Know whether and *-ever* free relative clauses [*]

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Abstract *Know whether* sentences and *-ever* free relative clauses have not been studied together, but they have similar contextual constraints. This work offers an explanation of their similarities based on well-established pragmatic principles. These constructions are proposed to evoke equally informative alternatives with stronger presuppositions, and as a consequence of Heim's (1991) pragmatic principle of Maximize Presupposition, the use of a *know whether* sentence or a sentence containing an *-ever* free relative clause requires the presuppositions of all of its alternatives not to be satisfied. This gives rise to a variety of requirements, depending on what grammatical environment either construction appears in and how its presuppositions project. Although the modal implications of *-ever* free relative clauses are typically analyzed as a semantically-encoded component of their meaning, this work argues that a pragmatic explanation provides better coverage of a broad range of empirical observations.

Keywords: interrogatives, free relatives, ignorance, variation, maximize presupposition

1 Introduction

There are many similarities between *know whether* sentences and *-ever* free relative clauses, particularly in the contextual constraints on their use. A *know whether* sentence is unacceptable in a context where the answer to the *whether*-interrogative is common knowledge, as in (1).

(1)   A: We can't meet on Monday because there will be a talk
        B: Ok, should I tell Elsie?
        A: No need, Elsie knows {??whether, that} there will be a talk
                                                        (Eckardt 2007: 448)

Likewise, certain sentences containing an *-ever* free relative clause[1] (hence, EFRC) are unacceptable when the identity of the EFRC's referent is common knowledge. In (2), the interlocutors publicly agree on the referent's identity in the relevant way, and the EFRC is infelicitous, unlike a *the*-definite.

(2)   A: The pie Bill is baking is a cherry pie
       B: Right, and there's a lot of sugar in {#whatever, the} pie he is baking

The main claim of this work is that both constructions' contextual requirements result from the same pragmatic considerations, namely, competition with alternatives of a certain kind and a pragmatic principle known as Maximize Presupposition (Heim 1991). This is an uncontroversial analysis of (1), largely in line with previous accounts (e.g., Eckardt 2007, Paillé & Schwarz 2019), but it is shown to derive some new patterns in quantificational sentences. In contrast, it is a departure from the predominant accounts of (2), which assume that the semantically-determined meaning of EFRCs involves ignorance, or more generally, modality (e.g., Dayal 1997). This departure is motivated by the fact that EFRCs exhibit the same patterns in quantificational sentences that *know whether* does.

The main empirical contribution of this work is to draw attention to the similarities in the titular constructions' requirements. The explanation of these similarities aims as much as possible to build on on existing, independently motivated proposals about the syntax-semantics of *know whether* sentences and EFRCs, together with well-established pragmatic principles. Thus, the theoretical component of this work is conservative. The main theoretical argument, appearing in Section 3, is that compared to an account involving semantically-encoded modality, a pragmatic account of EFRCs provides a better explanation for the various 'readings'[2] EFRCs allow.

1.1   Ignorance

Who has to be ignorant in (1)-(2), and of what? In (1), the interlocutors agree on the *whether*-interrogative's answer. Minimally changing (1) so that the answer is not explicitly made common knowledge improves the discourse, (3).

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1 A free relative clause, in English, is a construction that has the internal composition of a WH-clause but the external distribution of a DP, as in *Elsie bought what was on sale* (cf. *Elsie wondered what was on sale*, where the same string is an interrogative clause).

2 Since the data here take the form of contextual acceptability judgments, the analysis will assign *know whether* sentences and EFRCs requirements. Because the EFRC literature tends to talk about different readings of EFRCs, the term will be used here as well. Readings, in the sense of implications of an utterance, can be derived from contextual requirements; the implications of an utterance, derived from its requirements, are the features that compliant contexts share.

(3)   A: Can we meet on Monday, or will there be a talk?
       B: Ask Elsie. She knows whether there will be a talk

As Paillé & Schwarz 2019: 313 observe, *know whether* sentences are also acceptable in contexts where the speaker is known to know the answer but the addressee does not, as in (5).

(4)   Game show host: Aisha knows whether Ben is Canadian, and so do I
                       (Now, I want *you* to find out whether he is)

Finally, in contexts of disagreement like (5), where each speaker is opinionated but there is no common knowledge, the *know whether* sentence is acceptable.

(5)   A: Let's meet on Monday since there won't be a talk.
       B: No, we can't meet then. There actually is a talk.
       A: You're wrong, just ask Elsie. She knows whether there will be a talk.

Taken together, these facts suggest that the relevant contextual constraint should be expressed in terms of common knowledge: the *know whether* sentence is unacceptable in a context where the interlocutors publicly agree on the answer. Inspired by Stalnaker 1974, 1978, what is common knowledge in a conversational context c can be thought of as a set of situations, abbreviated CK_c. The elements of CK_c are candidates or "live options" for the topic situation under discussion by the interlocutors in c. To qualify for membership in CK_c, a situation must be compatible with the mutual public beliefs of the interlocutors in c. For the answer to a *whether*-interrogative to be common knowledge means that all elements of CK_c are uniform with respect to the value of the interrogative i.e., CK_c entails an answer.

  Similar facts hold of EFRCs. von Fintel 2000: 29 shows that examples like (6) can be acceptable in contexts where the speaker knows exactly what they are cooking and is teasing the addressee.

(6)   There's a lot of garlic in whatever (it is that) I am cooking

An EFRC is also felicitous in (7) where each interlocutor is opinionated about the identity of the EFRC's referent but they disagree (inspired by Heller & Wolter 2011: 177); the speaker is felt to treat the identity of the EFRC's referent as irrelevant.

(7)   A: The pie Bill is baking is a cherry pie
       B: No, it's a rhubarb pie
       A: (In any case,) there is a lot of sugar in whatever pie he is baking

  Taken together, these judgments suggest that EFRCs' contextual acceptability constraint should also be expressed in terms of common knowledge. In section 3, it

will be shown that EFRCs require that no member of a set of relevant properties be known to hold of the referent of the EFRC, as observed by Condoravdi 2008, 2015.

Finally, note that out-of-the-blue inferential judgments (especially with EFRCs) suggest that a stronger notion of ignorance is needed, namely, speaker-ignorance. The analysis will only derive a lack of common knowledge, which is appropriate given the generalizations about contextual acceptability judgments that will be presented, though see Chemla 2008 and Rouillard & Schwarz 2017 for relevant discussion.

2   *Know whether*

According to Eckardt 2007: 448, '…informants who are confronted with a discourse like in [(1)] usually show a strong dispreference for the pattern even to the claim that [(1)] is grammatically ill-formed. Upon closer reflection, they react by saying that an embedded *that*-clause would be the preferred option in this context.' What might underlie this reported preference? *Know whether* sentences are standardly analyzed as meaning that the subject knows whichever answer to the interrogative is true, as in (8) (e.g., Karttunen 1977).

(8)   Elsie knows whether there will be a talk
        Asserts: If there will be a talk, Elsie knows that there will be a talk, and if
        there won't be a talk, Elsie knows that there won't be a talk

In a context where it's known which answer to the *whether*-interrogative is true, the assertive content of *know whether* and *know that*, with an embedded clause corresponding to the true answer, is the same. The assertion of (8) reduces to *Elsie knows that there will be a talk* when it's known that there will be a talk, by modus ponens. Therefore, the unacceptability of *know whether* cannot be blamed on underinformativity (e.g., violation of Grice's (1975) Maxim of Quantity); *know whether* and *know that* contribute the same new information about Elsie's beliefs.

According to Eckardt 2007, *know whether* in (1) is unacceptable because its structure is unnecessarily complex for conveying the same information that the alternative containing *that* conveys. In Gricean terms, the use of *know whether* violates the Maxim of Manner. This work also attributes unacceptability to comparison with alternatives, but instead of *know whether* being suboptimal because of its form, it's claimed to be suboptimal because of its meaning, in particular, its presuppositions. No empirical argument in favor of this analytical choice is offered, but a well-established theory of unacceptability based on weak presuppositions already exists, whereas violations of Manner are less understood.

2.1 Proposal

[Heim 1991](#) (also [Sauerland 2008](#) a.o.) proposes that a principle called Maximize Presupposition (MP) explains contrasts like (9a-b).

(9)   a.   {#a, the} sun is shining
        b.   A: Aside from a firefighter, the other room is empty
            B: I know, and {#a, the} firefighter in the other room is getting bored

Either because of world knowledge (9a) or the preceding discourse (9b), the existence and uniqueness implications of *the* are common knowledge, and the indefinite article is unacceptable. Heim rejects the possibility that its unacceptability is due to underinformativity, as suggested by earlier work; on the assumption that existence and uniqueness implications are presuppositional (i.e., not part of the new information contributed by a definite), then the choice between *a* and *the* does not affect informativity. Heim concludes that a distinct principle requires speakers who intend to convey a message to use the presuppositionally strongest, felicitous utterance.

    This work attributes the unacceptability of *know whether* in Eckardt's discourse to a violation of MP, on par with (9a-b). *Know whether* and *know that* in (1) contribute the same new information, but *know that* is presuppositionally stronger (given the factive presupposition of *know*). To present the pragmatic analysis, some concrete assumptions about the meanings of the relevant sentences, the notion of alternatives, and the principle of MP will be made. The spirit of the analysis does not particularly rely on the structure of the sentences or the notion of alternatives adopted here, and many of the choices are made for presentational ease.

2.1.1 Denotations and LFs

Know is given the factive, proposition-selecting denotation in (10) ([Hintikka 1969](#))[3].

(10) $[\![\text{know}]\!]^c = \lambda s \,.\, \lambda p_{st} \,:\, p(s) = 1 \,.\, \lambda x_e \,.\, \forall s'[s' \in \text{Dox}(x,s) \to p(s') = 1]$
       where $\text{Dox}(x,s)$ is the set of situations compatible with what x believes in s

Next, inspired by [Karttunen 1977](#), an interrogative is taken to denote a question i.e., a function from situations to sets of true answers. For example, the interrogative *whether there will be a talk* denotes the question in (11).

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3 Expressions are interpreted relative to a context c, which supplies an assignment function g_c. Following [Heim & Kratzer 1998](#), '$\lambda \alpha : \phi . \gamma$' is read as the smallest function that maps any α such that ϕ to γ (or as the smallest function that maps any α such that ϕ to true iff γ—whichever makes sense). This work talks interchangeably about functions whose type ends in t and the sets they characterize.

(11) $[\![$whether there will be a talk$]\!]^c = \lambda s.\{p_{st}: \ p(s) = 1 \wedge$
           $p \in \{[\lambda s' \ . \ \text{there will be a talk in } s'], [\lambda s' \ . \ \text{there won't be a talk in } s']\}\}$

There exist many views on how (11) is compositionally derived and how it combines with *know*. A simplification of an idea for the Logical Forms (LFs) of *whether*-interrogatives (pursued in Larson 1985, Han & Romero 2004, Guerzoni & Sharvit 2014, a.o.) will be presented. *Whether* interrogatives have disjunctive LFs[4] like (12a), where each disjunct corresponds to a possible answer. *Or* gathers its disjuncts into a set, (12b) (cf. Alonso-Ovalle 2006), and *whether* denotes a function from sets of propositions to question-intensions, (12c), deriving the meaning in (11).

(12)   a.   LF: [whether [[$\lambda 1$ there will be a talk-s_1]
                                              or [$\lambda 2$ there won't be a talk-s_2]]]
           b. $[\![$or$]\!]^c = \lambda p_{st}.\lambda q_{st} \ . \ \{p, q\}$
           c. $[\![$whether$]\!]^c = \lambda P_{\langle st, t \rangle}. \ \lambda s. \ \{p_{st}: \ p(s) = 1 \wedge p \in P\}$

In order for *know*, which requires a proposition, to combine with the *whether*-interrogative, the ANS-operator in (13) is assumed (cf. Heim 1994, Dayal 1996). ANS combines with a situation *s* and a question-intension, returning the conjunction of all the true possible answers, so long as there is a true answer (abstracting away from maximality, which is irrelevant for polar interrogatives).

(13) $[\![$ANS$]\!]^c = \lambda s \ . \ \lambda Q_{\langle s \langle st, t \rangle \rangle} \ : \ Q(s) \neq \varnothing . \bigcap Q(s)$

(14) is the LF and interpretation of *Elsie knows whether there will be a talk* (the disjunctive *whether*-LF is abbreviated). Throughout this paper, the variable s_0 is assumed to be abstracted over to derive the (possibly partial) proposition denoted by the sentence. When the presupposition of a sentence ϕ is discussed, what is referred to is the domain condition of the proposition resulting from abstraction or, equivalently, the set of situations in the domain of the proposition (also represented as PRESUP(ϕ)). An utterance of ϕ is assumed to be felicitous in a context *c* only if $CK_c \subseteq$ PRESUP(ϕ). The trivial presupposition in (14b) comes from ANS, which requires the question-extension to be non-empty in s_0.

(14)   Elsie knows whether there will be a talk

           a.   LF: Elsie knows-s_0 ANS-s_0 whether there will be a talk
           b.   Presupposes: There will be a talk or there won't be a talk
           c.   Asserts: Elsie knows the true answer to whether there will be a talk

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4 An extensional system is assumed where situation arguments are supplied by situation variables in the LF (e.g., Percus 2000, von Fintel & Heim 2011). λ-binders are interpreted by the 'pedantic' version of Predicate Abstraction (Heim & Kratzer 1998).

2.1.2 Alternatives and MP

The pragmatic analysis pursued here makes a *know that* sentence a preferable alternative to *know whether* in (1). The question of what exactly alternatives are and how they enter into the computation of pragmatic inferences is complex, and it has been discussed primarily in connection to scalar implicatures (Horn 1972, Matsumoto 1995, Katzir 2007, a.o.). One robust finding is that the generation of scalar inferences is dependent on what question in discourse an utterance is addressing (van Kuppevelt 1996, Roberts 2012). For example, van Kuppevelt 1996 finds that a scalar inference is generated when it provides a stronger answer to the current question under discussion (though he expressed the finding differently). (15a-b) illustrate this. The 'exactly'-interpretation is obligatory in (15a) since the implicature constitutes part of the answer to the current question under discussion, but it is cancellable in (15b), where the implicature is irrelevant.

(15)   a.   A: How many patients did Dr. X treat?
            B: She treated five patients (??in fact, she treated eight)
       b.   A: Every doctor who treated at least five patients will receive an ice cream sandwich. Will Dr. X receive an ice cream sandwich?
            B: Yes, she treated five patients (in fact, she treated eight)

At the same time, it has been claimed that alternatives are structures that must meet structural congruency conditions. For example, to allow for (16a-b), but not (16b-c), to be alternatives for the computation of scalar implicatures, Katzir 2007 proposes that alternatives are at most as structurally complex as the original utterance.

(16)   a.   John ate all of the cookies
       b.   John ate some of the cookies
       c.   John ate some but not all of the cookies

In this work, alternatives are conceived as LFs that meet structural constraints and are relevant. The view that they are LFs (rather than, say, utterances, as in a traditional Gricean conception) allows for discrepancies between their hypothesized structure and pronunciation. It also allows for the possibility of alternatives that do not directly correspond to any utterance, which will be discussed in the analysis of EFRCs. The notion of relevance in the definition of the alternatives relation in (17) is assumed to be relative to the question under discussion in c.

(17)   For any LFs ϕ, ψ and context c:
       $\text{ALT}_c(\phi, \psi)$ iff ϕ is relevant in c and can be derived from ψ using only deletions, contractions, and substitutions (cf. Katzir 2007: 679)

Given the LF assumed for the *know whether* sentence, repeated in full in (18a), it follows that the LFs in (18b-c) could be alternatives. These LFs can be derived from (18a) by deletion of ANS, *whether*, and the other disjunct. (18b-c) attribute knowledge of the interrogative's possible answers.

(18)   a.   Elsie knows-s_0 ANS-s_0 [whether [[$\lambda 1$ there will be a talk-s_1]
                                                    or [$\lambda 2$ there won't be a talk-s_2]]]
         b.   Elsie knows-s_0 [$\lambda 1$ there will be a talk-s_1]
         c.   Elsie knows-s_0 [$\lambda 2$ there won't be a talk-s_2]

The factive presuppositions contributed by *know* in (18b-c) (respectively, that there will be a talk, and that there won't be a talk) asymmetrically entail the presupposition contributed by ANS in (18a) (that there will or there won't be a talk), but in any context satisfying (18b) or (18c)'s presuppositions, they are just as informative as (18a). The alternatives are Strawson-equivalent, in von Fintel's (1999) terms; whenever defined, their truth is contingent on the same thing, namely, Elsie's beliefs.

    MP, as defined in (19), is relevant in determining which alternative a speaker may utter. Recall that PRESUP(ϕ) represents the domain condition of the proposition ϕ denotes (or the set of situations in which the proposition is defined).

(19)   **Maximize Presupposition (MP)**
         For any LFs ϕ, ψ and context c, the speaker$_c$ must use ϕ if:

         a.   ALT$_c(\phi, \psi)$ Alternatives
         b. $\{s \in CK_c : \llbracket \phi \rrbracket^c(s) = 1\} = \{s \in CK_c : \llbracket \psi \rrbracket^c(s) = 1\}$ Equally informative
         c.   PRESUP(ϕ) $\subset$ PRESUP(ψ) ϕ's presupposition is stronger
         d. $CK_c \subseteq$ PRESUP(ϕ) ϕ would be felicitous

If the speaker utters the *whether* sentence in a context where CK_c entails an answer and the LFs in (18b-c) are relevant alternatives, the speaker violates MP and the use of *know whether* is expected to be infelicitous. This is the source of the unacceptability of *know whether* in Eckardt's discourse.

    MP has also been invoked to explain 'antipresuppositions' (Percus 2006): inferences generated by the use of presuppositionally weak alternatives that the presuppositions of presuppositionally stronger alternatives are false. From the perspective of a hearer who takes the speaker to comply with MP, since the speaker chose to use the presuppositionally weaker alternative, the hearer can infer that the presuppositionally stronger alternatives were not usable. Although this work focuses on contextual acceptability judgments (rather than out-of-the-blue inferential judgments), it assumes that ignorance inferences associated with out-of-the-blue *know whether* sentences have the status of antipresuppositions.

2.1.3 Individual- and situational-variation requirements

A new observation of this work is that certain *know whether* sentences may be acceptable despite the answer to the *whether*-interrogative being common knowledge. In such cases, different contextual requirements emerge. For example, *know whether* does not require ignorance when a distributive quantifier (e.g., *every*) binds into the *whether*-interrogative. A speaker may felicitously utter such a sentence when the answer is common knowledge, so long as the answer varies across the domain of *every*, (20)-(21). The answer to the *whether*-interrogative is known in both (20)-(21), but only in (20), where the answer varies across the set of boys, is the use of the *know whether* sentence felicitous.

(20)   *Context: John, Bill, and Al are the boys. John and Bill get picked up after school, and Al doesn't. Someone asks if they need to be reminded of this. . .*
       No need, every boy knows whether he will be picked up

(21)   *Context: John, Bill, and Al are the boys, and they all get picked up after school. Someone asks if they need to be reminded of this. . .*
       No need, every boy knows {??whether, that} he will be picked up

A similar contrast is found when *know whether* appears in the scope of the situation quantifier *always*, (22)-(23). The answer is known in both (22)-(23), but only (22), where the answer varies across the situations quantified over by *always*, is acceptable.

(22)   *Context: On the first two Mondays of this month, there was a talk, and on the other two Mondays, there wasn't. Mary had to tell Elsie when there would be a talk, but Elsie read the schedule.*
       Elsie always knew whether there would be a talk (when Mary came)

(23)   *Context: Every Monday this month, there was a talk. Mary had to tell Elsie when there would be a talk, but Elsie read the schedule.*
       Elsie always knew {??whether, that} there would be a talk (when Mary came)

   Universally quantified statements are commonly held to project universal presuppositions (Heim 1983, more recently Chemla 2009, a.o.). This means that they presuppose that every individual or situation in the restrictor of the quantifier satisfies the presuppositions of its nuclear scope, as in (24)-(25).

(24) $[\![[\text{every } \phi_{et}] \, \psi_{et}]\!]^c$ is defined only if $\{x\colon [\![\phi]\!]^c(x) = 1\} \subseteq \{x\colon [\![\psi]\!]^c(x) \text{ is defined}\}$. When defined, $= 1$ iff $\{x\colon [\![\phi]\!]^c(x) = 1\} \subseteq \{x\colon [\![\psi]\!]^c(x) = 1\}$

(25) $[\![[\text{always } C_{st}] \, \psi_{st}]\!]^c$ is defined only if $\{s\colon [\![C]\!]^c(s) = 1\} \subseteq \{s\colon [\![\psi]\!]^c(s) \text{ is defined}\}$. When defined, $= 1$ iff $\{s\colon [\![C]\!]^c(s) = 1\} \subseteq \{s\colon [\![\psi]\!]^c(s) = 1\}$

By putting together the assumptions about universal quantifiers and the pragmatic account of ignorance, the newly observed contextual requirements can be explained. The LF in (26a) (*Every boy knows whether he will be picked up*) could have (26b-c) as alternatives (*Every boy knows that he will/won't be picked up*). Once again, the presuppositions of (26b-c) asymmetrically entail the presuppositions of the (26a).

(26)   a.   Every boy-s_0 $\lambda 1$ t_1 knows-s_0 ANS-s_0 [whether [[$\lambda 2$ he$_1$ will be
                    picked up-s_2] or [$\lambda 3$ he$_1$ won't be picked up-s_3]]]
            Presupposes: For every boy x, either x will be picked up or x won't
       b.   Every boy-s_0 $\lambda 1$ t_1 knows-s_0 [$\lambda 2$ he$_1$ will be picked up-s_2]
            Presupposes: For every boy x, x will be picked up
       c.   Every boy-s_0 $\lambda 1$ t_1 knows-s_0 [$\lambda 2$ he$_1$ won't be picked up-s_2]
            Presupposes: For every boy x, x won't be picked up

But in any context satisfying (26b-c)'s presuppositions, uttering (26a) is as informative as (26b-c). All of them are contingent on the boys' beliefs. If the speaker utters (26a) in a context where the presupposition of, e.g., (26b) is common knowledge, MP is violated and the use of (26a) is expected to be infelicitous. This is proposed to be the source of the unacceptability of *whether* in (21).

If (26b-c) are alternatives to (26a) and the speaker intends to use (26a), then common knowledge cannot entail the presuppositions of (26b-c). Two types of CK_c-sets meet this constraint: i) a CK_c-set in which it is unsettled for at least one boy whether he will be picked up, and ii) a CK_c-set in which it is settled for at least two boys x, y that x will be picked up and that y won't. Thus, MP may be satisfied in (20), even though the answer for every boy is known, because the answer varies across boys. The same line of analysis explains the contrast between the situation quantificational (22)-(23).

Every and *always* must bind into the interrogative in order for there to be different ways of satisfying MP; for example, (27), in which *every* scopes over *know whether* but does not bind into the interrogative, requires ignorance. This is because without binding, the presupposition of *know whether* projects globally, unaffected by *every*, and the only way for MP to be satisfied is for it to be unsettled which answer is true.

(27)   A: We can't meet on Monday because there will be a talk
       B: Ok, should I tell everyone?
       A: No need, everyone knows {??whether, that} there will be a talk

2.2   Discussion

More predicates than just *know* embed *whether*-interrogatives. Lahiri's (2002) classification of embedding predicates is given in (28).

(28)   a.   Rogative predicates (e.g., *wonder, ask, depend on, investigate*)

           b.   Veridical responsive predicates (e.g., *know, hear, discover*)

           c.   Non-veridical responsive predicates (e.g., *agree on, be certain about*)

Rogative predicates embed only interrogatives (e.g., *Elsie wonders whether…* vs. **Elsie wonders that…*), whereas responsive predicates can embed declaratives too. Veridical, responsive predicates express a relation to the true answer to an interrogative, whereas non-veridical ones express a relation to a possible answer. To illustrate, *Elsie knows who came to the party* implies her beliefs about who came are true, whereas *Elsie and Mary agree on who came to the party* does not.

    The proposal above explained judgments about *know whether*, but similar judgments arise when *know* is replaced with other veridical responsive predicates that are factive when they embed declaratives e.g., *heard, discovered*.

(29)   A: We can't meet on Monday because there will be a talk

          B: Ok, should I tell Elsie?

          A: No need, Elsie already heard {??whether, that} there will be a talk

(30)   A: We can't meet on Monday because there will be a talk

          B: Ok, should I tell Elsie?

          A: No need, Elsie already discovered {??whether, that} there will be a talk

These judgments can be explained along the same lines as *know whether*: the *whether*-sentences in (29)-(30) can evoke equally informative, presuppositionally stronger alternatives, and if these are salient in the evaluation of (29)-(30), then the use of *whether* violates MP. In contrast, it appears that *whether*-interrogatives are fine under rogative predicates regardless of whether the answer is known, (31).

(31)   A: We can't meet on Monday because there will be a talk

          B: Ok, should I tell Elsie?

          A: Please do, Elsie is wondering whether there will be a talk

This is expected based on the analysis, since rogative predicates are typically thought not to accept declarative meanings, let alone be factive. Thus, there are no equally informative alternatives with stronger presuppositions that are relevant for MP.

    Finally, the acceptability of non-veridical predicates with embedded *whether*-interrogatives does not seem in any way to depend on what is known. In (32), *agree on whether* is acceptable despite the true answer being common knowledge.

(32)   A: The ball is hidden in Box 1

          B: Right. We can't tell whether the experimental subjects think it's in Box 1 or not, but one thing is clear: they agree on whether it's in Box 1

MP is only relevant for equivalent alternatives whose presuppositions are ordered by asymmetric entailment. *Agree* with a declarative is not factive, so *agree on whether* and its alternatives do not fit this profile. No MP-driven inference is expected.

The following two points are given as open questions. Eckardt 2007: 448 observes that constituent interrogatives embedded under *know* don't produce similar judgments, as shown by the acceptability of *know who* in (33).

(33)   A: We have received responses to all of the invitations to our party. Tom, Sue, and Linda will come, and John and Bill will not.
B: Ok, should I tell Elsie?
A: No need, Elsie already knows who will come to the party

There is nothing marked about A's final utterance. One possible explanation suggested by Eckardt is that constituent interrogatives do not systematically evoke alternatives of the kind that *whether*-interrogatives do. Why this might be is left as a topic for future work on how alternatives are constructed. The second question concerns variable judgments. First, not all speakers perceive a contrast between *whether* and *that* in (1), and as pointed out by a reviewer, these judgments are even less robust in negated examples.

(34)   A: We can't meet on Monday because there will be a talk
B: Ok, should I tell Elsie?
A: Please do, Elsie doesn't know {whether, that} there will be a talk

(35)   *Context: John, Bill, and Al are the boys, and they all get picked up after school. Someone asks if they need to be reminded of this. . .*
Please remind them, no boy knows {whether, that} he will be picked up

The acceptability of *whether* in (34)-(35) is somewhat surprising, since it is commonly assumed that negation is a presupposition 'hole', passing up the presuppositions of the underlying positive sentence, and that *no* has the same universal presupposition as *every*. As such, if alternatives based on the *whether*-interrogative's possible answers are salient, (34)-(35) with *whether* are expected to be odd.

Two possible analyses suggest themselves. The first (rather uninteresting) possibility is that (34)-(35) do not evoke alternatives of the same kind as the positive statements evoke in the given contexts of evaluation. It is not clear why this might be, given that the contexts are unchanged. Another possibility, arising from Paillé & Schwarz 2019, is that *know whether* is acceptable because once its implicatures are taken into consideration, it is not contextually equivalent to *know that*. Paillé & Schwarz 2019 discuss 'agent ignorance inferences' associated with negative *know whether* sentences, which are inferences that the subject not only doesn't believe the true answer but also is unopinionated about the answer. These inferences are not

expected on the basis of the basic meaning of a negated *know whether* sentence, which logically implies only that the subject does not believe the true answer (compatible with their unopinionatedness or their believing the wrong answer). Perhaps *whether* is acceptable in (34)-(35) because its pragmatically enriched meaning conveys agent ignorance inferences that the *that*-alternative does not, rendering them non-equivalent. To flesh out this analysis, more needs to be said about the source of agent ignorance, and the definition of MP would need to be modified to account for pragmatic non-equivalence among alternatives.

MP is needed independently of *know whether* sentences (e.g., to account for the oddity #*a sun is shining*), and modern theories of alternatives do not exclude the comparison among alternatives assumed here. Therefore, there is no reason to exclude the pragmatic analysis given in the preceding subsection. Other factors may play a role in in producing the described judgments (e.g., unnecessary formal markedness, as suggested by Eckardt), and it is left for future work how to distinguish between the effects of MP vs. formal markedness.

Having established that a principle like MP is operative and that compliance with MP can in principle produce ignorance and variation requirements, this work now turns to EFRCs. A similar line of explanation can explain a wide range of readings that are attested with EFRCs. EFRCs are analyzed as definites that evoke equivalent alternatives that carry stronger presuppositions. This analysis, along with MP and presupposition projection under quantifiers, is shown to capture EFRCs' readings.

3 *-Ever* free relative clauses

3.1 Data

(36a-c) are three examples of EFRCs. An EFRC may have a singular NP sortal like (36a), a plural NP sortal like (36b), or no overt sortal at all like (36c).

(36) a. There is a lot of sugar in whatever pie Bill is baking   Singular sortal
      b. This toolbox contains whatever tools I own   Plural sortal
      c. Whoever was in here last left the light on   No sortal

EFRCs are definites, carrying a presupposition of the existence of a maximal entity in the denotation of the restrictor (e.g., Jacobson 1995, based on Sharvy 1980, Link 1983). (37) is a piece of evidence in support of this view, provided by Dayal 1995: 201. EFRCs pattern like plural definites rather than universal quantifiers in being contradictory continuations to (37) (i.e., EFRCs exhibit homogeneity — Fodor 1970, Löbner 1985, a.o. — though see Tredinnick 2005, Šimík Forthcoming for a more detailed discussion of when homogeneity inferences arise).

(37)   John liked some of the things Sue ordered but...

    a.   he didn't like everything she ordered
    b. *he didn't like what(ever) she ordered
    c. *he didn't like the things she ordered

Another piece of evidence is that EFRCs with a singular sortal pattern with *the* rather than *every* in contexts that do not satisfy uniqueness, as in (38).

(38)   Bill baked five pies today, and there's a lot of sugar in {every, #whatever, #the} pie he baked

3.1.1 Ignorance readings

At least five distinct readings have been identified for English EFRCs, which will be discussed in turn. Their availability is conditioned by the grammatical make up of the EFRC's host sentence. The literature centers on *ignorance readings*, in which an EFRC signals ignorance about the identity of its referent, (39).

(39)   There is a lot of sugar in whatever pie Bill is baking

Different views are found in the literature on what sort of ignorance is conveyed. This work largely follows Condoravdi 2008, 2015 in assuming that an EFRC conveys that no member of a set of contextually salient properties is known to hold of the EFRC's referent. This view on ignorance explains why EFRCs can be felicitous in contexts where the interlocutors can identify the EFRC's referent with an individual-denoting expression like *that pie* in (40) (Heller 2005, Condoravdi 2008).

(40)   A (pointing): Bill is baking that pie
        B: I see. Given his taste, there's a lot of sugar in whatever pie he is baking

Although the entity that *whatever pie he is baking* refers to is known, it is not necessarily the case that all of its properties are known. For example, speakers report that in using an EFRC, B implies that the pie's flavor is unknown. Accordingly, (40) contrasts with (41), where the pie is pointed to and its flavor is given; presumably, it's harder to think of a significant property that remains unknown.

(41)   A (pointing): Bill is baking that cherry pie
        B: ?I see. Given his taste, there's a lot of sugar in whatever pie he is baking

Nonetheless, there are some far-fetched scenarios in which B's utterance could be acceptable. For example, if A and B know that Bill's cherry pies are sometimes made

with wheat flour and sometimes made with corn flour and they're not sure about the current one, B could say *whatever pie Bill is baking (this time)*.

A contextually-determined, property-based view of ignorance can also explain the judgments in (42)-(43).

(42)   Bill is baking a cherry pie, and...

    a.   *there's a lot of sugar in whatever pie he is baking

    b.   there's a lot of sugar in {the pie he is baking, it}

(43)   *Context: Mary and Bill are baking, but they momentarily left the room. A and B enter and see two pies, one on the left and one on the right.*
    A: Both of these are cherry pies
    B: I know, but Bill has a sweet-tooth and Mary doesn't, so there's a lot of sugar in whatever pie he is baking

An EFRC, unlike an ordinary definite, is judged an infelicitous continuation to (42). The problem seems to be that the speaker has used the EFRC *whatever pie Bill is baking* in a context where it is known that its referent has the salient property of being a cherry pie. On the other hand, the same EFRC is felicitous in (43), despite it being common knowledge that its referent is a cherry pie, because other salient properties are unknown.

The empirical generalization adopted in this work is that an EFRC on an ignorance reading is acceptable only if no member of a set of contextually salient properties is known to hold of its referent. In the presentation of the analysis, it will be claimed that these properties — whatever their contextually-determined content might be — must meet certain logical requirements (in particular, they must constitute a non-trivial partition of a domain of individuals that the EFRC's referent belongs to).

3.1.2   Indifference readings

The second reading of EFRCs is called the *indifference reading*, on which the EFRC signals that an agent was indifferent as to the identity of the EFRC's referent, (44a-b) (von Fintel 2000: 32). (44a) could plausibly be uttered by a speaker who is fully aware of what tool was handy and is intending to convey their indifference.

(44)   a.   I grabbed whatever tool was handy

    b.   Zack simply voted for whoever was at the top of the ballot

Similarly, (45) is felicitous despite it being known that the tool in the toolbox was the hammer.

(45)   *Context: The hammer was in the toolbox, and the screwdriver was on the*
         shelf. Sue was assembling the bed in a rush, so...
         Sue grabbed whatever tool was in the toolbox

Instead of conveying ignorance, such examples seem to attribute indifference to the agent regarding the identity of EFRC's referent. Thus, when the identity of the tool is known and the subject is known not to be indifferent, as in (46), the EFRC is infelicitous.

(46)   *Context: The hammer was in the toolbox, and the screwdriver was on the*
         shelf. Sue was assembling the bed carefully and the next step called for a
         hammer, so...
         Sue grabbed {#whatever tool, the tool that} was in the toolbox

Condoravdi (2015: 217) observes that the indifference reading is '...more restricted and arises when the [EFRC] is an argument of an action-denoting predicate implying that the agent in principle has a choice as to who or what' (see also Rawlins 2015 on the teleological nature of indifference readings). Condoravdi, following Dayal 1997, uses compatibility with an appositive as a diagnostic for the availability of a non-ignorance reading; a non-agentive predicate like *liked* contrasts with *grabbed* in that it makes available only an ignorance reading and is incompatible with an *as-it-happened* appositive specifying the EFRC's referent, (47)-(48).

(47)   Sue grabbed whatever tool was in the toolbox (this hammer, as it happened)

(48)   Sue liked whatever tool was in the toolbox (*this hammer, as it happened)

3.1.3   Individual-variation readings

The third reading arises when a distributive quantifier (e.g., *every*) binds into the EFRC (Lauer 2009: 8). A speaker who is fully aware of what her coworkers ordered, (49a), or of what roles the boys were asked to perform, (49b), could utter these naturally occurring examples.

(49)   a.   I picked up sandwiches for a few of my coworkers, and everybody
              loved whatever they ordered
         b.   Every boy contributed in whatever role he was asked to perform
                                                                    (found online)

When the identity of the EFRC's referent is known, these constructions have a different requirement, namely, that the identity of the EFRC's referent varies across the domain of the quantifier. This is shown by the contrast between (50)-(51). In both (50)-(51), the EFRC's identity is known in the relevant way, but only in (50),

where the identity of the EFRC's referent varies, is the use of the EFRC acceptable. Such sentences will be said to have an *individual-variation reading*.

(50)   *Context: Mary, Sue, and Elsie are the professors. Conference A was Mary's first conference, Conference B was Sue's, and Conference C was Elsie's. Someone asks what conference every professor most enjoyed.*
         Every professor most enjoyed whatever conference she first attended

(51)   *Context: Mary, Sue, and Elsie are the professors, and Conference A was their first conference. Someone asks what conference they most enjoyed.*
         Every professor most enjoyed {#whatever, the} conference she first attended

A quantificational expression and binding are both necessary for this reading to arise. Note that (52), which lacks binding, can only imply ignorance about what conference Elsie first attended.

(52)   Every professor most enjoyed whatever conference Elsie first attended

Such examples cannot be analyzed as conveying indifference; *most enjoy*, unlike *grab* and like *like*, does not allow appositives specifying the referent's identity, (53).

(53)   Sue most enjoyed whatever pie Bill baked (*this cherry pie, as it happened)

The individual-variation reading is analogous to what was observed with *every* binding into the *whether*-interrogative of a *know whether* sentence; such examples were shown to be felicitous in contexts where the interrogative's answer is known, only if the answer varies across the domain of *every*.

3.1.4   Situational-variation readings

The fourth reading recognized in the literature has many names, including *free choice*, *universal*, *quantificational*, and *generalizing*. (54a) is from Dayal 1997: 110, (54b) is from von Fintel 2000: 36, and (54c) is from Condoravdi 2008: 3. For consistency with the discussion of *know whether*, this work uses the term *situational-variation reading*.

(54)   a.   Whatever Mary cooks uses onions
         b.   There is a lot of violence in whatever Parker writes
         c.   Whatever exit you take will get you onto MLK Blvd

There is an intuition that the EFRC could be paraphrased with free-choice *any* or universal *every*. Faced with such examples, some have assumed that EFRCs have varying force, either definite or universal. This work follows Dayal 1997 and

Tredinnick 2005, who argue that the definite view can be maintained by considering the interaction between definiteness and a property unifying the main predications in (54a-c): quantification over situations. (54a-b) involve quantification over generic situations, and (54c) involves quantification over future situations.

Sentences with situational quantifiers need not convey ignorance. (55) is felicitous despite there being no uncertainty about who the EFRC refers to.

(55) *Context: Bill is a boxer. He's had fights with three different opponents: John, Mary, and Sue ...*
  Bill has always lost to whatever opponent he faced

But the sentence has different implications on its situational-variation reading, namely, that the identity of the EFRC's referent varies across the situations quantified over. For (55), this amount to an implication that Bill faced different opponents across boxing matches. Thus, when it's known that he has always faced the same opponent, the EFRC is unacceptable, (56).

(56) *Context: Bill is a boxer. He's had many fights but always with the same opponent, John ...*
  Bill has always lost to {#whatever, the} opponent he faced

The term 'situational-variation' highlights the implication that the identity of the EFRC's referent varies across situations, but this is likely also responsible for the intuition that these examples are 'generalizing': they require truth in every situation quantified over, irrespective of the EFRC's extension in each situation, with the implication that the EFRC's extension varies across situations.

This reading is also available with *will*, which quantifies over possible future situations (Copley 2009). (57) for Condoravdi 2008 can mean that in every possible future situation s, the exit you take in s gets you onto MLK Blvd, with the implication that across possible future situations, you take different exits.

(57) Whatever exit you take will get you onto MLK Blvd

If (57) is uttered in a context in which it's known that you take the same exit in every future situation, the EFRC is unacceptable, (58).

(58) *Context: On your way to my house, you will see signs for exits one and two. You will take exit two, and...*
  {The, #whatever} exit you take will get you onto MLK Blvd

Finally, note that situational-variation readings, like individual-variation readings, require a quantifier over situations to bind the situation argument in the restrictor of

the EFRC (Šimík 2018). For instance, depending on whether *on Monday* is included in (59), different readings are made salient.

(59)   Bill has always lost to whatever opponent he faced (on Monday)

Without *on Monday*, (59) tends to receive the situational-variation reading, under which it says that in every relevant situation *s*, Bill loses in *s* to the person he faces in *s*, with the implication that it was different people across situations. In contrast, with *on Monday*, the face-off tends to be understood as independent of the losing situations and the sentence does not have a situational-variation reading. It conveys only ignorance about who Bill faced on Monday. Likewise, the sentence in (57) has only an ignorance reading when the tense morphology of the EFRC's restrictor signals that the exit-taking is independent of the getting onto MLK, (60).

(60)   Whatever exit you took will get you onto MLK Blvd

3.1.5   Diverse-subpart readings

Finally, unembedded EFRCs with a plural sortal have a *diverse-subpart reading*. (61) is an example from Condoravdi 2015: 218, whose non-ignorance reading is illustrated by compatibility with a conjunctive appositive exhaustively specifying the EFRC's referent.

(61)   The thieves grabbed whatever small objects they could reach through the holes they opened — figurines, vases, and lamps

(61) does not exclude an indifference reading, but the discourse in (62), where the referent of the EFRC has been identified with definite expressions but the EFRC is nonetheless felicitous as an argument of a non-agentive predicate, *contain*, makes the same point.

(62)   A: The only tools you own are a hammer and a screwdriver, right?
         B: Yes, and this toolbox contains whatever tools I own

There is a slight contrast between (62) and (63), in which the individual tools making up the plural EFRC's referent are not saliently distinct. For this reason, it's called a diverse-subpart reading. The plural EFRC carries an implication that the subparts making up its referent differ with respect to some salient properties.

(63)   A: The only tools you own are two hammers, right?
         B: ?Yes, and this toolbox contains whatever tools I own

3.2 Proposal

Five readings have been identified, whose availability depends on the grammatical make-up and environment of the EFRC, but it is proposed that they are derived from a uniform grammatical representation. Specifically, EFRCs are definite descriptions that compete with other more specific descriptions, as a result of the alternative-generating modifier *-ever*. Each of these alternative descriptions denotes the same entity as the EFRC, but carries a stronger presupposition about the identity of its referent, making MP relevant. The various constructions that EFRCs occur in affect the way that their presuppositions project, leading to different ways of satisfying MP (i.e., different readings).

3.2.1 Denotations and LFs

EFRCs are assigned meanings as in (64) (ignoring situation variables). They are Fregean, Linkian definites with a presuppositional "comment"; the definedness of (64) depends on the constraints imposed by definiteness, given in (65), and the applicability of *-ever*, discussed below.

(64) $[\![\text{whatever pie Bill is baking}]\!]^c$ is defined only if
         $[\![\text{-ever}]\!]^c(\sigma x[[\![\text{pie Bill is baking}]\!]^c(x)]) = 1$.
         When defined, $[\![\text{whatever pie Bill is baking}]\!]^c = \sigma x[[\![\text{pie Bill is baking}]\!]^c(x)]$

(65)   For any $\langle e,t \rangle$-function Q,
         $\sigma x[Q(x)]$ is defined only if there is a mereologically maximal entity in Q.
         When defined, $\sigma x[Q(x)]$ is the mereologically maximal entity in Q.

This meaning is compositionally derived using a proposal for nonrestrictive, presuppositional modifiers by Morzycki 2008. Morzycki discusses adjectival modifiers that seem to comment on a quantifier's domain of quantification rather than restrict it, as in (66) from Larson & Marušič 2004: 275 (see also Bolinger 1967, Cinque 2010, a.o.).

(66)   Every unsuitable word was deleted
         a.   Restrictive reading: Every word that was unsuitable was deleted
         b.   Nonrestrictive reading: Every word was deleted; they were unsuitable

It is not clear whether (66a-b) are two readings of the sentence or two types of scenarios it can describe, distinguished by whether or not all the words happen to be unsuitable. In Romance, however, a syntactic alternation constrains the possible readings, suggesting that (66a-b) can be grammatically encoded. Morzycki 2008: 103 discusses the Spanish alternation in (67a-b), from Mackenzie 1999, and similar facts

in Italian; postnominally, *sofisticados* in (67a) can be used in contexts where some or all of Maria's friends are sophisticated (i.e., can be restrictive) whereas prenominally, (67b), it requires them all to be sophisticated (i.e., can only be nonrestrictive).
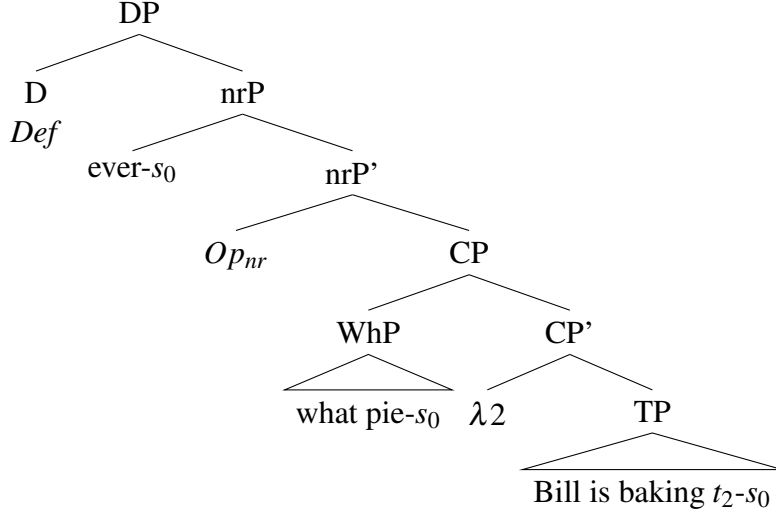
(67)　a.　los amigos sofisticados de María
　　　b.　los sofisticados amigos de María
　　　　　Restrictive: Those of Maria's friends who are sophisticated

$\checkmark$ (67a), *(67b)

　　　　　Nonrestrictive: Maria's friends, all of whom are sophisticated

$\checkmark$ (67a), $\checkmark$ (67b)

According to Morzycki 2008, the nonrestrictive reading involves a not-at-issue ascription of the modifier's meaning to the maximal entity in the denotation of the restrictor (i.e., the sum of Maria's friend in (67b)). He offers two analyses for the readings of such modifiers: one that enriches the semantic component with a rule of nonrestrictive modification, and an alternative that enriches the syntax with an operator for nonrestrictive modification. The syntactic approach is adopted here. *-Ever* in EFRCs is assumed to occupy a position within the EFRC's extended DP where it is interpreted nonrestrictively, like preverbal *sofisticados* in (67b).

　　The LF of an EFRC is given in (68). It is largely inspired by Caponigro's (2003) implementation of the idea that definite free-relatives consist of a definite determiner applying to directly to a property-denoting CP[5]. The WH-word is interpreted as a set restrictor, contributing that the elements of the set are (in)animate and have the property associated with the sortal. A silent determiner, *Def*, applies at the top. The nonrestrictive modification operator, Op_{nr}, contributes the presupposition that the property denoted by *-ever* holds of the maximal entity in the denotation of the CP. The context-sensitivity of EFRC's readings is captured by assuming that *-ever* has an $\langle s, et \rangle$-type index (omitted throughout) and receives its value from the assignment g_c supplied by c. To represent EFRC-LFs like (68), where s_0 is the index for all the intensional properties in the EFRC, object language abbreviations like '[whatever pie Bill is baking]-s_0' will be used.

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5 See Groos & Van Riemsdijk 1981 for the original arguments in favor of this derivation over an alternative that treats the CP as part of a complex nominal with a silent head (e.g., Bresnan & Grimshaw 1978), and see van Riemsdijk 2017 for more recent discussion. While the structure adopted here appears to be more widely accepted, the current proposal is compatible with either structure.

(68)

```
              DP
         ╱        ╲
        D           nrP
      Def        ╱      ╲
              ever-s₀      nrP'
                        ╱      ╲
                     Opₙᵣ        CP
                              ╱      ╲
                           WhP        CP'
                          ╱    ╲     ╱    ╲
                  what pie-s₀  λ2      TP
                                    ╱      ╲
                              Bill is baking t₂-s₀
```

a. $\llbracket \text{CP'} \rrbracket^c = \lambda x_e.$ Bill is baking x in s_0

b. $\llbracket \text{WhP} \rrbracket^c = \lambda P_{et}. \lambda x_e.$ x is inanimate in $s_0 \wedge x$ is a pie in $s_0 \wedge P(x) = 1$

c. $\llbracket \text{CP} \rrbracket^c = \lambda x_e.$ x is inanimate in $s_0 \wedge x$ is a pie in $s_0 \wedge$ Bill is baking x in s_0

d. $\llbracket Op_{nr} \rrbracket^c = \lambda Q_{et}. \lambda P_{et} : P(\sigma x[Q(x)]).Q$

e. $\llbracket \text{nrP'} \rrbracket^c = \lambda P_{et} : P(\sigma x[\llbracket \text{CP} \rrbracket^c(x)]). \llbracket \text{CP} \rrbracket^c$

f. $\llbracket \text{nrP} \rrbracket^c$ is defined only if $\llbracket \text{ever-}s_0 \rrbracket^c(\sigma x[\llbracket \text{CP} \rrbracket^c(x)]) = 1$. When defined, $\llbracket \text{nrP} \rrbracket^c = \llbracket \text{CP} \rrbracket^c$

g. $\llbracket Def \rrbracket^c = \lambda P_{et}.\sigma x[P(x)]$

h. $\llbracket (68) \rrbracket^c$ is defined only if $\llbracket \text{ever-}s_0 \rrbracket^c(\sigma x[x$ is inanimate in $s_0 \wedge x$ is a pie in $s_0 \wedge$ Bill is baking x in $s_0])$. When defined, $\llbracket (68) \rrbracket^c = \sigma x[x$ is inanimate in $s_0 \wedge x$ is a pie in $s_0 \wedge$ Bill is baking x in $s_0]$

3.2.2 Alternatives

On an ignorance reading, an EFRC conveys that there is a salient unknown regarding its referent. Condoravdi 2008, 2015 proposes to derive EFRCs' ignorance implications from the contextually-determined alternatives that EFRCs evoke, and the same will be done here. This work assumes that the morpheme *-ever* denotes a contextually-determined property that triggers alternatives whose denotations constitute a partition of *-ever*'s denotation, as in (69)-(70). This idea is partly inspired by

the literature on weak NPIs (e.g., Krifka 1995). Their polarity sensitivity is claimed to be a consequence of their evoking alternatives roughly of the kind assumed here[6].

(69) For any context c, $\{[\![\phi]\!]^c : \text{ALT}_c(\phi, \text{ever})\}$ is a partition of $[\![\text{-ever}]\!]^c$

(70) A set of properties $C_{\langle\langle s,et\rangle,t\rangle}$ partitions property $P_{\langle s,et\rangle}$ iff for any situation s:
    a. $\exists Q, Q' \in C[Q \neq Q']$ Non-trivial
    b. $\bigcup\{Q(s): Q \in C\} = P(s)$ Jointly exhaust P
    c. $\forall Q, Q' \in C[Q(s) \cap Q'(s) = \varnothing]$ Pairwise incompatible

For example, (71b) is a partition of (71a) (assuming no pie is both a cherry pie and a rhubarb pie), and (72b) is a partition of (72a).

(71) a. $\lambda s.\lambda x.\, x$ is a cherry pie in $s \vee x$ is a rhubarb pie in s
     b. $\{[\lambda s.\lambda x.\, x$ is a cherry pie in $s], [\lambda s.\lambda x.\, x$ is a rhubarb pie in $s]\}$

(72) a. $\lambda s.\lambda x.\, x$ is on the left in $s \vee x$ is on the right in s
     b. $\{[\lambda s.\lambda x.\, x$ is on the left in $s], [\lambda s.\lambda x.\, x$ is on the right in $s]\}$

This view on *-ever* implies that the alternatives to an EFRC-LF will be definite-LFs in which an alternative to *-ever* replaces *-ever*. Note that the correspondence between these hypothesized alternative LFs and actual utterances may be indirect. Given the claim that *-ever*'s alternatives partition *-ever*, any alternative to an EFRC-LF, where some alternative, property-denoting expression replaces *-ever*, will have a stronger presupposition than the EFRC-LF. Together with MP, this view on the meaning of the EFRC and the meanings of its alternatives predicts the various readings observed in the preceding section, as the following sections will show.

3.2.3 Ignorance reading

Suppose (73) is uttered in a context where the assignment provides (71a) as the value of *-ever* and (71b) for the set of its alternatives.

(73) There's a lot of sugar in whatever pie Bill is baking

(73) carries the presupposition in (74a) while the alternatives determined on the basis of the alternatives to *-ever* carry the presuppositions in (74b-c).

(74) a.   The pie Bill is baking is a cherry pie or a rhubarb pie

---

6 For example, Chierchia 2013 proposes that *ever* in **John has ever been to Canada* denotes an obligatorily exhaustified existential quantifier over times, whose domain of quantification evokes so-called 'subdomain alternatives' (a notion closely resembling a partition). Exhaustification yields that there is some past time in domain D at which John was in Canada but no time in any subdomain D' of D at which he was in Canada (a contradiction). This contradiction is obviated by negation.

b. The pie Bill is baking is a cherry pie
c. The pie Bill is baking is a rhubarb pie

The EFRC denotes the same entity as its alternatives, namely, the pie that Bill is baking. They differ only in what they presuppose. MP is relevant in determining whether the speaker's utterance of the EFRC is acceptable. The use of the sentence is only acceptable if the presuppositions of its equivalent, presuppositionally stronger alternatives are not common knowledge. This amounts to a requirement that CK_c does not entail that the pie Bill is baking is of a particular flavor. This is satisfied in cases of speaker-ignorance, addressee-ignorance (the teasing reading), and disagreement (the irrelevance reading). It is not satisfied if the interlocutors publicly agree on what flavor the pie is. Taking the perspective of a hearer who takes the speaker to be MP-compliant and who observes an utterance of an EFRC, the utterance generates an antipresupposition that CK_c meets the requirements of an EFRC.

Recall the infelicity of (75), in which a speaker provides that the pie Bill is baking is a cherry pie but refers to it using the EFRC *whatever pie Bill is baking*.

(75)   *Bill is baking a cherry pie, and there's a lot of sugar in whatever pie he is baking

The context is not sufficiently rich to fully specify what property *-ever* denotes and how *-ever*'s denotation is partitioned. However, the *cherry pie*-ascription provides a clue as to how individuals are being categorized. The unacceptability of (75) is explained on the assumption that whatever values are assigned to *-ever* and its alternatives, one of the alternatives denotes [$\lambda s.\lambda x.\ x$ is a cherry pie in s]. The information that the EFRC's referent has this property is common knowledge when the second conjunct containing the EFRC is evaluated, resulting in an MP-violation. In contexts where some non-flavor-based partition is salient, like (76), the EFRC is fine, even if it's known to denote a cherry pie. Presumably, the alternatives to *-ever* denote [$\lambda s.\lambda x.\ x$ is on the left in s] and [$\lambda s.\lambda x.\ x$ is on the right in s] in this context.

(76)   *Context: Mary and Bill are baking, but they momentarily left the room. A and B enter and see two pies, one on the left and one on the right.*
A: Both of these are cherry pies
B: I know, but Bill has a sweet-tooth and Mary doesn't, so there's a lot of sugar in whatever pie he is baking

Regarding (75), one might wonder why speakers do not take the EFRC to signal some unknown about the pie other than its flavor. Framed in terms of the theory, why do speakers construct possible alternative sets for *-ever* that necessarily include [$\lambda s.\lambda x.\ x$ is a cherry pie in s], rather than accommodating a set of position-based properties as in (76) (or any other set of partitioning properties, for that matter)? This

work does not offer an answer to this question but points out a parallel judgment with quantification in (77).

(77)   Bill doesn't love pie but everyone ??(except Bill) does

The determination of alternative sets resembles the determination of quantificational domains in the following sense. Although Bill in principle could be excluded from the domain quantified over by *everyone* to prevent a contradiction, speakers tend to judge the sequence contradictory without the overt exceptive. Likewise, although the cherry pie property could be excluded from the set of alternatives to *-ever*, it tends to be included, leading to infelicity. It seems that in evaluating such discourses, speakers are inclined towards what's salient, not what's consistent.

While incompatibility with appositives was not treated as a core fact to be explained about EFRCs, it was used as a diagnostic for the availability of non-ignorance readings. A question that awaits future work is why examples like (78) are unacceptable.

(78)   There's a lot of sugar in whatever pie Bill is baking (*namely, a cherry pie)
        cf. There's a lot of sugar in the pie Bill is baking (namely, a cherry pie)

Suppose that the property ascribed to the EFRC's referent by a *namely*-appositive obligatorily counts as an alternative to *-ever* (cf. Onea & Volodina 2011 on *namely*-appositives answering implicit specificational questions). Even granting this, (78) should be MP-compliant if the CK_c-set to which it's added does not determine that the pie Bill is baking is a cherry pie, and this information is added by the appositive itself. One possible explanation of the incompatibility is to consider how MP-based reasoning sometimes license inferences about the speaker's epistemic state rather than common knowledge (e.g., Chemla 2008, Rouillard & Schwarz 2017). The unacceptability of *namely*-appositives could be explained by a contradiction between the speaker's utterance of the *namely*-appositive and the strengthened inference generated by MP, that the speaker's epistemic state does not determine which partition cell the EFRC's referent falls in.

3.2.4 Variation with quantifiers

Individual-variation, situational-variation, and indifference readings are all analyzed as special cases of a quantifier binding into the restrictor of an EFRC. For the same reasons discussed with *know whether*, the use of such constructions can be MP-compliant when the identity of the EFRC's referent is known in the relevant way. In short, the presupposition of a quantificational statement in which the quantifier binds

into the EFRC is the strongest felicitous one among its alternatives when it is known that the EFRC's identity varies (in the relevant way) across the quantifier's domain.

Recall that (79a), in which *every* binds into the EFRC, is unacceptable in a context like (79) that provides that every professor attended the same conference as their first. (79b) is the relevant LF.

(79)   *Context: Mary, Sue, and Elsie are the professors, and Conference A was their first conference. Someone asks what conference they most enjoyed.*

    a. #Every professor most enjoyed whatever conference she first attended

    b. LF: every prof-s_0 [$\lambda 7$ [t_7 enjoyed-s_0

                             [whatever conference she$_7$ first attended]-s_0]]

The constituent *[$\lambda 7$ [t_7 enjoyed-s_0 [whatever conference she$_7$ first attended]-s_0]]* denotes a partial function whose domain contains only those individuals such that the first conference they attended has the property assigned to *-ever*. *Every* requires every professor to be in the domain of this function, so (79) as a whole presupposes (80a) while the alternatives presuppose (80b-d), assuming (81a-b) as the values of *-ever* and alternatives.

(80)   a. For every prof x, the first conference x attended was Conference A, Conference B, or Conference C

       b. For every prof x, the first conference x attended was Conference A

       c. For every prof x, the first conference x attended was Conference B

       d. For every prof x, the first conference x attended was Conference C

(81)   a. $\lambda s. \lambda x$. x is Conference A in s $\vee$

                           x is Conference B in s $\vee$ x is Conference C in s

       b. $\{[\lambda s. \lambda x$. x is Conference A in $s]$,

          $[\lambda s. \lambda x$. x is Conference B in $s], [\lambda s. \lambda x$. x is Conference C in $s]\}$

A speaker uttering the EFRC-sentence complies with MP only if all of (80b-d) are not common knowledge. Two types of CK_c-sets meet this requirement: i) a CK_c-set in which it is unsettled which conference at least one professor attended and ii) a CK_c-set in which it is settled that at least two professors attended different conferences. The context above supplies that every professor attended Conference A, hence it does not meet this requirement.

Taking the perspective of a hearer who takes the speaker to be MP-compliant and who observes an utterance of an EFRC, the utterance generates an antipresupposition that common knowledge meets the contextual requirements of an EFRC. Hence the EFRC has a reading that implies either that it's unknown which conference every professor attended, or that the professors attended different conferences.

The same explanation is given for situational-variation readings. Indeed, although they have been presented as distinct readings in the literature, individual-variation and situational-variation readings have the same status on the current analysis. Their similarity stems from the fact that they both project universal presuppositions. Recall that when the referent of the EFRC is known, and it is the same entity across situations quantified over by *always*, (82) with an EFRC is unacceptable.

(82)   *Context: Bill is a boxer. He's had many fights but always with the same opponent, John . . .*

    a.   #Bill has always lost to whatever opponent he faced

    b.   LF: always C-s_0 [$\lambda 7$ [Bill has lost-to-s_7

                               [whatever opponent he faced]-s_7]]

Given universal presupposition projection under *always*, (82a) presupposes (83a), and its alternatives presuppose (83b-c), assuming (84a-b) as the values of *-ever* and of alternatives.

(83)   a.   In every situation, the opponent Bill faced was John or Mary

        b.   In every situation, the opponent Bill faced was John

        c.   In every situation, the opponent Bill faced was Mary

(84)   a. $\lambda s . \lambda x . x$ is Bill in $s \lor x$ is Mary in s

        b. $\{[\lambda s . \lambda x . x$ is Bill in $s], [\lambda s . \lambda x . x$ is Mary in $s]\}$

A speaker uttering the EFRC sentence complies with MP only if common knowledge entails neither (83b) nor (83c) (satisfied if it is unknown who Bill faced in at least one situation, or if it is known that Bill faced different opponents in at least two situations). In the preceding example, context supplies that in every relevant situation, the opponent Bill faced was John, hence the use of the EFRC violates MP. The same proposal can extend to situational-variation readings with *will*, assuming that in addition to whatever temporal or epistemic conditions it imposes on the set of situations it quantifies over, it has universal presuppositions like *always*. (85) is unacceptable when in every possible future, you take the same exit; in this context, its use violates MP assuming the values in (86a-b) for *-ever* and its alternatives.

(85)   *Context: On your way to my house, you will see signs for exits one and two. You will take exit two, and. . .*

    a.   #Whatever exit you take will get you onto MLK Blvd

    b.   LF: will C-s_0 [$\lambda 7$ [[whatever exit you take]-s_7 gets-s_7 you to MLK]]

(86)   a. $\lambda s . \lambda x . x$ is exit one in $s \lor x$ is exit two in s

        b. $\{[\lambda s . \lambda x . x$ is exit one in $s], [\lambda s . \lambda x . x$ is exit two in $s]\}$

Recall that when individual- and situational-quantifiers scope over the EFRC but do not bind into its restrictor, the EFRC has only an ignorance reading, as in (87a-c).

(87)   a.   Every professor most enjoyed whatever conference I first attended
        b.   Bill has always lost to whatever opponent he faced on Monday
        c.   Whatever exit you took will get you onto MLK Blvd

This is because without binding, the presupposition of the EFRC projects globally, unaffected by quantifier, and the only way for MP to be satisfied is for it to be unsettled which partitioning property holds of the EFRC's referent.

The indifference reading is explained largely in the same way as individual- and situational-variation readings. Adopting an idea from the literature on agentivity, certain predicates are taken to introduce an agent-teleological modal base into the grammatical representation of the sentence (Koenig & Davis 2001, Martin & Schäfer 2012, Kratzer 2015, et al. on defeasible causatives and transfer of possession). (88) is a piece of evidence for this view from Oehrle 1976: 25. In (88), the animate, agentive subject allows for a reading under which the uptake of the offer is non-actual, while (89), which has an inanimate non-agentive subject, implies actual uptake.

(88)   L'organisateur de la course lui a offert la première place. Mais elle a refusé ce marché.
        'The organizer of the race offered her the first position, but she refused this deal.'

(89)   Son excellent résultat lui a offert la première place. #Mais elle ne l'a pas prise.
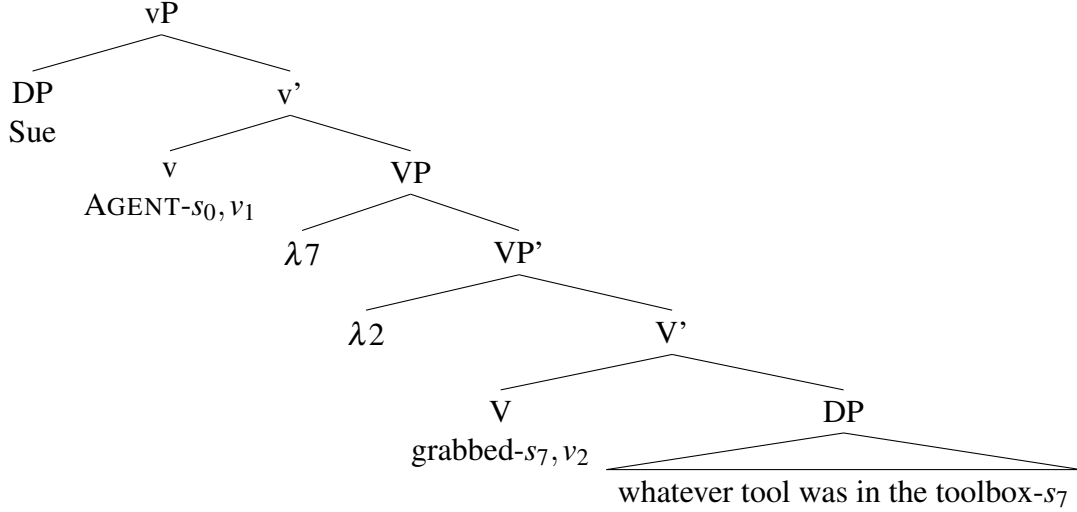   'Her excellent result offered her the first position. But she didn't take it.'

The indifference reading is analyzed as a result of an agentive modal binding into the EFRC, allowing for MP to be satisfied when it is known that across the agent-teleological modal, the identity of the EFRC's referent varies in the relevant way. This amounts to an implication of agent-indifference. Recall the example in (90), in which the EFRC is unacceptable when the agentive subject is known to not have been indifferent about the identity of the tool in the toolbox.

(90)   *Context: The hammer was in the toolbox, and the screwdriver was on the shelf. Sue was assembling the bed carefully and the next step called for a hammer, so...*
        Sue grabbed {#whatever tool, the tool that} was in the toolbox

Suppose that the relevant LF for (90) is (91). AGENT, as defined in (92) (based on Kratzer 2015), binds the EFRC's situation argument s_7 and projects universal presuppositions. Event arguments (type ε) are represented explicitly.

(91)

```
                        vP
            ┌───────────┴───────────┐
           DP                       v'
           Sue              ┌────────┴────────┐
                            v                 VP
                    AGENT-s₀, v₁        ┌──────┴──────┐
                                       λ7           VP'
                                              ┌──────┴──────┐
                                             λ2            V'
                                                    ┌───────┴────────┐
                                                    V               DP
                                              grabbed-s₇, v₂
                                                    whatever tool was in the toolbox-s₇
```

(92) $\llbracket\text{AGENT}\rrbracket^c = \lambda s . \lambda v_\varepsilon . \lambda P_{\langle s,\varepsilon t\rangle} . \lambda x : \text{GOALS}(s,x,v) \subseteq \{s': P(s') \text{ is defined}\}.$
         $x \text{ is the agent of } v \text{ in } s \wedge \text{GOALS}(s,x,v) \subseteq \{s': \exists v'_\varepsilon[P(s',v')=1 \wedge \text{CAUSE}(s',v,v')]\}$
         $\text{GOALS}(s,x,v)$ is the set of situations where the goals of x in s during v are
         realized

The function denoted by the VP is partial, defined only for those situations s' in
which the tool in the toolbox in s' has the *-ever*-property in s'. AGENT requires all of
the goal-realizing situations of the agent to be in the domain of this function. Thus,
(91) presupposes (93a) and its alternatives presuppose (93b-c), assuming (94a-b) as
the value of *-ever* and alternatives.

(93)   a.   In every situation where Sue's goals during her agentive act are real-
                ized, the tool in the toolbox is a hammer or a screwdriver
         b.   In every situation where Sue's goals during her agentive act are real-
                ized, the tool in the toolbox is a hammer
         c.   In every situation where Sue's goals during her agentive act are real-
                ized, the tool in the toolbox is a screwdriver

(94)   a. $\lambda s . \lambda x . x$ is a hammer in $s \vee x$ is a screwdriver in s
         b. $\{[\lambda s . \lambda x . x \text{ is a hammer in } s], [\lambda s . \lambda x . x \text{ is a screwdriver in } s]\}$

The alternatives are as informative as the sentence containing the EFRC; all of them
describe an actual agentive event on the part of Sue and in all situations where
the agentive event leads to Sue's intended result, her action causes a grabbing of

the tool in the toolbox. They differ in terms of what property is presupposed to hold of the tool in Sue's goal-realizing situations, hence MP is relevant. The use of the EFRC-sentence is MP-compliant only if neither (93b) nor (93c) is common knowledge. Two types of CK_c-sets meet this requirement: i) a CK_c-set in which it is unsettled, for at least one of Sue's goal realizing situations, what tool was in the toolbox and ii) a CK_c-set in which it is settled, for at least two goal realizing situations s and s', that the tool is a hammer in s and a screwdriver in s'. From the perspective of a hearer who takes the speaker to be MP-compliant, the hearer can infer, roughly, that it is unknown what type of tool Sue needed to be in the toolbox (for the purposes of her grabbing the tool), or that it is known that Sue didn't care (for the purposes of her grabbing the tool) what type of tool was in the toolbox.

Several question remain to be answered about indifference. Non-actuality of uptake was given as evidence for modality in the meaning of *The presenter offered her the first place*, but *Sue grabbed whatever tool was in the toolbox* implies not just that the grabbing of the tool was actual, but also that the tool was actual. This doesn't follow from the proposal above, where the extension of the EFRC is determined in Sue's goal-realizing situations, which do not have to be related in any way to s_0. As pointed out by a reviewer, this fact is part of a more general phenomenon where syntactically low modals give rise to *actuality entailments* (e.g., Hacquard 2006, Hacquard 2009): unexpected entailments about the extension in the evaluation situation of their embedded, intensional properties. If this line of explanation for the extensionality of *grab* is pursued, the difference between *grab* and, e.g., *offer* remains to be clarified.

The second question is the divide between assertive and presuppositional content in indifference readings. Given the perceived readings of (95a-b) (based on von Fintel 2000: 36), it has been proposed that the indifference implication is truth conditional rather than presuppositional (see also Rawlins 2015, Condoravdi 2015).

(95)   a.   Sue didn't just grab whatever tool was in the toolbox (...she grabbed the hammer that was in there on purpose)
        b.   Unless Sue just grabbed whatever tool was in the toolbox, she took a long time to assemble the bed

Under the current analysis, there is no difference in status between the ignorance and indifference implications. Both are antipresuppositions generated by the use of a presuppositionally weak alternative. It is not clear that this is a fault. Rawlins (2015: 275) observes that ordinary definites may give rise to indifference implications, which at times may appear to be at-issue; (96) apparently has a reading that expresses a condition on Alfonso acting indifferently. This suggests that the question about the division of content is not unique to EFRCs.

(96)   Unless Alfonso just grabs the tool that's handy, we'll be waiting for hours
        ≈ Unless Alfonso acts indifferently. . .

3.2.5 Diverse subpart reading

EFRCs with a plural sortal need not carry any modal implications of ignorance, but
there is a slight contrast between (97a-b), where the subparts making up the EFRC's
referent have salient, distinct properties in (97a) but not (97b).

(97)   a.   A: The only tools you own are a hammer and a screwdriver, right?
              B: Yes, and this toolbox contains whatever tools I own
        b.   A: The only tools you own are two hammers, right?
              B: ?Yes, and this toolbox contains whatever tools I own

   Plural EFRCs presuppose that the maximal non-atomic entity in the denotation
of the restrictor has the *-ever*-property. To comply with MP, the maximal non-atomic
entity can't be known to have one of the alternative properties. Two types of CK_c-
sets meet this requirement: i) a CK_c-set in which it is unsettled which alternative
property holds of the referent and ii) a CK_c-set in which it's settled that different
alternative properties hold of the entity's subparts. The latter type of CK_c-set supports
the non-modal reading identified by Condoravdi 2015. Following Condoravdi, a
very fine-grained partition of *-ever* is in principle possible (e.g., based on properties
of being identical to atomic subparts of the EFRC's referent). This implies that
the use of a plural EFRC can always be construed as MP-compliant, carrying the
antipresupposition that the EFRC's plural referent is simply made up of different
parts, which is guaranteed by plurality. Regarding the contrast between (97a-b),
if *-ever* and alternatives receive the salient values in (98a-b), then B's utterance is
MP-compliant only in (97a); B's utterance in (97b) could be MP compliant under
different values (e.g., $\lambda s. \lambda x.\ x$ is hammer 1 in $s \vee x$ is hammer 2 in s).

(98)   a. $\lambda s . \lambda x.\ x$ is a hammer in $s \vee x$ is a screwdriver in s
        b. $\{[\lambda s . \lambda x.\ x$ is a hammer in $s], [\ \lambda s . \lambda x.\ x$ is a screwdriver in $s]\}$

3.3 Discussion

The following subsections compare the present analysis with some of the previous
approaches to the readings of EFRCs. Section 3.3.1 discusses how the current
account avoids some challenges posed to previous accounts of ignorance by adopting
a notion of identity that is relativized to a contextually-determined, property-based
partition. Section 3.3.2 highlights an advantage of the present account over most
others, relating to the lack of ignorance when a quantifier binds into an EFRC's

restrictor; because many previous accounts take EFRC's to semantically encode modality, they have trouble explaining the absence of modal inferences and the attested inferences of variation. Finally, Section 3.3.3 compares the present analysis of indifference readings to the predominant one found in the literature, which is based on a contextually-determined, counterfactual presupposition. The availability of indifference readings favor the present account.

3.3.1 Other views on ignorance

Dayal 1997 offers the first formal semantic analysis of EFRCs, and it primarily aims to explain ignorance and situational-variation readings. According to Dayal 1997 (as recast in von Fintel 2000: 30, analysis-N), EFRCs carry a presupposition of non-rigid designation across a contextually determined modal base F, as in (99), and ignorance arises when F is epistemic.

(99)   For any world w and any property $P_{\langle s,et \rangle}$:
$[\![\text{whatever}]\!]^c(w)(F)(P)$ is defined only if $\exists w', w'' \in F$
$$[\iota x[P(w')(x)] \neq \iota x[P(w'')(x)]]$$
When defined, $[\![\text{whatever}]\!]^c(w)(F)(P) = \iota x[P(w)(x)]$

This analysis implies that on an ignorance reading, an EFRC is felicitous only if the speaker (or relevant epistemic source) is not certain of which individual the EFRC denotes. Heller 2005, Condoravdi 2008, and Heller & Wolter 2011 identify two empirical challenges for the analysis in (99), relating primarily to the type of variation in identity that the EFRC requires. The first challenge is the unexpected felicity of EFRCs in contexts where the speaker can identify the EFRC's referent with an individual-denoting expression like the demonstrative *that pie* in (100); on the assumption that demonstratives denote entities 'rigidly' (i.e., in any world, they pick out the same entity as they do in the actual world, as in Kaplan 1989), the presupposition of (99) is expected not to be satisfied in (100).

(100)   A (pointing): Bill is baking that pie.
           B: I see. Given his taste, there's a lot of sugar in whatever pie he is baking

The second challenge is the unexpected infelicity of EFRCs in contexts where an NP-property is saliently ascribed to the EFRC's referent, as in (101). Such contexts are in principle compatible with the speaker being unable to identify the individual that the EFRC denotes, making the EFRC's non-rigidity requirement satisfiable.

(101)   *Bill is baking a cherry pie, and there's a lot of sugar in whatever pie he is baking

Heller & Wolter (2011) aim to resolve both of these problems by proposing a different presuppositional condition on the use of an EFRC. They propose that EFRCs carry an ignorance presupposition that is relativized to noun meanings. On their ontological assumptions (based especially on Gupta 1980), noun meanings are not properties, as assumed here, but rather *sorts*. Sorts are intensions of sets of individual concepts that uphold three principles: the principle of application (which says that the individual concepts pick out entities with the noun-related property), the principle of identity (which tracks the entities picked out by the individual concepts across worlds), and the principle of separation (which distinguishes between individual concepts). An example common noun denotation under their assumptions is given in (102) (slight notational differences for readability).

(102) $[\![\text{statue}]\!]^c$ is the function S from worlds into sets of individual concepts (type $\langle s, \langle \langle s, e \rangle, t \rangle \rangle$) such that for any world w:

    a. $\forall i \in S(w)$: $\text{STATUE}(i(w)) = 1$ Application

    b. $\forall i \in S(w)$: $\forall w', w''$: if $i(w')$ and $i(w'')$ are defined, then $i(w')$ is the same statue as $i(w'')$ Identity

    c. $\forall i, i' \in S(w)$: if $\exists w'$ such that $i(w') = i'(w')$, then $i = i'$ Separation

According to Heller & Wolter 2011, EFRCs have the presupposition in (103), to be discussed below.

(103) For any world w and any properties $P_{\langle s, et \rangle}, Q_{\langle s, et \rangle}$:
$[\![\text{whatever}]\!]^c(w)(F)(P)(Q)$ is defined only if
$\forall S_{\langle s, \langle \langle s, e \rangle, t \rangle \rangle}$: $\exists w', w'' \in F[\iota x[P(w')(x)]$ is not the same S as $\iota x[P(w'')(x)]]$.
When defined, $[\![\text{whatever}]\!]^c(w)(F)(P)(Q) = 1$ iff $\forall w' \in F[Q(\iota x[P(w')(x)])]$

(102b) suggests under what conditions we judge two entities to be the same S. If some individual concept in the extension of S has x as its extension in one world and y as its extension another, then x and y are the same S. In other words, if a single way of picking out an individual among the statues, the pies, or any other S happens to pick out those two individuals at any two worlds, they are the same statue, pie, etc. (103) requires that no sort provide an individual concept that picks out the same entity as $\lambda w. \iota x[P(w)(x)]$ at every $w \in F$.

    The denotation is meant to solve the two problems faced by Dayal's account based on non-rigidity. The first problem, posed by felicitous EFRCs in contexts of demonstration, is solved by assuming a particular view on demonstration. In short, demonstratives, unlike common nouns, do not denote sorts; as such, they do not provide a method of identifying their referent in the way that a common noun does, and there is no problem with referring to an entity using a demonstrative and then an EFRC. The EFRC's ignorance requirement represented in (103) is satisfiable.

The second problem, posed by infelicitous EFRCs which have been saliently ascribed a property like *cherry pie* is explained by Heller & Wolter 2011: 184 as follows: 'Knowing that the sort [*cherry pie*] applies to the denotation of the FR provides a principle of identity for this entity, and there is no information in this context which guarantees that the entity will not be the same [*cherry pie*] across the possible worlds in the modal base. This violates Condition S, which requires there not to be any such identifying nominal sort.' The proposal is compatible with the felicity of the EFRC in the discourse repeated in (104), which is inspired by one of their own that is used to motivate the switch to sorts in the meaning of EFRCs.

(104)　　*Context: Mary and Bill are baking, but they momentarily left the room. A and B enter and see two pies, one on the left and one on the right.*
A: Both of these are cherry pies
B: I know, but Bill has a sweet-tooth and Mary doesn't, so there's a lot of sugar in whatever pie he is baking

Although the EFRC's referent is known to be a cherry pie, the pie Bill is baking coincides with the extension of the concept $[\lambda w.$ the cherry pie on the left in $w]$ in some of the relevant belief worlds and $[\lambda w.$ the cherry pie on the right in $w]$ in others. As such, the sort denoted by *cherry pie* does not provide a method of identifying the EFRC's referent across the epistemic modal base, making the requirement of the EFRC on their proposal satisfiable.

Arguably, however, the proposal faces problems explaining the contrast in (105).

(105)　　Bill is baking a (#cherry) pie, and there's a lot of sugar in whatever pie he is baking

The sequence in (105) is marked when *cherry* is included and completely unmarked when it is excluded. In neither case, however, is there any information in the context that guarantees that the relevant sorts (i.e., *pie* and *cherry pie*) do not provide a method of identifying the EFRC's referent across the modal base. Framed in terms of the theory in Heller & Wolter 2011, the puzzle is why speakers are inclined to assume the sorts denoted by *pie* and *cherry pie* do not track the referent's identity when *cherry* is absent but do track its identity when *cherry* is present. The intuition underlying the analysis presented here is that there is a conflict between the salient *cherry pie* property ascription and the context-dependent ignorance requirement of the EFRC, but it is not obvious how to use that property ascription to render (105) a presupposition failure on their analysis. In particular, contextually restricting the sorts quantified over in the EFRC's presupposition will not help, since it will only serve to make the presupposition easier to satisfy. As such, without further

clarification, their proposed presupposition does not explain EFRCs' incompatibility with salient property ascriptions.

3.3.2 Non-modal variation

On the current proposal for the meaning of EFRCs, repeated in (106) (notational modifications for consistency), modal variation is not part of the semantics. Compliance with pragmatic principles produces the requirement that some intensional denotation's value varies across a modal base.

(106) $[\![\text{whatever}]\!]^c(s)(P)$ is defined only if $[\![\text{-ever}]\!]^c(s)(\sigma x[P(s)(x)])$. When defined, $[\![\text{whatever}]\!]^c(s)(P) = \sigma x[P(s)(x)]$
(where $\{[\![\phi]\!]^c : \text{ALT}_c(\phi, \text{-ever})\}$ is a partition of $[\![\text{-ever}]\!]^c$)

For comparison, the analysis in Dayal 1997, von Fintel 2000 is repeated in (107); here, modal variation is clearly part of the semantics.

(107) $[\![\text{whatever}^{\text{Dayal}}]\!]^c(s)(F)(P)$ is defined only if $\exists s', s'' \in F$
$$[\sigma x[P(s')(x)] \neq \sigma x[P(s'')(x)]]$$
When defined, $[\![\text{whatever}]\!]^c(s)(F)(P) = \sigma x[P(s)(x)]$
(where F is the extension in s of a salient modal base function)

The question this subsection explores is whether the facts favor a semantic or a pragmatic account of modal variation. To illustrate that this question is independent of the notion of identity an analysis adopts, non-rigidity in (107) could be substituted with property-based variation, as in (108); this rendition of a semantic account presupposes that the referent has the general *-ever*-property and that for every alternative property, it's possible that the referent has it.

(108) $[\![\text{whatever}]\!]^c(s)(F)(P)$ is defined only if
  a. $[\![\text{-ever}]\!]^c(s)(\sigma x[P(s)(x)])$
  b. $\forall \phi[\text{ALT}_c(\phi, \text{ever}) \rightarrow \exists s' \in F[[\![\phi]\!]^c(s')(\sigma x[P(s')(x)])]]$
  When defined, $[\![\text{whatever}]\!]^c(s)(F)(P) = \sigma x[P(s)(x)]$
  (where F is the extension in s of a salient modal base function and $\{[\![\phi]\!]^c$
  $: \text{ALT}_c(\phi, \text{-ever})\}$ is a partition of $[\![\text{-ever}]\!]^c$)

Both types of accounts are able to account for ignorance, situational-variation, and indifference readings. According to semantic accounts, EFRCs carry a presupposition that requires variation with respect to the EFRC's extension across a contextually-determined modal base, F. The modal base across which the EFRC varies can be the set of epistemically accessible situations (ignorance), the set of counterfactually accessible situations (indifference), or the set of generically accessible situations

(situational-variation). On a naive implementation, the modal base against which the EFRC is evaluated is whichever is made salient in the conversation (cf. conversational backgrounds in Kratzer 1977, 1981).

The problem faced by a semantic account is non-modal variation, namely, individual-variation readings and diverse-subpart readings. Recall that (109) is felicitous in contexts in which it's settled for every professor what her first conference was, so long as the conference varies across professors, and that (109) cannot be analyzed as an indifference reading, given its main predicate.

(109)   Every professor most enjoyed whatever conference she first attended

Furthermore, the choice of predicate and referent for the EFRC make a situational-variation reading implausible, as evidenced by the oddity of (110). Generally, enjoying a particular conference the most describes a state, not something that happens on multiple occasion.

(110)   #Sue always most enjoyed the first conference she attended

Variation across the set of epistemically accessible situations, the set of counterfactually accessible situations, or the set of generically accessible situations will not provide the attested reading of the example. A similar problem is posed by diverse-subpart readings, (111a); with a singular sortal, (111b), the sentence only implies I don't know what tool I own, suggesting that *contain* on its own does not make available an indifference or situational-variation reading. The implication of (111a) — that the parts making up the sum of tools I own have distinct properties — must come from plurality, and none of the proposed possible values for F are helpful in deriving this reading.

(111)   a.   This toolbox contains whatever tools I own
         b.   This toolbox contains whatever tool I own

The natural analytical intuition is to derive individual-variation readings by requiring the identity of the EFRC's referent to vary across the domain of the quantifier. Reconciling the modal presupposition analysis with these judgments with new values for F proves difficult, as shown below.

Since the goal is to derive the non-modal variation readings modally, F might be assigned a "realistic" value, consisting of parts of the topic situation s_0. For the individual-variation example, perhaps what context makes salient is a set of situations that are part of the topic situation s_0, each of which contains exactly one of the entities that *every professor* quantifies over, (112a). For the diverse subpart example, assume the set of situations in (112b), which are parts of the topic situation containing proper subparts of the tools I own.

(112)   a. $\{s': \ s' \sqsubseteq s_0 \land$ exactly one of the professors in s_0 is in $s'\}$
         b. $\{s': \ s' \sqsubseteq s_0 \land$ the tools I own in $s' \sqsubset$ the tools I own in $s_0\}$

(112b) works well when paired with (108). *This toolbox contains whatever tools I own* is predicted to presuppose that the tools I own have the *-ever*-property, and for every property-denoting ϕ that is an alternative to *-ever*, a subpart of the tools I own has the ϕ-property. But (112a) does not help much in producing an implication that the professors' first conferences have different properties; indeed, paired with (108), the resulting presupposition appears to be unsatisfiable. Once the universal presupposition resulting from *every professor* and binding is taken into consideration, the relevant example is predicted to have the presupposition in (113).

(113)   For every professor x in s_0

         a.   The first conference x attended in s_0 has the *-ever*-property in s_0
         b.   For every alternative to *-ever* $\phi, \exists s \in$ (112a) such that the first conference x attended in s has the ϕ-property in s

(113b) says that for every professor, the first conference she attended has different properties across the situations in (112a). But this is impossible, given the assumption that the alternative properties partition *-ever* and the assumption that the situations in (112a) are parts of the topic situation s_0. For every professor, only one alternative property can hold of her first conference in s_0 and therefore throughout any of s_0's parts. The original presupposition in (107) does not sit well with (112a) either, producing the presupposition in (114). In order for the sentence to be defined, it has to be the case that for every professor in s_0, she attended exactly one first conference in s_0. Therefore, it cannot be the case that for every professor, there are two distinct unique first conferences in the subparts of s_0, as (114) requires.

(114)   For every professor x in $s_0, \exists s, s' \in$ (112a)
         [The first conference x attended in $s \neq$ The first conference x attended in s']

An analysis that semantically encodes modal variation must be amended to capture non-modal readings of variation; until a more appropriate (and ideally, independently motivated) value for F is proposed, it is an open question how to capture individual-based variation under a semantic rather than pragmatic account of modal variation.

   The problem also applies to other analyses that semantically encode modal variation in different ways, to be discussed briefly. Hirsch 2015 offers a different semantic account, elaborated on in Šimík 2018. To explain similarities in the syntactic composition of EFRCs and interrogative clauses, Hirsch 2015 proposes that a sentence containing an EFRC in fact underlyingly contains an interrogative clause as well. Specifically, the property-denoting restrictor of the EFRC is both part of a definite

DP, as commonly assumed, and part of an interrogative adjunct clause that pointwise restricts an epistemic modal. The pointwise restriction results in a presupposition of variation across the modal base, making modal variation part of the semantics[7]. Šimík 2018 shows how the analysis can be extended to situational-variation readings by pointwise restricting a sentence-internal quantifier over situations rather than an epistemic modal. This view faces problems explaining the same data point as the modal-presupposition account, namely the individual-variation reading; unless an appropriate modal base is found and can be convincingly argued to be part of the grammatical make up of the universally quantified statement for the interrogative clause adjunct to restrict, the individual-variation reading remains unexplained.

Condoravdi's (2015) account introduces the notion of contextually-determined alternative properties, thus avoiding the problems relating to non-rigidity. However, the alternative properties are discharged with one of two modalized rules. The first rule produces a presupposition of variation across the context set, and the second rule makes variation across a counterfactual modal base part of an EFRC sentence's assertive content. Since both rules are modalized, the non-modal variation in (114) is problematic as well.

Lauer 2009 is the first to point out the individual-variation reading and the problem it poses for inherently modal accounts. He notes that the type of variation an EFRC can convey is determined by what quantificational expressions scope over the EFRC. Under his proposal, which is couched in a dynamic semantic framework, EFRCs have grammatically-encoded postsuppositions which require variation with respect to the EFRC's referent in the EFRC's output context. In sentences with individual quantifiers that bind into the EFRC, this amounts to a requirement that the EFRC denote different individuals across the domain of the quantifier. Thus, his proposal derives the same result as the current proposal for the problematic *Every professor most enjoyed whatever conference she first attended*.

Under Lauer's proposal, variation is part of the grammatical meaning of EFRCs. Under the current proposal, evocation of alternatives is grammatically encoded (because of *-ever*), but variation is not. It is a result of MP-based reasoning. The current account naturally explains non-modal readings with plural EFRCs: MP is satisfiable without ignorance about the EFRC's referent, so long as no individuating property

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7 (i) is a brief sketch of the compositional details in Hirsch 2015; as a result of the partiality of (id), the LF in (ia) presupposes that every possible answer in (ib) is epistemically possible.

(i)   a.   LF: Op [□ [Q whatever Mary cooked] [John ate [*Def* whatever Mary cooked]]]

        b. $[\![$Q whatever Mary cooked$]\!]^c = \lambda p_{st}.\ \exists x[p = \lambda w.$ Mary cooked only x in $w]$

        c. $[\![$John ate [*Def* whatever Mary cooked$]\!]^c = \lambda w.$ John ate $\sigma x[$Mary cooked x in $w]$ in w

        d. $[\![\square]\!]^c = \lambda p_{st} : F_c(w) \cap p \neq \varnothing\ .\ \lambda q_{st}\ .\ \lambda w\ .\ \forall w' \in F_c(w) \cap p\colon q(w') = 1$

        e. $[\![$Op$]\!]^c = \lambda P_{st,t}.\ \lambda w.\ \forall p \in P\colon\ p(w) = 1$

holds of the entire maximal plural referent (hence the diverse-subpart reading). In contrast, to avoid ignorance requirements for plural EFRCs, Lauer 2009: 26-27 hypothesizes that they are exempt from the requirements of singular EFRCs, not predicting any implication about diverse subparts. Additionally, this work is able to provide a unified explanation for the parallel readings of *know whether* sentences and EFRCs without assigning *whether*-interrogatives postsuppositional requirements; the MP-based account predicts that similar effects arise when alternative-evoking expressions are integrated into presuppositional expressions, whereas Lauer's does not predict such a correlation.

3.3.3 Problems with counterfactuality

Since von Fintel 2000, counterfactuality has been assumed to play a role in deriving indifference readings. According to von Fintel 2000: 33 (final Analysis-I), EFRCs have the denotation in (115), inspired by Dayal 1997. The presupposition of an EFRC involves quantification over the worlds in the modal base that most closely resemble the world of evaluation but in which the restrictor of the EFRC denotes a different entity; in all of these worlds, the main predication of the sentence is true.

(115)   For any world w, any modal base F_{st}, and any properties $P_{\langle s,et \rangle}, Q_{\langle s,et \rangle}$:
$[\![\text{whatever}]\!]^c(w)(F)(P)(Q)$ is defined only if
$\forall w' \in \text{MIN}_w(F \cap \{w'': \iota x[P(w'')(x)] \neq \iota x[P(w)(x)]\}): Q(w')(\iota x[P(w')(x)])$
When defined, $[\![\text{whatever}]\!]^{g,c}(w)(F)(P)(Q) = 1$ iff $Q(w)(\iota x[P(w)(x)])$

Indifference readings arise when context supplies the extension of a counterfactual modal base as the value for F[8]. An EFRC-sentence carries the presupposition that a change to the identity of the EFRC's referent would not affect the truth of the sentence. For example, *Sue grabbed whatever tool was in the toolbox* presupposes that if the tool in the toolbox had been something else, Sue would've grabbed that.

   As pointed out before, indifference readings are only available with certain predicates. Without further elaboration, this does not follow from Analysis-I. For example, consider (116), which makes a counterfactual modal base salient but where the EFRC is an argument to a non-agentive predicate. The EFRC is unacceptable.

(116)   *Context: The tool Sue bought at the store today is this hammer. She wanted a screwdriver and would have bought one if she'd had more money. When she got home, she put the hammer where she puts all of her tools.*
       #This toolbox contains whatever tool Sue bought at the store today

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8 Under this version of the meaning of the EFRC, ignorance arises when F is epistemic; non-rigidity across F, which is what Analysis-N required, is derived by assuming that MIN is a partial function, applying only to non-empty sets, thus $F \cap \{w'': \iota x[P(w'')(x)] \neq \iota x[P(w)(x)]\}$ has to be non-empty.

A counterfactual modal base in which the EFRC denotes something else is salient; in counterfactual worlds where Sue has more money, she buys the screwdriver. Furthermore, the predicted presupposition (that the toolbox would contain the screwdriver if Sue had bought it) is satisfied by the information that all of her tools go in the box. The unacceptability of (116) is unexpected. On the other hand, the current analysis relates indifference to agentive modal bases in the grammatical representation of the sentence. While determining which verbs introduce this type of modality is beyond the scope of this work, the prediction of the analysis is that the availability of an indifference reading is conditioned by the choice of verb. Hence, it is not unexpected that *contain* does not support an indifference reading while *grab* does.

The perspective on the data here differs from Tredinnick's (2005), who claims that certain EFRCs license *external indifference* readings; the label alludes to examples that license counterfactual inferences in the absence of an agent. Tredinnick 2005: 28 discusses the contrast in (117), claiming that *whatever* licenses an inference that in those days, if John had picked different numbers from the ones he actually did, they still would have won.

(117)   In those days, {every, whatever} lottery number John picked won

This work attributes the availability of such inferences to the presence of a generic operator, as suggested by *in those days*, rather than the EFRC itself. Independently of EFRCs, certain generics are known to license counterfactuality, as in examples like *Sally handles the mail from Antarctica*, which can be used to describe an 'unfulfilled office function' (Carlson 1995) i.e., a situation in which there isn't actually mail from Antarctica but in which, if there were, it would be handled by Sally. In support of the view that counterfactuality is a result of genericity rather than the EFRC, if *in those days* is replaced with *this morning* and it is understood that only one lottery number can be picked per day, the EFRC in (117) licenses only ignorance and has no reading that implies that a different choice of lottery number this morning would still have led to a win. The current analysis predicts that the only inferences licensed by the use of an EFRC in (117) is that the lottery numbers differed in their properties across generic situations. This view on the data is supported by the acceptability of (118) in the context in (118a) but not in (118b).

(118)   Whatever lottery number he picked won
          a.   *Context: In those days, John always picked either 3 or 4*
          b.   *Context: In those days, John always picked 3*

Further, note that a specification of the properties with respect to which the numbers varied, as in (118a), makes counterfactual inferences much less robust. (118) in (118a) can be felicitously be followed with a statement that if he had picked different

numbers, they would not have won, further supporting the conclusion that the EFRC in (118) does not obligatorily produce counterfactual inferences.

4 Conclusion

This work generally provided a uniform analysis for the contextual requirements of *know whether* sentences and EFRCs. Both carry implications (depending on the grammatical environment they appear in) that are a consequence of their evoking equally informative alternatives with stronger presuppositions. It is worth pointing out a few of the differences in the treatments of the two constructions. While comparison with such alternatives is part of the grammatical meaning of EFRCs (as a result of their containing *-ever*), *whether*-interrogatives are only compared to declaratives denoting their possible answers if such alternatives are contextually salient. This assumption provides a possible explanation for variable judgments about *know whether*, which do not seem to be present with EFRCs. Additionally, more readings were identified for EFRCs than for *know whether* sentences; for example, there was no corresponding indifference reading of *know whether* sentences. Under the current proposal, this can be explained with the additional assumption that agentive modal bases tend not to be part of the meaning of attitude predicates like *know, saw, discover* (though this work offers no principled reason why).

In general, this work extended MP to new empirical domains. It argued that a pragmatic analysis of EFRCs provides better empirical coverage for the readings they exhibit than an analysis that encodes variation as a grammatical component of EFRCs' meaning.

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