A compositional semantics for *wh-ever* free relatives[1]

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Abstract. This paper focuses on two puzzles posed by *wh-ever* free relatives ('FRs'): *wh-ever* FRs (a) license ignorance inferences, and (b) display properties in common with questions. I propose to resolve these puzzles by unifying the analysis of *wh-ever* FRs with Rawlins' (2008, 2013) analysis of unconditionals. The proposal derives ignorance, predicts question properties, and captures both the similarities and differences between *wh-ever* FRs and unconditionals.

Keywords: *wh-ever* free relatives, unconditionals, ignorance inferences

1. Introduction

This paper is concerned with the analysis of *wh-ever* FRs, as in (1). Following e.g. Jacobson (1995), a common approach is to analyze FRs as definite descriptions. This is illustrated in (2) with an FR without *ever*. *What Mary cooked* in (2a) has the same denotation as *the thing Mary cooked*, (2b). Extending this approach without modification to FRs with *ever*, however, leaves certain properties unexplained. This paper focuses on two puzzles.

(1) John ate **whatever Mary cooked**.

(2) a. John ate **what Mary cooked**.
b. ⟦what Mary cooked⟧(w) = ιx [Mary cooked x in w]

1.1. Puzzle 1: Ignorance

Wh-ever FRs obligatorily license modal inferences of ignorance or indifference, illustrated in (3) with data from von Fintel (2000) (see also e.g. Dayal 1997, Iatridou & Varlakosta 1996, Tredinnick 2005, Lauer 2009, Condoravdi 2015).

(3) a. Whatever Arlo is cooking has a lot of garlic. (ignorance)
b. I simply voted for whoever was at the top of the ballot. (indifference)

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The example in (3a) most naturally conveys that the speaker is ignorant about the identity of the thing(s) Arlo is cooking. (3b) does not require that the speaker be ignorant about the identity of the person they voted for, but rather conveys that the speaker voted for the person at the top of the ballot indiscriminately, indifferent to the identity of that person. I will focus on the ignorance reading and ask: how is ignorance derived? One approach in the literature localizes ignorance in the lexical semantics of *whatever*. Re-formulating Dayal (1997), von Fintel (2000) adopts the denotation for *whatever* in (4):

(4) ***Whatever(w)(F)(p)* presupposes (a), asserts (b)**

a. $\exists$w' $\exists$w'' $\in$ F(w): ιx [P(w')(x)] $\neq$ ιx [P(w'')(x)]

b. ιx [P(w)(x)]

Whatever is a definite determiner, which triggers a modal presupposition. The presupposition says that a different entity is picked out by the definite description in at least two worlds in the modal base. With an epistemic modal base, this yields ignorance: (1) presupposes that Mary cooked different things in different epistemically accessible worlds and asserts that John ate the thing(s) Mary cooked in the evaluation world. My goal will be to provide an alternative account of ignorance which avoids construction-specific stipulation.

1.2. Puzzle 2: question-like properties

Wh-ever FRs display a cluster of properties in common with matrix questions (Richardson 1995, Gawron 2001, Rawlins 2010). Each of (5)-(8) constitutes a paradigm where (a) is a matrix question, (b) contains a definite description with a relative clause, and (c) contains a *wh-ever* FR. (a) and (c) pattern together to the exclusion of (b). An account of *wh-ever* FRs must resolve the question: why do *wh-ever* FRs display question-like properties?

(5) **Interrogative morphology**

a. **What** did John eat?

b. *John ate the food **what** Mary cooked?

c. John ate **what** Mary cooked.

(6) ***Ever***

a. What**ever** did John eat?

b. *John ate the food which**ever** Mary cooked.

c. John ate what**ever** Mary cooked.

(7) ***The hell***

a. What **the hell** did John eat?
b. *John ate the food what **the hell** Mary coked.
c. John ate whatever **the hell** Mary cooked.

(8) ***Else***

a. What **else** did John eat?
b. *John ate the food which **else** Mary cooked.
c. John ate whatever **else** Mary cooked.

1.3. Strategy for the present paper

My strategy to resolve the two puzzles will be to extend insights from the literature on unconditionals to the analysis of *wh-ever* FRs. In *wh-ever* FRs, a *wh-ever* XP occurs in argument position, as in (1), repeated in (9a). In unconditionals, a *wh-ever* XP appears as a free adjunct, (9b).

(9) a. John ate **whatever Mary cooked**. *(wh-ever FR)*
b. **Whatever Mary cooked**, John had fun. *(unconditional)*

Building on Rawlins' (2008, 2013) analysis of unconditionals, I will propose that the LF for *wh-ever* FRs has three ingredients: a question, a covert modal, and a definite description. The question and modal interact to derive ignorance (Puzzle 1), and question-like properties follow from the presence of a question in the LF (Puzzle 2). Motivation for the analysis will be provided.

2. Unconditionals

The two puzzles posed by *wh-ever* FRs — ignorance and question-like properties — similarly arise with unconditionals. An episodic unconditional like (9b) naturally conveys that Mary is ignorant about the identity of the thing(s) Mary cooked. The question-like properties in (5)-(8) also replicate in this and similar examples:

(10) a. **What**ever Mary cooked, John had fun. *(interrogative morphology)*
b. What**ever** Mary cooked John had fun. *(ever)*
c. Whatever **the hell** John did, Mary will forgive him. *(the hell)*
d. Whatever **else** John did, Mary will forgive him. *(else)*

Despite the parallels between *wh-ever* FRs and unconditionals, the two constructions have received quite different analyses. I spell out the analysis of unconditionals in Rawlins (2008, 2013). This analysis solves the two puzzles for unconditionals and, accordingly, serves as a useful starting point for an analysis of *wh-ever* FRs.

2.1. Rawlins (2008, 2013)

Rawlins pursues the intuition that (9b) analyzes as a conjunction of conditionals of the form in (11a), as in (11b). The analysis is spelled out in steps.[2]

(11) a. If Mary cooked x, John had fun.
b. If Mary cooked **pizza**, John had fun, and if Mary cooked **pasta** John had fun, ...

Step 1: the *wh-ever* XP is a Hamblin question. Rawlins analyzes *whatever Mary cooked* as an interrogative CP, which denotes a set of propositions of the form λw . *Mary cooked x in w*, following Hamblin (1973).[3]

(12) ⟦whatever Mary cooked⟧
a. $= \lambda p_{st}.\ \exists x\ [p = \lambda w\ .$ Mary cooked x in w]
b. $\{\lambda w.$ Mary cooked **pasta** in w, $\lambda w.$ Mary cooked **pizza** in w, ... $\}$

Step 2: the unconditional is a conditional. The second piece of Rawlins' analysis is to unify unconditionals with indicative conditionals like (13). After Lewis (1975), Kratzer (1977), and Heim (1982), the *if*-clause in (13) provides the restrictor for a covert necessity modal. The LF is (14a), with the modal defined as in (14b). The modal quantifies over worlds accessible from the world of evaluation according to some contextually provided accessibility function, F_c.

(13) If Mary cooked pasta, John had fun.

(14) a. [[□ Mary cooked pasta] John had fun]
b. $[\![\Box]\!]^c = \lambda p_{st}.\ \lambda q_{st}.\ \lambda w.\ \forall w' \in F_c(w)\ [p(w') \rightarrow q(w')]$ *(type <st,<st,st>>)*

[2] I have made some simplifications and notational modifications to accommodate space restrictions; for further details, I refer the reader to Rawlins (2013, §§2-3).

[3] For Hamblin, every node denotes a set and a question denotes a set of propositions. Composition principles, including Pointwise Functional Application (employed below), are then defined in such a way as to allow two sets to compose. To facilitate exposition, notation and prose in this paper will make a simplification and treat the characteristic function for a set as interchangeable with the set characterized. (12a) provides the characteristic function for a set of propositions. For relevant further discussion, see e.g. Rawlins (2008; Appendix 3-A).

The restrictor argument for the modal in (14a) is provided by *Mary cooked pasta* and the scope is provided by *John had fun*. The predicted meaning is (15):

(15) $[\![\Box]\!]^c(\lambda$w. Mary cooked pasta in w)(λw. John had fun in w)
= λw. $\forall$w' $\in F_c$(w) [Mary cooked pasta in w' $\rightarrow$ John had fun in w']

Rawlins proposes that the LF for an unconditional like (9b) similarly contains a covert necessity modal. The *wh-ever* CP provides the restrictor of the modal, per the structure in (16).

(16) **LF for (1):** [[$\Box$ whatever Mary cooked] John had fun]

Step 3: the *wh-ever* CP pointwise restricts the modal. Recall from (12) that *whatever Mary cooked* denotes a set of propositions of the form λ *w* . *Mary cooked x in w*. Recall from (14b) that the modal requires a proposition as its restrictor argument. *Whatever Mary cooked* and the modal compose via Pointwise Functional Application (e.g. Hamblin 1973, Kratzer & Shimoyama 2002): each proposition in the set in (12) is taken as the restrictor of the modal in (14b) to derive:

(17) $[\![\Box$ whatever Mary cooked$]\!]^c$

a. $= \lambda P_{<st,st>}$. $\exists$x [P = λq_{st}. λw. $\forall$w' $\in F_c$(w) [Mary cooked x in w' $\rightarrow$ q(w')]]

b. {λq_{st}. λw. $\forall$w' $\in F_c$(w) [Mary cooked **pasta** in w' $\rightarrow$ q(w')],
λq_{st}. λw. $\forall$w' $\in F_c$(w) [Mary cooked **pizza** in w' $\rightarrow$ q(w')], ... }

The proposition provided by *John had fun* is then taken pointwise as the argument of each element of (17) to deliver (18). Each element of (18) is a modalized proposition. Given that conditionals are just modalized propositions, each is a conditional, as in the idiomatic re-formulation in (19).

(18) $[\![\Box$ whatever Mary cooked John had fun$]\!]^c$

a. $= \lambda p_{st}$. $\exists$x [p = λw . $\forall$w' $\in F_c$(w) [Mary cooked x in w' $\rightarrow$ John had fun in w']]

b. {λw. $\forall$w' $\in F_c$(w) [Mary cooked **pasta** in w' $\rightarrow$ John had fun in w'],
λw. $\forall$w' $\in F_c$(w) [Mary cooked **pizza** in w' $\rightarrow$ John had fun in w'], ... }

(19) {if Mary cooked **pasta**, John had fun, if Mary cooked **pizza**, John had fun, ...}

Step 4: converting to a single proposition. Since (9b) does not intuitively denote a set of propositions, but rather a single proposition, an additional operator is necessary. Rawlins adopts an operator which takes a set of propositions as its argument and asserts that every proposition in that

set is true. I will refer to this operator as 'Op'. The updated LF for (9b) is (21), in which Op takes highest scope. Op applies to the set of propositions in (18) to deliver the final meaning for (9b) in (22) — in effect, a conjunction of conditionals of the form *if Mary cooked x, John had fun*.

(20) $[\![\text{Op}]\!] = \lambda P_{<st,t>}.\ \lambda w.\ \forall p\ [P(p) \rightarrow p(w)]$

(21) **Updated LF for (1):** [Op [[□ whatever Mary cooked] John had fun]]

(22) $[\![(9b)]\!]^c$

a. $= \lambda w.\ \forall p\ [\exists x\ [p = \lambda w'.\ \forall w'' \in F_c(w')\ [\text{Mary cooked x in w''} \rightarrow \text{John had fun in w''}]] \rightarrow p(w)]$

b. $= \lambda w.\ \forall w' \in F_c(w)\ [\text{Mary cooked } \textbf{pasta} \text{ in w'} \rightarrow \text{John had fun in w'}]\ \&$
$\forall w' \in F_c(w)\ [\text{Mary cooked } \textbf{pizza} \text{ in w'} \rightarrow \text{John had fun in w'}]\ \&\ ...$

2.2. Resolving the puzzles

Rawlins' analysis resolves for unconditionals the two central puzzles of concern in this paper. Because the *wh-ever* XP is a question, it is unsurprising that the *wh-ever* XP displays question-like properties. Regarding ignorance, the analysis makes it possible to derive ignorance without construction-specific stipulation, but this requires more demonstration.

2.2.1. Deriving ignorance

Rawlins makes two assumptions which together provide the necessary pieces to derive ignorance. First: an assumption about the elements of the set provided by the *wh-ever* CP. Rawlins assumes that the propositions in the set are presupposed to be mutually exclusive relative to the context set: at any given world in the context set, at most one proposition holds. For exposition, I will indicate this by modifying the set shown in (12) above for *whatever Mary cooked* as in (23):

(23) $[\![\text{whatever Mary cooked}]\!]$

a. $\approx \{\lambda w$. Mary cooked only **pasta** in w,
b. λw . Mary cooked only **pizza** in w),
c. ...$\}$

Each alternative is interpreted exhaustively: (23a) says that Mary cooked *only* pasta; (23b) says that Mary cooked *only* pizza; and so forth. The propositions are mutually exclusive.

The second assumptions has to do with the modal. Rawlins assumes that the modal is subject to a non-triviality presupposition, which requires that there be some world in the modal base at

which the restrictor argument is true. Where $F_c(w)$ is the modal base and p is the set of world characterized by the restrictor argument, the non-triviality presupposition may be stated:

(24) **Non-triviality presupposition**
$F_c(w) \cap p \neq \emptyset$

The only addition needed to derive ignorance is one other assumption about the modal: that the modal base is epistemic. $F_c(w)$ is the set of worlds compatible with the speaker's beliefs at the evaluation world, (25). With an epistemic modal base, the non-triviality presupposition requires that p be true at some epistemically accessible world.

(25) **Epistemic modal base**
$F_c(w) = \{w' : w' \text{ is compatible with the speaker's beliefs in } w\}$

The critical point in the computation for the derivation of ignorance is Step 3, where the *wh-ever* CP composes with the modal. Each proposition in the set provided by *whatever Mary cooked* — i.e. (23) — is taken pointwise as the restrictor argument of the modal. This interacts with the non-triviality presupposition in such a way as to derive the overall presupposition for (9b) in (26).

(26) **Predicted presupposition of (9b)**

a. $F_c(w) \cap \{w' : \text{Mary cooked only } \textbf{pasta} \text{ in } w'\} \neq \emptyset$

b. & $F_c(w) \cap \{w' : \text{Mary cooked only } \textbf{pizza} \text{ in } w'\} \neq \emptyset$

c. & ...

Taking (23a) as the restrictor of the modal triggers a presupposition that Mary cooked only pasta at some epistemically accessible world, (26a); taking (23b) as the restrictor triggers a presupposition that Mary cooked only pizza at some epistemically accessible world, (26b); and so forth. I take it that each of these triggered presuppositions projects.

Let us focus on the presuppositions in (26a) and (26b): it is epistemically possible that Mary cooked only pasta, and it is epistemically possible that Mary cooked only pizza. How can this conjunctive presupposition be satisfied? The only way is for the speaker to be ignorant about the identity of the thing Mary cooked: given the speaker's beliefs, it must be a live possibility that the thing Mary cooked is pasta, and a live possibility that the thing Mary cooked is pizza. The ignorance inference in (9b) straightforwardly obtains.

2.3. Summary

This section has presented Rawlins' analysis of unconditionals, and demonstrated that this analysis can resolve our two central puzzles for *wh-ever* constructions: ignorance, and question-like properties. The goal now is to extend Rawlins' analysis for unconditionals to *wh-ever* FRs.

3. Extending to *wh-ever* FRs

3.1. Bridging from unconditionals to *wh-ever* FRs

As a first step towards extending to *wh-ever* FRs, consider the unconditional in (27a), which has a parallel interpretation to the *wh-ever* FR in (1), repeated as (27b). In (27a), there is a pronoun in argument position whose interpretation intuitively co-varies with that of the *wh-ever* XP.

(27) a. Whatever Mary cooked, John ate it.
b. John ate whatever Mary cooked. *=(1)*

A natural hypothesis for (27a) would analyze *it* as an individual variable bound by *whatever Mary cooked*. This is not, however, consistent with Rawlins' approach: *whatever Mary cooked* denotes a set of propositions, so is not of the right type to bind an individual variable. Rather, the correct meaning is predicted for (27a) in a way consistent with Rawlins' analysis if *it* is analyzed not as a bound variable, but as an E-type pronoun with the denotation in (28). The Rawlins-style LF for (27a) is (29), and (27a) is interpreted as the conjunction of conditionals in (30).

(28) ***It* = E-type pronoun:** $[\![\text{it}]\!](w) = \iota x$ [Mary cooked x in w]

(29) **LF for (27a):** [[□ whatever Mary cooked] John ate ιy [Mary cooked y in w']]

(30) $\lambda p.\ \exists x\ [p = \forall w' \in F_c(w)$ [Mary cooked only x in w' $\rightarrow$ John ate ιy [Mary cooked y in w']]]

The world variable in the E-type pronoun is bound by the modal in (30). Because the modal has a different restrictor in each conditional in the set characterized, it follows that the referent of the E-type pronoun varies between the conditionals. Consider the idiomatic paraphrase of (27a):

(31) a. If Mary cooked only **pasta** in w', Mary ate the thing(s) Mary cooked in w',
b. & if Mary cooked only **pizza** in w', Mary ate the thing(s) Mary cooked in w',
c. & ...

The conditional in (31a) says: in all accessible w' at which Mary cooked only pasta, John ate the thing(s) Mary cooked at w' — i.e. the E-type pronoun refers to pasta. (31b) says: in all accessible w' at which Mary cooked only pizza, John ate the things that Mary cooked at w' — i.e. the E-type pronoun refers to pizza. In this way, the correct interpretation obtains: (27a) says that for every *x*, in all accessible worlds at which Mary cooked only *x*, John ate *x*.

Given the intuitive parallel between (1) and (27a), I will pursue the hypothesis that *wh-ever* FRs like (1) and unconditionals like (27a) have a uniform analysis ('Unification Hypothesis').

3.2. Extending to *wh-ever* FRs

The empirical focus now shifts to (1) itself (*John ate whatever Mary cooked*). At first, the Unification Hypothesis appears to be a non-starter. Since a *wh-ever* XP denotes a set of propositions in Rawlins' analysis and *ate* requires an individual first argument, (1) should be uninterpretable due to a type-mismatch. *Whatever Mary cooked* has the denotation in (32a) and *ate* has the denotation in (32b), and these cannot compose, (32c).

(32) **Type-mismatch in (1)**

a. $[\![\text{whatever Mary cooked}]\!] = \lambda p_{st}.\ \exists x\ [p = \lambda w.\ \text{Mary cooked x in w}]$ *(<st,t>)*

b. $[\![\text{ate}]\!] = \lambda x.\ \lambda y.\ \lambda w.\ \text{y ate x in w}$ *(<e,<e,st>>)*

c. $[\![\text{ate}]\!]([\![\text{whatever Mary cooked}]\!])$ *Type-mismatch!*

Hence, the basic compositional challenge: how can the *wh-ever* XP in (1) be interpreted as restricting a covert modal, and how can there be a definite description in argument position equivalent to E-type *it* in (27a)?

Step 1: Spelling out the internal composition of questions. We have taken an interrogative like *whatever Mary cooked* itself to denote a set of propositions. I will now revise this assumption: an interrogative CP does not denote a set of propositions, but rather a property (e.g. Groenendijk & Stokhof 1989, Jacobson 1995, Caponigro 2004, Rawlins 2010, George 2011). Consider (33a), with the structure in (33b):

(33) **LF for an interrogative CP**

a. What did Mary cook?

b. $[_{CP}$ what $[_{TP}\ \lambda 1$ Mary cooked $t_1]]$

Following Caponigro (2004), *what* has the property meaning in (34a). *What* composes with the derived property in (34b) via Predicate Modification to yield the property meaning for the inter-

rogative CP in (34c): an individual is mapped to the proposition that that individual is inanimate and Mary cooked that individual. To facilitate discussion, I will simplify (34c) as (34d).

(34) a. $[\![\text{what}]\!] = \lambda x.\ \lambda w.$ x is inanimate in w *(<e,st>)*

b. $[\![\text{TP}]\!] = \lambda x.\ \lambda w.$ Mary cooked x in w *(<e,st>)*

c. $[\![\text{CP}]\!] = \lambda x.\ \lambda w.$ x is inanimate in w & Mary cooked x in w *(<e,st>)*

d. $\approx \lambda x.\ \lambda w.$ Mary cooked x in w

A covert Q morpheme is responsible for converting the property meaning in (34d) into a set of propositions (George 2011). Q is defined as in (35) and, as a component of its meaning, existentially closes the open individual argument slot in its input property. The updated LF for (33a) containing Q is shown in (36a); Q applies to the property in (34d) as shown in (36b).

(35) **Defining Q**

$[\![\text{Q}]\!] = \lambda f_{<e,st>}.\ \lambda p_{st}.\ \exists x\ [p = \lambda w.\ f(x)(w)]$

(36) **Incorporating Q into (33)**

a. $[_{QP}$ Q $[_{CP}$ what $[_{TP}\ \lambda 1$ Mary cooked $t_1]]]$

b. $[\![\text{QP}]\!] = [\![\text{Q}]\!]([\![\text{CP}]\!])$
$= \lambda p_{st}.\ \exists x\ [p = \lambda w.$ Mary cooked x in w$]$

Given these assumptions about the composition of a question, some housekeeping is needed for the LF for the unconditional in (27a). The revised LF is (37). The critical change: the sister of the modal is not a bare interrogative CP, but rather is now a QP, which embeds the interrogative CP.[4]

(37) **Updated LF for (27a):**

[[$\Box$ $[_{QP}$ Q $[_{CP}$ whatever Mary cooked]]] John ate ιy [Mary cooked y in w']][5]

[4]As discussed in fn. 3, I have treated a set of propositions as interchangeable with its characteristic function to facilitate exposition. If the two are kept separate and Pointwise Functional Application is defined as an operation between two sets (as in Hamblin 1973), in order for the QP to pointwise compose with the modal, the QP must denote the set characterized in (36b). In Hamblin's framework where every node denotes a set, the composition advocated here could be implemented as follows to output a set. Differing from Hamblin's own internal composition of a question, $[\![\textit{what}]\!] = \{\lambda x\ .\ \lambda w\ .$ x is inanimate in w$\}$, which composes with $\{\lambda x\ .\ \lambda w\ .$ Mary cooked x in w$\}$ via Predicate Modification to derive $[\![\text{QP}]\!] = \{\lambda x\ .\ \lambda w\ .$ x is inanimate in w & Mary cooked x in w$\} \approx \{\lambda x\ .\ \lambda w\ .$ Mary cooked x in w$\}$. Q would then be defined syncategorematically: the sister of Q must be a singleton set α containing a property — schematically, $\alpha = \{f_{est}\}$ — and $[\![\text{Q}\alpha]\!] = \{p : \exists x\ [p = f(x)]\}$. As such, $[\![\text{QP}]\!] = \{p : \exists x\ [p = \lambda w.$ Mary cooked x in w$]\}$, the set characterized in (36b).

[5]Although I indicate *ever* within the interrogative CP, I in fact remain agnostic as to whether *ever* and other operators characteristic of questions like *the hell* and *else* operate within the interrogative CP or operate on the QP.

Step 2: questions and definite descriptions have a common core. Given the analysis of questions just presented, questions and definite descriptions are compositionally quite similar: each involves an operator being applied to a property (cf. Jacobson 1995, Caponigro 2004). This is brought out in directly comparing (38) with (39):

(38) **Question: apply Q to a property**

a. What did Mary cook?

b. $[\![Q]\!](\lambda x.\ \lambda w.$ Mary cooked x in w)
$= \lambda p_{st}.\ \exists x\ [p = \lambda w.$ Mary cooked x in w]

(39) **Definite description: apply *the* to a property**

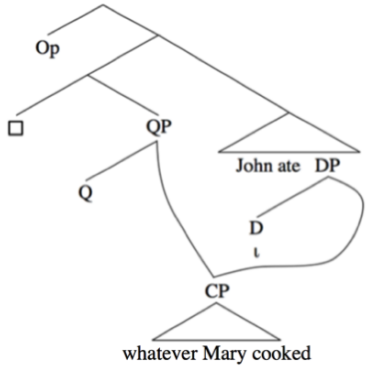
a. the (thing) Mary cooked

b. $[\![the]\!](\lambda x.\ \lambda w.$ Mary cooked x in w)(w)
$= \iota x$ [Mary cooked x in w]

In (38), Q applies to a property to derive a set of propositions; in (39), *the* applies to that same property to derive a definite description.

Step 3: building the LF for (1). The key proposal is that, in *wh-ever* FRs, the property contributed by the *wh-ever* CP forms *both* the core of a question, and the core of a definite description. There are different ways the proposal can be modeled, but I will opt for a syntactic structure involving multi-dominance, which offers a particularly intuitive illustration.[6] The structure for (1) is (40):

(40) **Structure for (1)**



The interrogative CP *whatever Mary cooked* is multiply dominated; in effect, it occurs in two positions. It is dominated by a QP in the restrictor position of the modal, and by a DP in argument

[6]The proposal could also be modeled with a movement derivation, rather than multi-dominance. Space restrictions preclude discussion.

position. In the QP, the sister of *whatever Mary cooked* is the covert Q morpheme, which converts the property meaning to a set of propositions, as in (38) above. In the DP, the sister of *whatever Mary cooked* is a covert definite determiner (ι), which converts the same property meaning to a definite description, as in (39).[7]

Unification is achieved. The LF for the *wh-ever* FR (1) in (40) is parallel to the LF for the unconditional (27a) in (37). In each case, a modal is pointwise restricted by a set of propositions provided by *[Q whatever Mary cooked]* and, in argument position, there is a definite description ιx *[Mary cooked x in w']*. The only difference between (27a) and (1) is in how the definite description comes about. In (27a), *whatever Mary cooked* is just the sister of Q in the restrictor of the modal, and the definite description is contributed by E-type *it*. In (1), *whatever Mary cooked* is the sister of Q, but also is itself definitized in argument position. Two issues require further comment.

3.2.1. Pronouncing (40)

How does the structure in (40) correspond to the pronounced string in (1)? I take it that the multiply dominated constituent, *whatever Mary cooked*, is spelled out just once, in its rightmost position. This is consistent with other constructions which have been analyzed with multi-dominance, as illustrated in (41) with Right Node Raising[8]:

(41) John likes and Mary hates [the Scottish play].

According to multi-dominance analyses of (41), a single occurrence of *the Scottish play* is both the sister of *likes* in the left conjunct and the sister of *hates* in the right conjunct (e.g. Wilder 1999, Bachrach & Katzir 2009). *The Scottish play* is pronounced once, in its rightmost position.

3.2.2. Existence presupposition

An aspect of the meaning of *wh-ever* FRs which I have thus far not discussed is that they trigger an existence presupposition: (1) presupposes that Mary cooked something at the actual world. This is brought out in (42): the *although*-clause in (42) denies that Mary cooked anything and the sentence is degraded.

(42) #Although it's possible that Mary didn't cook anything, **John ate whatever Mary cooked**.

[7]The structure in argument position is similar to that proposed for FRs without *ever* in Caponigro (2002), where he takes the *wh* XP to be a CP embedded by a covert D. The external syntax of *what(ever) Mary cooked* is that of a DP, consistent with the presence of the DP layer. A further issue concerns the "matching" effect that the external syntactic category of an FR matches that of the *wh* word within the FR. See Caponigro (2002) for an approach.

[8]See also Johnson (2010), Johnson & Fox (2015) on Quantifier Raising.

It has been argued that matrix *wh*-questions also carry an existence presupposition: the question *What did Mary cook?* presupposes that Mary cooked something. (43) is adapted from Postal (1971) (see also e.g. Karttunen & Peters 1976, Comorovski 1996):

(43) #Although it's possible that Mary didn't cook anything, **what did Mary cook?**

Since the LF for (1) contains the question *[Q whatever Mary cooked]*, the existence presupposition in (1) comes about in a similar way to the existence presupposition of the corresponding matrix *wh*-question: it is presupposed that some proposition of the form λw . *Mary cooked x in w* in the set provided by the question is true at the actual world. I remain agnostic about the compositional source of this presupposition, except to note that the issue in *wh-ever* FRs reduces to the same issue in matrix *wh*-questions.[9]

3.3. Summary

This section has developed a proposal extending Rawlins' analysis of unconditionals to *wh-ever* FRs. The *wh-ever* CP denotes a property. That property does double duty, forming both the core of a question, and the core of a definite description. The question pointwise restricts a covert modal, and the definite description occurs in argument position. I provided one way to model the proposal, using a multi-dominance structure. I now demonstrate how the proposal offers a perspective on a range of further data.

4. Prediction #1: Asymmetries between unconditionals and *wh-ever* FRs

There is apparent counter-evidence to the hypothesis that unconditionals and *wh-ever* FRs have a uniform analysis. I will focus on one asymmetry: multiple *wh* constructions are acceptable in unconditionals, but not in *wh-ever* FRs. This is illustrated in (44), with an example discussed in Rawlins (2013:150) (see also e.g. Izvorski 2000, Gawron 2001, Grosu 2003, Rawlins 2013, i.a.).

(44) **Multiple *wh*: unconditional (a) vs. *wh-ever* FR (b)**

a. (?)Whoever said what to whom, we've got to put this behind us.[10]

b. *John talked to whoever said what to whom.

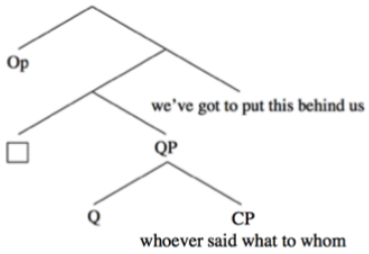
The observed asymmetry in fact follows as a prediction of the proposal. Despite the Unification Hypothesis, there is an important difference between the LF for an unconditional and the LF for a

[9]Rawlins observes a similar existence inference with unconditionals and encodes the existence requirement in a question operator.

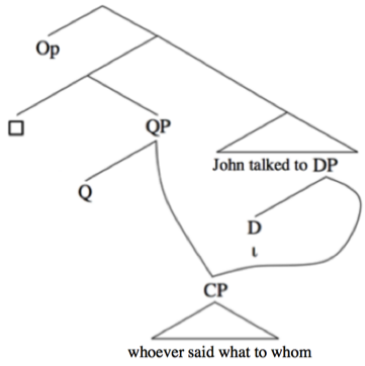
[10]The example is originally from Huddleston & Pullum (2002).

wh-ever FR. In an unconditional, the *wh-ever* CP itself is only the argument of the Q morpheme in the restrictor of the modal. In an argument *wh-ever* FR, the *wh-ever* CP is both the argument of Q and the argument of ι in argument position. The structures for (44a) and (44b) are (45) and (46), respectively:

(45) **Structure for (44a)**



(46) **Structure for (44b)**



It is clear from the existence of multiple *wh*-questions, like (47), that Q must be defined in such a way that it can compose with a multi-place predicate.

(47) a. Who said what to whom?

b. [$_{QP}$ Q [$_{CP}$ who said what to whom]]

The interrogative CP in (47) has three open individual arguments, as in (48a). Q must compose with the predicate in (48a) to deliver a set of propositions of the form λw . *x said y to z in w*. This means that Q must existentially close all of the unsaturated individual argument slots in its input predicate, as in (48b). George (2011) provides an analysis of Q which achieves this result.

(48) a. ⟦who said what to whom⟧ = λx. λy. λz. λw. x said y to z in w
b. ⟦Q⟧(⟦who said what to whom⟧) = λp. ∃x ∃y ∃z [p = λw. x said y to z in w]

Different from Q, the ι operator, like the overt definite determiner, can inflexibly combine only with a predicate with one unsaturated individual argument slot. The contrast between (44a) and (44b) now follows straightforwardly. The structure in (45) is interpretable, since *whoever said what to whom* is just the argument of Q. In (46), on the other hand, problems arise because *whoever said what to whom* is the argument of ι, as well as Q. *Whoever said what to whom* cannot compose with ι due to a type-mismatch: ι requires an <e,st> first argument, and *whoever said what to whom* is of type <e,<e,<e,st>>>. The type-mismatch renders (44b) ungrammatical.

5. Prediction #2: Variable binding

Consider the possibility of a variable binding relationship between a subject quantifier and a pronoun in an object *wh-ever* FR. The baseline is (49), where the subject is *no boy*, and the *wh-ever* FR does not contain a pronoun. This example is natural on an ignorance reading: (49) may convey that no boy ate the thing Mary cooked, with the speaker ignorant about the identity of that thing.

(49) No boy ate whatever Mary cooked.

The critical datum is (50), where *his* is inserted into the *wh-ever* FR and bound by *no boy*. Informants report (50) as deviant on an ignorance reading: (50) cannot convey the conjunction of (51a) and (51b). To bring this out, suppose the speaker knows that a party happened last night where every boy's mother brought a dish and the speaker knows that no boy ate his mother's dish, but the speaker is uncertain about the identity of the dishes. (50) does not seem a natural utterance.[11]

(50) No boy_1 ate whatever his_1 mother cooked. (* on ignorance reading)

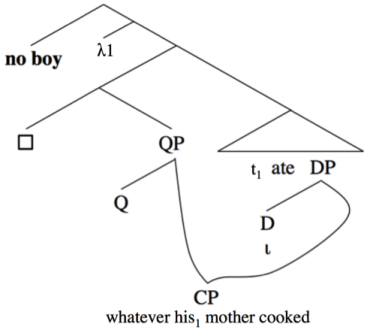
(51) a. For no boy *x* did *x* eat the thing *x*'s mother cooked.
b. For every boy *x*, the speaker is ignorant about what *x*'s mother cooked.

The deviance of (50) is predicted under the present proposal, and the bearing out of this prediction provides evidence for the posited covert epistemic necessity modal. The derivation for (50) is illustrated in (52). For *no boy* to bind *his* in the CP, *no boy* must c-command the CP in both positions where it occurs. From subject position, *no boy* c-commands the CP in its position sister

[11] Note that some informants report variable binding to be improved if *no* is replaced by *every*, as in: *Every* boy_1 *ate whatever* his_1 *mother cooked.* One possibility is that the example with *every* involves telescoping, rather than variable binding — but further work is needed to verify that the proposal made here for (50) fully generalizes.

to D, but not in its position sister to Q. *No boy* must move to a position where it c-commands the QP, which means undergoing QR to a position above the modal. The structure in (52) shows the output of this QR. In (52), *no boy* is above the modal and binds both *his* and its trace left in subject position.

(52) **Structure for (50)**



Given that the modal is epistemic on an ignorance reading, the configuration in (52) is in violation of the Epistemic Containment Principle, from von Fintel & Iatridou (2003):[12]

(53) **Epistemic Containment Principle ('ECP')**
A quantifier cannot bind its trace across an epistemic modal.

No boy in (52) is above the modal and its trace is below the modal, so the ECP is violated. The ungrammaticality of (50) follows from the violation of the ECP.[13]

Under an approach to *wh-ever* FRs like that in von Fintel (2000) (cf. (4) in §1.1), it is difficult to see why (50) would be deviant. Recall that von Fintel analyzes *whatever* as a definite determiner and localizes modality in a presupposition of *whatever*. The LF for (50) on this analysis would be:

(54) **LF for (50) by von Fintel (2000):** [no boy $\lambda 1$ ate [whatever his$_1$ mother cooked]]

[12] In moving above the modal, *no boy* moves across *his* as it occurs within the QP sister to the modal, so binding in (50) would be in violation of Weak Crossover, as well.

[13] Note that the effect in (50) is restricted to ignorance. (50) can acceptably convey that the no child ate the thing that his mother cooked, indifferent to its identity. This is brought out in: *No child (simply) ate whatever his mother cooked. They demanded good food.* The asymmetry between ignorance and indifference seems consistent with the proposal. To derive the indifference reading, the modal would have a counterfactual, rather than epistemic modal base. The ECP would not apply, and counterfactual modals may be lower in the structure than epistemic modals, so Weak Crossover may not be violated. That said, I leave a proper treatment of indifference to future research.

Whatever his mother cooked is a definite description, so is interpretable as the complement of *ate*, and *no boy* binds *his* from subject position. Since modality is introduced as a presupposition of *whatever*, within the complement of *ate*, *no boy* clearly does not bind a trace across an epistemic modal, and no ECP violation is incurred.

6. Conclusion and outlook

This paper has proposed to extend Rawlins' (2008, 2013) analysis of unconditionals to *wh-ever* FRs (§3) and, in doing so, has accounted for our two central puzzles, as well as further properties:

- *Wh-ever* FRs give rise to ignorance inferences (Puzzle 1; §2.2.1).
- *Wh-ever* FRs display question-like properties (Puzzle 2; §2.2).
- *Wh-ever* FRs, unlike unconditionals, disallow multiple *wh* constructions (§4).
- Subject quantifiers cannot bind a pronoun in an object *wh-ever* FR with ignorance (§5).

The present paper leaves a number of questions open for future research, two of which I flag. Question 1: how to derive indifference readings? In addition to the ignorance readings analyzed in this paper, *wh-ever* FRs allow indifference readings (recall ex. (3b)). Building on von Fintel (2000), indifference may involve counterfactual modality. This can be accommodated in the proposed framework by changing the modal base from epistemic, as assumed to derive ignorance, to counterfactual. This extension remains to be fully worked out. Question 2: how to capture cross-linguistic variation? To derive the meaning of a *wh-ever* FR, a property must do double duty, both forming the core of a question and the core of a definite description. How the property is built syntactically, however, is a potential locus of variation within and between languages. In English, I have taken the syntactic source for the property to be an interrogative CP. This is supported by the question-like properties observed above — as well as by (55a) and (55b): an overt complementizer *that* cannot intervene between *whatever* and the rest of the clause; and the rest of the clause cannot extrapose, stranding *whatever*. Interrogative CPs display the same properties, (56).

(55) a. *John ate whatever that Mary cooked.
b. *John ate whatever yesterday that Mary cooked.

(56) a. *Bill asked [what that John ate].
b. *Bill asked [what yesterday that John ate].

Languages employ a range of strategies to construct *ever* free relatives, however, and variation in the syntax of how the property is built may provide a useful starting point to approach this typology.

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