ≥ 2 alternatives from the set $\llbracket U \rrbracket^f$.

Given Congruence, F-marking on an utterance is linked to alternatives corresponding a previous question,

²⁸Following 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.

²⁹In 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 (2020) for more details on the update process.

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 that (54) is uttered out of the blue (i.e., there is no explicit question this is an answer to).

(54) Chris plays [SOCCER]_F.

Given the Congruence constraint and focus marking, the utterance in (54) will be felicitous only if there is a question in discourse of the form *What does Chris play?* Incorporating Congruence into the model of dynamic update amounts to conveying that the utterance in (54) triggers the presupposition that the current QUD/top(Q) is a question of the form *What does Chris play?* (see Biezma 2020). In the absence of an explicit question, this will need to be accommodated. Following Biezma and Rawlins (2017); Biezma (2020), accommodation is characterized as in (55):

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

For our example in (54), 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 Chris play?*, (56a-i). Once this is done, they can proceed with the dynamic update of the declarative. The declarative proposes that the cs_{l_c} in the context resulting after the accommodation be updated with the information that Chris plays soccer, (56a-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, (56b) ($Q_{c_2} = Q_c$) (since $a = \mathcal{W}$, we simplify the assertion update, see (41); details here are from Biezma 2019, 2020).

(56) Let $c = \langle a, cs, Q, \emptyset \rangle$ be the initial context:

- a. $c + \ulcorner \text{ASSERT}(\text{Chris plays } [\text{soccer}]_F) \urcorner$
 - (i) Accommodate that the local context is $\langle a_c, cs_c, Q'_c \rangle = l'_c$
s.t. $Q'_c = push(Q_c, \llbracket \text{what does Chris play?} \rrbracket)$, i.e., $top(Q'_c) = \llbracket \text{what does Chris play?} \rrbracket$
(Focus anaphora)
 - (ii) Propose the update of cs_c (with the answer) (Assertion)
 $\langle a_c, cs_c, Q'_c, l'_c \oplus \ulcorner \text{Chris plays } [\text{Soccer}]_F \urcorner \rangle$
 $l'_c \oplus \ulcorner \text{Chris plays } [\text{Soccer}]_F \urcorner = \langle a_c, cs_c \sqcap \llbracket \text{Chris plays } [\text{Soccer}]_F \rrbracket, Q'_c \rangle$
- b. Acceptance: Accept the proposed future context and $pop(Q'_c)$:
 $c_2 = \langle a_c, cs_c \sqcap \llbracket \text{Chris plays } [\text{Soccer}]_F \rrbracket, Q_c, \emptyset \rangle$

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).

Prosodic focus marking is the main cue to identify what is at issue (the current QUD) in simple sentences in English but more complex structures also do this syntactically. Following previous literature, we argue below that in *if*-constructions the syntactic structure also conveys information about what is at issue.³⁰ 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).

³⁰*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.

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:

- (57) 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 identifying 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 draws on 'Relevance' and 'Congruence' to capture the special effects associated with BCs.

3.2.3 Mapping *if*-constructions to discourse

In this section we finally tackle the IP. Our proposal is that the key to understanding the inferences associated with BCs is the recognition that context update by *if*-constructions has consequences not only for the *a*- and *cs*- slots in a context as described in §3.1, but also for the Q-slot that tracks discourse coherence. We argue that *if*-constructions have a particular 'mapping to discourse' by which they affect the question-stack, and thus impose congruence constraints. We show that the special inferences obtained in the case of BCs can be explained as an effort to maintain discourse coherence in light of the presupposition of factual independence between antecedent and consequent. The connection between BCs and discourse has been highlighted in earlier literature: 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 in both BCs and HCs, and exploit it as the source of the inferences that are 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 *if*-constructions and questions at the structural and at the interpretational level), which has seen recent developments in e.g., von Stechow (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 *if*-constructions as a complex discourse move in terms of questions and their answers, our proposal appeals to constraints on discourse structure to derive the various 'flavors' of BCs discussed in the literature without a BC-specific semantics: these flavors are the result of pragmatic reasoning.

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, characterized as the QUD in Roberts's model (as seen in (57) above). This means that when speakers integrate the utterance of an *if*-construction in 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. The utterance overtly specifies the discourse question to which the answer is subordinated (the technical details of the update process are postponed to

§3.2.4, after we have had a chance to work through some examples). The mapping between *if*-clauses and QUDs (establishing $top(Q)$), 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 Stechow 2009, Biezma 2011b,a). However, as we will see in §3.2.5, only the default mapping is available to BCs. Our proposal will be able to explain why.

What is the QUD set up by the antecedent *if*-clause? The consequent in an *if*-construction spells out a property claimed to be common to all antecedent worlds: they are all claimed to have the property of being worlds where the consequent is true. The QUD set up by the antecedent in *if* ϕ , ψ will thus be about a property that all antecedent worlds (selected ϕ -worlds) have. We can intuitively characterize it as ‘*What do the selected ϕ -worlds look like?*’ / ‘*What is true at the selected ϕ -worlds?*’. In what follows we take the shortcut of paraphrasing the question as *what if ϕ ?*, though this is not always a suitable overt paraphrase and the overt question may also introduce additional inferences (see Rawlins 2010b; Bledin and Rawlins 2019). Here is a simple illustration with the HC *If it rains, I wear my hat*:

(58) **Default mapping:** *If ϕ , ψ*

QUD: What do the selected worlds in which ϕ is true look like?

Answer: They are ψ -worlds.

(59) **Example:** *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’ many different ways. We certainly do not take an utterance of an *if*-construction to be a question about all those ways (we do not take the proposition that I wear my hat in (59) to be the only true proposition in the antecedent worlds). However, constraints on discourse structure guide our identification of the specific QUD established 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 answer and thus the at-issue content. As we have seen in §3.2.2, general constraints on discourse structure (such as Relevance and Congruence) guide our interpretation, allowing us to enrich and refine the QUD. Understanding that the consequent provides the answer allows us to identify the speaker’s intention in placing the question. For an example like (59), learning that the information that the speaker wears their hat answers the question raised by the antecedent leads us to conclude that the intended question specifically 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?*). The indication that the consequent spells out a possible answer together with the understanding that the possible answers in the denotation of a question are related, allows us to narrow down/can identify the intended QUD. In this way, discourse felicity constraints guide us in recovering the specific goals the speaker had in mind in setting up what in principle appears a rather vague QUD.³¹

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

(60) **Example:** *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.

³¹The 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 evening? Was dinner good? vs. How was your evening? Was your date attractive?*. In the case of BCs, as well as HCs with the default mapping to discourse, it is the answer to the question that allows us to identify the QUD targeted by the speaker, not a subquestion.

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, the fact that the consequent provides an answer guides us in identifying the specific 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 alleviate the hunger). 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. 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 them hungry, and that 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:

(61) 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 going to alleviate the hunger, or that calling the doctor would alleviate 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/suggestion 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 (‘ \rightsquigarrow ’ indicates that what follows is an inference/implicature):

(62) A’s parent, 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.

\rightsquigarrow I suggest/allow you to eat the biscuits on the sideboard.

As (62) 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., (64a)) or any other exchange in which similar goals can be reconstructed (e.g., (63), (64b)):³²

³²That the *if*-construction 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,

- (63) A: I'm hungry.
B: There are biscuits on the sideboard.
 ↪ I suggest/allow you to eat the biscuits on the sideboard.
- (64) 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?
 Parent: You are four.
 ↪ I command you to say that you are four.
- b. Son: The ticket collector is coming.
 Parent: 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.³³ This is illustrated below. Suppose that A eats the biscuits following B's utterance in (65). It would be odd for B to scold them afterwards:

- (65) A: I'm hungry.
B: There are biscuits on the sideboard.
 [A goes to the kitchen and eats the biscuits.]
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 are cancelling the permission inference that would have been triggered otherwise. Crucially, the same holds for (62) and (63): cancellation is possible if it is done right away, but not a while afterwards. If not cancelled, it becomes part of the update.

This additional discourse mapping of *if*-constructions 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 cannot. The following example (adapted from Franke 2009, pg. 275) illustrates the point:

- (66) B has been helping A to pack for a trip by handing them stuff, and is obviously tired:
A: There are biscuits on the sideboard.
 [B hands the cookies to A who starts laughing. A explains that they were just suggesting that B eat them since they look tired and sugar would do them good.]

An 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

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 Stechow (2009) (see example (69) below).

³³See Biezma et al. (2012); Arregui and Biezma (2016) for a discussion on discourse manners and non-cancellable implicatures in *if*-constructions 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.

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).³⁴

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. We propose to map BCs to discourse as a complex question-answer move and understand the associated inferences as enrichment in the same manner. Participants in discourse 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 participants are not capable of building such a relation, they find both *if*-constructions and question-answer pairs infelicitous (as expected). This is exemplified in (67), where the *if*-construction in (67a) (from Sano and Hara 2014) and the question-answer pair in (67b) are (without further contextual aid) normally considered infelicitous:

- (67) 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 (67a) would normally be a BC-interpretation: our *cs* contains both tuples with worlds in which France is hexagonal and with worlds in which it is not, and this will be factually independent with whether there is beer in the fridge or not. However, an utterance of (67a) (as well as B's response in (67b)) 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 the claim 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). Since there is no preconceived link between antecedent and consequent, i.e., they are independent, it is hard to come up with a plausible answerhood relation. 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 (67a) and (67b) 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 (and 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).³⁵ While we cannot go into this issue further here, see Goebel (2019) for an elaboration of the

³⁴Notice 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 Alex is still out there. Alex will get completely soaked.
 B: Don't worry. Alex has an umbrella.
 A: But the poor child! This is terrible! Dreadful!
 B: Stop exaggerating. If it rains, Alex has an umbrella.

B's point in uttering the BC is to emphasize that Alex has an 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 Alex has an umbrella and it's now time to move on (the matrix clause is intended to convey an exhaustive answer).

³⁵For approaches to indirect speech acts that make use of tools from decision theory (see van Rooij 2003; Benz and van Rooij

mechanism of pragmatic enrichment in BCs.

Note that utterances of HC *if*-constructions, in which antecedent and consequent are dependent, also trigger inferences. A frequent implicature in such cases is that the consequent is causally related to the antecedent (as in (59)). Given that this dependence relation is aligned with our assumptions about factual dependencies, the inference of causal dependence is easier to arrive at and may be impossible to avoid. In the case of BCs, inferences are less ‘direct’: given that we have discarded a factual dependence 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.³⁶

Before turning in §3.2.5 to the question of why *if*-constructions with independent antecedent and consequent can only have a default mapping in which the antecedent establishes the question that the consequent addresses, let us summarize with an example how all the pieces come together.

3.2.4 Formal implementation

In this section we bring together our conclusions regarding how *if*-constructions map to discourse with the characterization of updates by *if*-constructions in §3.1. While the earlier discussion incorporated the Mirror Constraint and accounted for widened update in BCs (thus solving the GUP), two ingredients were missing: an acknowledgement that the utterance of *if*-constructions brings about a change in the *Q*-slot and an acknowledgment of the pragmatic enrichment needed to maintain discourse coherence. We remedy the first deficiency by including accommodation of the *if*-clause associated QUD within the characterization of conditional update. We remedy the second by accepting that enrichment generated via relevance-centered inferences is incorporated globally in the updated context (our proposal is simplified in that we have not included in our characterization of context a particular way to track suggestions, commands, etc. - we leave this for future research³⁷). The final characterization of conditional update will thus solve also the IP.

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. The central insight is 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 Bledin and Rawlins (2019). 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.

³⁶Ippolito (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 (69), 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 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.

³⁷Commands, 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 2013/2020). Developing all the details here goes beyond the scope of this paper and is left here for future research. It suffices for us to encode the *cs* update triggered by the manifest event. We can accept both the

We bring all the ingredients together below and present the complete proposal on the basis of our running example:

(68) **Example:** *If you are hungry, there are biscuits on the sideboard*

- a. if-construction update:
 $c + \ulcorner \text{ASSERT (if you are hungry, there are biscuits on the sideboard)} \urcorner =$
 $c + (\ulcorner \text{ASSUME (you are hungry)} \urcorner + \ulcorner \text{ASSERT (there are biscuits on the sideboard)} \urcorner) =$
 $\langle a_c, cs_c, Q_c, (l_c \otimes \ulcorner \text{you are hungry} \urcorner) \oplus \ulcorner \text{there are biscuits on the sideboard} \urcorner \rangle$
- b. Q-slot update (default mapping to discourse):
 Accommodate that the local context (l'_c) is $\langle a_c, cs_c, Q'_c \rangle$ s.t.
 $Q'_c = \text{push}(Q_c, \llbracket \text{what if the addressee is hungry?} \rrbracket)$, i.e.,
 $\text{top}(Q'_c) = \llbracket \text{what if the addressee is hungry?} \rrbracket$
- c. a-slot update (triggered by the if-clause):
 $l'_c \otimes \ulcorner \text{you are hungry} \urcorner = l''_c = \langle a_c \sqcap \llbracket \text{you are hungry} \rrbracket, cs_c, Q'_c \rangle,$
 felicitous only if $\llbracket \text{you are hungry} \rrbracket$ is compatible with cs_c .
- d. cs-slot update (triggered by the consequent clause):
 $l''_c \oplus \ulcorner \text{there are biscuits on the sideboard} \urcorner =$
 $\langle a_c \sqcap \llbracket \text{you are hungry} \rrbracket, (cs_c \sqcap \llbracket \text{you are hungry} \rrbracket) \sqcap \llbracket \text{there are biscuits on the sideboard} \rrbracket \rangle \cup$
 $(cs_c \sqcap \llbracket \text{you are hungry} \rrbracket), Q'_c,$
 felicitous only if $\llbracket \text{there are biscuits on the sideboard} \rrbracket$ is compatible with $cs_c \sqcap \llbracket \text{you are hungry} \rrbracket$
 and relevant, and the *Mirror Constraint* is obeyed.
- e. Update widening (triggered by violation of Mirror Constraint):
 Update is widened to: $cs_c \cap \llbracket \text{there are biscuist on the sideboard} \rrbracket$
- f. Acceptance (emptying of \mathcal{F} -slot):
 $c_2 = \langle a_c \sqcap \llbracket \text{you are hungry} \rrbracket, cs_c \cap \llbracket \text{there are biscuits on the sideboard} \rrbracket, Q'_c, \emptyset \rangle$
- g. Suspension of temporary assumptions (popping of a):
 $c_2 + \text{AsPop} = \langle \mathcal{W}, cs_{c_2}, Q_{c_2}, \emptyset \rangle$
- h. Relevance inference (pragmatic enrichment):
 The speaker suggests that addressee eats biscuits to solve the hunger (= p):
 $c_2 + \text{Inference} = c'_2 = \langle \mathcal{W}, cs_{c_2} \sqcap p, Q_{c_2}, \emptyset \rangle$
- i. QUD resolution:
 $c'_2 + \ulcorner \text{Pop} \urcorner = \langle \mathcal{W}, cs_{c_2} \sqcap p, \text{pop}(Q_{c_2}), \emptyset \rangle = \langle \mathcal{W}, cs_{c_2} \sqcap p, Q_c, \emptyset \rangle$

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 alleviate 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

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 the information that there are biscuits be accepted, (iB₁). We can also accept the suggestion to alleviate the hunger by eating biscuits while rejecting the information that there are biscuits on the sideboard, (iB₂):

- (i) A: If you are hungry, there are biscuits on the sideboard.
 B₀: Thanks! I really need to eat something.
 B₁: I saw them, but they are Morgan's! They may be reserving them for something.
 B₂: Thanks for the suggestion, but they are not on the sideboard anymore. I'll ask Morgan where they put them.

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

(see fn. 37). In the case of an HC like *if it rains, we cancel the picnic*, the relevance update would be that the cancelling of the picnic is due to/ caused by the rain.

3.2.5 The other mapping

Let us complete our discussion on the mapping of *if*-constructions into discourse by discussing the other logical possibility for their mapping. Crucially, 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 either pressure 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:³⁸

(69) 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 (69) 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 perfection, i.e., a strengthening inference that the antecedent provides not just sufficient conditions but also necessary conditions.³⁹

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 no matter what, 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, conditional perfection could never be obtained.

That BCs do not perfect in this way does not in itself mean that they cannot have a non-default mapping to discourse. It only means that if they did, the answer provided by the antecedent could not be interpreted exhaustively. So, why wouldn't BCs allow the non-default mapping? Given that non-BCs allow it, the answer should follow from the particularities of the BCs interpretation: that antecedent and consequent are taken to be factually independent and that context update by the consequent is global. Let's start by identifying the QUD set up by a BC if we were to assume a non-default mapping. Given a BC *If ϕ , ψ* , the QUD would be asking *What are the propositions χ such that for all selected worlds in which χ is true, ψ is true?* We paraphrase this reading with *When ψ ?* and take it to be the question encoded in (69) (though as noted earlier for "what if?", the linguistic counterpart of the specific (discourse) inquiry may not

³⁸It 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.

³⁹Given 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 *if*-constructions). 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.

always be suitable). Let's imagine the spelled out question/answer pair that the non-default mapping of the *if*-construction would indicate:

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

If the question is meant to be literally about the general circumstances (worlds) in which there are biscuits on the sideboard, the fact that there are actually biscuits on the sideboard is relevant. The response offered in (70) only provides that information indirectly (since a widening update would be required to avoid violating the Mirror Constraint). The only advantage of uttering the *if*-construction in (70) over the bare matrix clause plainly stating that there are biscuits on the sideboard is to provide further information regarding the context set, i.e., 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; nothing is gained by uttering the more complex form. In this situation the more complex expression is blocked and the *if*-construction cannot receive a non-standard mapping to discourse (blocking 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).⁴⁰

3.2.6 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 syntax-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 there appears to be a syntactic difference between BCs and HCs (examples from Ebert et al. 2014):

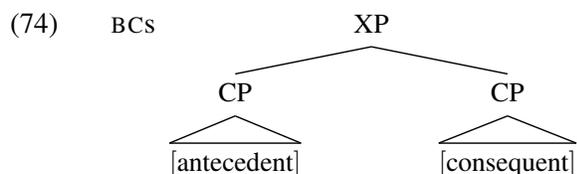
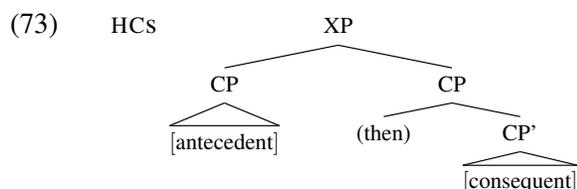
- (71) Wenn Du mich fragst, was ich von Dir denke, (dann) bist Du ein Idiot.
 if you me ask what I of you think then are you a idiot
 'If you ask me what I think of you, then you are an idiot.'
- (72) Wenn Du mich fragst, was ich von Dir denke, Du bist ein Idiot.
 if you me ask what I of you think you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

⁴⁰Notice that in a context in which the only thing that can be eaten to alleviate hunger are biscuits and that biscuits are always on the sideboard, A's question in (70) can be taken to convey that the speaker is hungry and wants to address that issue. The BC is then a means to rephrase A's question making clear that the question that is being addressed is what the selected worlds in which A is hungry look like. In this alternative scenario, the BC in (70) is expected to be felicitous. The prediction agrees with speakers' intuitions.

‘If you ask me what I think of you, you are an idiot.’

Ebert et al. (2014) (henceforth EEH) argue that the interpretation of (71) is unambiguously that the speaker’s attitude depends on whether the addressee has asked what is thought of him, whereas (72) always conveys that the speaker thinks that the addressee is an idiot (independently of whether he asked or not). Crucially, in (71) the consequent exhibits V1 (i.e., German is a V2 language and in (71) the verb is the first word of the consequent, making the antecedent to count as the first constituent of the clause), whereas in (72) 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):



In BCs the speech act introduced by the consequent is semantically independent of 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.

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):

- (75) 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.'
- (76) 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'
- (77) 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:

- (78) 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, (80). 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, (79), 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 (82), where we necessarily find V1 order but a BC-question interpretation.

- (79) 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?’
- (80) 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 travels you stay.2.sg at home
‘If John goes on a trip, do you stay at home?’
- (81) If I’m hungry, is there pizza in the fridge?/ there is pizza in the fridge?
- (82) a. Wenn ich Hunger habe, Gibt es Pizza im Kühlschrank?
if I hunger have give.3sg it pizza in fridge
b. *Wenn ich Hunger habe, es Gibt Pizza im Kühlschrank?
if I hunger 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.⁴¹ 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 interpreted as HCs 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.⁴² 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 (83) is marked while its *then*-less version is perfectly fine. However, other English speakers have no problem accepting (83).

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

Speakers who accept (83) take away similar information as the one extracted from the *then*-less *if*-construction: the speaker uttering (83) 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 (83). This reading is however

⁴¹ 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 *if*-construction with a matrix interrogative is to be understood as a BC or a HC.

⁴²Notice 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. We address this below.

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 (83) 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 (84), which even speakers who find (83) marked find perfectly acceptable:

(84) 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-):

(85) Steffy: Well, **if that's it, then I am late for another meeting, so...**

Hope: Yeah, I think we covered just about everything.

Steffy: Okay.

(SOAP)

In (84) and (85) 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 (84) and (85) 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 (84),⁴³ 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 (85). 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). Biezma (2014) provides an account of non-temporal *then* within *if*-constructions and across discourse, and argues that *then* is a discourse marker signaling 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 fact that a particular (discourse) move has been made (leading to the interpretations discussed for (84) and (85) above). 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 objects (e.g., discourse moves) when there is no factual dependence relation. That is, *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 (84) 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 a ‘causal explanatory claim’ interpretation (at the propositional level or at the level of discourse moves). The availability of *then* is thus possible regardless of considerations about whether the *if*-construction are interpreted as BCs or HCs.

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.

⁴³The 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.

4.3 Utterances with command inferences and no imperative form

One of the most problematic examples for a speech act theory of BCs is Siegel's example, provided within the relevant context in (3) above and repeated here:

- (3) Scenario: an adult is travelling by bus with a child. They see a ticket collector who is going around checking that children above four have paid full fare.
Parent: If they ask you how old you are, you are four.

Recall that the problem presented by Siegel's BC is that it can be uttered in a context in which all participants are aware of the fact that the addressee is not four (as in the scenario in (3), where the BC is uttered by a parent, who doesn't want to pay the mandatory bus fare for kids older than four, to their kid, the addressee).

Siegel (2006) used the BC 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).⁴⁴ However, EEH claim that the speech act performed by the consequent is a command, explaining this way also the overall interpretation. EEH's proposal is that we interpret the consequent as a command because at LF there is a COMMAND speech act heading the consequent.⁴⁵ In (3) we understand that the order is that the addressee say that they are four.

⁴⁴McCready (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, McCready 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.
(ii) a. If you're hungry, there are some₁ cookies on the table. They₁ are ginger snaps.
b. If you're free, I'm going to a₁ party tonight. It₁ 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 into such problems. 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 the hypothesis 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 sake 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. Thanks to Andreas Walker for discussion regarding this point.

⁴⁵This 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 fn. 8 that this is not sufficient to claim that the consequent performs a command speech act.

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 in their analysis 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 (86):

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

The interpretation of (86) in most contexts is not that of a command/request that the addressee say that they are at most four, but a command that they not say that they are more than four. Deriving the meanings in (3) and in (86) would require a COMMAND operator sensitive to context and to the speaker's goals in discourse and we would end up appealing to mechanisms similar to the ones argued for in this paper (able to derive all the meanings of BCs without the need for 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).⁴⁶ However, in this latter approach two questions would remain open. The first one concerns 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 not across the board) is an inference triggered by understanding the consequent as providing an answer to the question indicated by the antecedent (see (64) 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 more than four, there can be no information update (and thus no consequent entailment). 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 corresponding to the *if*-construction we would remove from *cs* all the worlds in which the antecedent is true (the ticket inspector asks the addressee's age) but the consequent is false (the child is older than four). Given that the addressee is five in all worlds in *cs*, the prediction is that the update would remove from *cs* all worlds in which the inspector asks the addressee's age. This would mean that an informational update of *cs* with (3) would amount to claiming that the inspector will not ask the addressee's age (and the addressee is not four, of course).⁴⁷ However, it is obvious that the ticket inspector is asking all children their age, and it is obvious that everyone knows this, so this update is not acceptable. The addressee needs to work hard to make sense of the fact that the speaker is uttering (3). 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, it is ordered/suggested that the kid respond that they are four (which everybody accepts is not true). Hence, the speaker is commanding the addressee to respond with a lie when questioned. The relevance

⁴⁶Indeed, if one were to adopt a speech act account of BCs, this would be a better approach. One of the main problems of this 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'. See also fn. 50 for further concerns.

⁴⁷This is because we eliminate all worlds in which the inspector asks (+A) and the addressee is not four (-4) because of the informational update of the *if*-constructions, and notice that we do not have +4+A or +4-A-worlds, since in *cs* all the worlds are -4-worlds. There would only be -A-4-worlds left.

update is the only one that can be accepted.^{48 49}

For us, it is important to note that an indirect speech act proposal would still need additional pragmatic mechanisms, similar to the ones proposed in this paper. However, if we rely on pragmatic reasoning to

⁴⁸The 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 case there is a common denominator helping to trigger the inference: the *if*-clause has a *verbum dicendi* or refers 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 other canonical BCs, cannot shift to the past (see Csipak 2015):

- (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 in the antecedent, 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) Sue 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.

⁴⁹ 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 proposed is incompatible with what we accept to be the case (this kind of examples have been dubbed 'Dracula conditionals', see Akatsuka 1991, or 'monkey's uncle conditionals', see 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_c , assuming that we all accept that elephants don't fly or that the speaker is not Marilyn Monroe. The effect is similar to that triggered by examples of vacuous 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 (just as in the ticket collector example in (3), see fn. 47). This is indeed what is intended in these cases (unlike in (3)). Again, in (i) and (ii) 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 and, hence, no strengthening is necessary.

arrive at the final interpretation, what we actually lack is justification to posit further semantic machinery.⁵⁰

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.

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, we observe parallelisms between the interpretation of *if*-constructions and 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:

- (87) 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)

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. The construction of meaning in BCs is the result of a conspiracy among a unified (simple) semantics for all *if*-constructions, contextual assumptions, dynamic updates and intentional discourse-structure.

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⁵⁰ 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.

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