A Choice Function Analysis of *Either* in the *Either/or* Construction

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Abstract. In this paper, I propose an analysis that covers both the wide scope *or* reading of the *either/or* construction and the availability of Alternative Question and Yes/No Question readings, namely a hybrid of an ellipsis analysis and a choice function analysis of *either*. After presenting two sets of data, I introduce two hybrid analyses that combine an ellipsis analysis and a choice function analysis. The two differ from each other in terms of the item that introduces the choice function variable: in the first analysis, the disjunction particle *or* introduces the choice function variable while in the second analysis, *either* has that semantic role. It is demonstrated that the two analyses both account for the *either/or* construction data, whereas only the second hybrid analysis, in which *either* introduces the choice function variable, explains the Alternative Question and Yes/No Question data. Finally, I review another account proposed in previous research, namely the focus alternative semantics analysis, and point out its problems.

Keywords: *Either/or* construction · Alternative questions · Choice functions

1 The Data

As noted in [1] as a problematic case and discussed in [2] in more detail, when disjunction is combined with certain kinds of elements in a sentence the sentence is (at least) two-ways ambiguous:

(1) The department is looking for a phonologist or a phonetician. (cf. [1])
   a. ⟦look for⟧ (⟦a phonologist or a phonetician⟧) (d) (narrow scope)
   b. ⟦look for⟧ (⟦a phonologist⟧) (d) ∨ ⟦look for⟧ (⟦a phonetician⟧) (d) (wide scope)

There are two *de dicto* readings of *or* in relation to the intentional predicate. The narrow scope *or de dicto* reading is in (1a), and under this reading the department would be satisfied by finding either a phonologist or a phonetician. The "problematic"

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de dicto reading, which I am interested in, is described in (1b). On this reading, the department does not yet necessarily have a specific candidate in mind. They do already have in mind which of the two types of specialist they are going to look for, but the speaker forgot which it was. This reading becomes clearer when continued with "… but I don't know which." Thus, the overall meaning is as if the disjunction is connecting two propositions, taking widest scope, even though the indefinite in each disjunct takes narrow scope. This is called the "wide scope *or*" reading in [2].

[3] observes that the possible readings of a sentence change when *either* comes into the structure. He states a generalization:

(2) [3]'s generalization (from [4]):
   a. In *or* coordinations without *either*, as well as in *either…or…* coordinations with *either* undisplaced, the scope of *or* is confined to those positions where *either* can potentially appear.
   b. When *either* is displaced it specifies the scope of *or* to be at that displaced position.

(2a) is based on the assumption that the base position of *either* is next to the left edge of the Disjunction Phrase (DisjP). Thus, when *either* is adjacent to the DisjP all three readings are available (3), whereas when *either* floats to a higher position the narrow scope *or de dicto* reading disappears (4). Note that sentences with *either* floated higher than that in (4) behave in the same way as (4).

(3) Mary is looking for (either) a maid or a cook.
   a. ⟦look for⟧ (⟦a maid or a cook⟧) (m) (narrow scope)
   b. ⟦look for⟧ (⟦a maid⟧) (m) ∨ ⟦look for⟧ (⟦a cook⟧) (m) (wide scope)

(4) Mary is either looking for a maid or a cook.
   a. ∗?⟦look for⟧ (⟦a maid or a cook⟧) (m) (narrow scope)
   b. ⟦look for⟧ (⟦a maid⟧)(m) ∨ ⟦look for⟧ (⟦a cook⟧) (m) (wide scope)

[4] and [5] report data which at first glance look like an exception to [3]'s generalization, where disjunction can take wide scope over an island as in (5) but *either* cannot appear out of the island as in (6). In (5), *or* can take either narrow or wide scope with respect to *if*. Note that *either* can appear inside the island and the disjunction can take narrow or wide scope with respect to *if* as in (7). ((5) and (6) are taken from [4]).

(5) If Bill praises Mary or Sue then John will be happy.
   a. If Bill praises Mary then John will be happy and if Bill praises Sue then John will be happy. (narrow scope)
   b. If Bill praises Mary then John will be happy or if Bill praises Sue then John will be happy. (wide scope)

(6) *Either if Bill praises Mary or Sue then John will be happy.

(7) If Bill praises either Mary or Sue then John will be happy. (^{OK}NS/^{OK}WS)

The fact that sentences with *either* inside an island do have wide scope *or* readings as in (7) conforms to the generalization in (2a), since sentences with *either* in its base position can have the scope of *or* higher than the surface position of *either*. In contrast, it goes against the generalization in (2b), since floated *either* does not mark the exact scope of *or* but allows the scope of *or* to be in a higher position.

To sum up, [3]'s generalization in (2) states that (i) in sentences with no *either* or with *either* in its base position, *or* can take both narrow scope and wide scope, while (ii) in sentences with floated *either*, only the wide scope *or* reading is available. We have also reviewed additional data reported by [4] and [5], in which *or* can take scope over an island but *either* cannot overtly appear outside the island.

Lastly, consider (8). An interrogative sentence with a DisjP without *either* is ambiguous between an Alternative Question (AltQ) and a Yes/No Question (YNQ) as in (8a). Once *either* comes in, however, an AltQ reading is no longer available and the sentence is unambiguously a YNQ regardless of the position of *either*, as shown in (8b, c).

(8) Availability of question readings and the position of *either*
   a. Did John see a maid or a cook? (AltQ/YNQ)
   b. Did John see either a maid or a cook? (*AltQ/YNQ)
   c. Did John either see a maid or a cook? (*AltQ/YNQ)

In the rest of this paper, I propose an analysis that accounts for the wide scope *or* reading of the *either/or* construction and the availability of AltQ/YNQ readings introduced above. In Sect. 2, I first introduce two hybrid analyses that combine an ellipsis analysis and a choice function analysis. The two differ from each other in terms of the item that introduces the choice function variable: in the first analysis, the disjunction particle *or* introduces the choice function variable while in the second analysis, *either* has that semantic role. It is demonstrated that the two analyses both account for the *either/or* construction data, whereas only the second hybrid analysis, in which *either* introduces the choice function variable, explains the AltQ/YNQ data. I thus eventually propose a hybrid analysis of an ellipsis analysis and a choice function analysis of *either*. In Sect. 3, I review a previous study and point out its problems. Section 4 concludes.

2 Proposal

2.1 Two Hybrid Analyses

I first introduce two possible analyses combining an ellipsis analysis and a choice function analysis, and examine the wide scope *or* data. Both of the analyses combine an ellipsis analysis, and a choice function analysis in which an item introduces a choice function variable and the wide scope *or* reading is obtained through Existential Closure of the choice function variable.

The first hypothesis is that *or* introduces a choice function variable (cf. [5, 6]) and *either* only has a syntactic role of marking the left edge of the first disjunct (cf. [7]). The choice function variable that *or* introduces takes the set of disjuncts, the denotation of the DisjP, as its argument and the position of Existential Closure determines the scope position of *or*. With the work of *either*, it is guaranteed that the scope position of *or* is never lower than the position of *either*, since *either* determines the size of the DisjP.

Let us look at the examples. In sentences with no *either* or with *either* in its base position (9) (= (3)), where there is an ambiguity between narrow scope and wide scope *or*, no ellipsis is involved in the derivation of the examples. Thus there are multiple

possible positions for Existential Closure which correspond to the multiple possible scope positions of *or*.

(9) Ambiguous between NS and WS *or*
   a. Mary is looking for a maid or a cook.
   b. Mary is looking for either a maid or a cook.
      ○ [∃f] Mary is looking for [∃f] PRO to FIND f({a maid, a cook}) (cf. [8])

In sentences with floated *either* as in (10), where the wide scope *or* reading is forced, *either* marks the left edge of the first disjunct and ellipsis is involved in the derivation. Since the choice function variable is introduced with the disjunction, Existential Closure is restricted to a position above the DisjP. With this analysis, we can account for the fact that only the wide scope *or* reading is available in the sentences.

(10) Unambiguous: only WS *or*
   a. Mary is either looking for a maid or ~~looking for~~ a cook (= (4)).
      ○ ∃f. Mary is f({looking for a maid, looking for a cook})
   b. Mary either is looking for a maid or ~~is looking for~~ a cook.
      ○ ∃f. Mary f({is looking for a maid, is looking for a cook})
   c. Either Mary is looking for a maid or ~~Mary is looking for~~ a cook.
      ○ ∃f. f({Mary is looking for a maid, Mary is looking for a cook})

The second hypothesis is that *either* introduces a choice function variable and *or* forms a set of disjuncts that serves as its argument. The claim that a DisjP denotes the set of its disjuncts is not new (cf. [9] among others). I adopt a compositional semantics of DisjP with the denotation of *or* in (11). (For detailed discussion, see Sect. 3.2).

(11) $[\![\text{or}]\!]^{w,g} = \lambda x_{<s,\sigma>} . \lambda y_{<s,\sigma>} . \{[\![x]\!]^w, [\![y]\!]^w\}$

(12) $[\![\text{a maid or a cook}]\!]^{w,g} = \{[\![\text{a maid}]\!]^w, [\![\text{a cook}]\!]^w\}$

Or has a set-forming function as its denotation. It takes two arguments of the same type and forms a set of them. The result of combining *or* with the disjuncts is the set of the disjuncts, as in (12).

The second version of the hybrid analysis can equally capture the facts in (9) and (10) since, as we can observe from the data, the position where the choice function variable is placed coincides with the overt position of *either*. In this analysis, we assign *either* the semantic work of introducing the choice function variable, as in (13). To get this to work out formally, I analyze this as involving a covert operator coindexed with *either*, whose sole semantic work is to modify the assignment function g so that it assigns to its index a choice function variable f_i, as in (14).

(13) $[\![\text{either}_i]\!]^{w,g} = g(i)$

(14) $[\![\text{Op}_i\ [\text{either}_i\ \text{DisjP}]]\!]^{w,g} = [\![\text{either}_i\ \text{DisjP}]\!]^{w,\, g[i \to f_i]}$, where $f_i \in D_{Chf}$ is a choice function $Chf(f_i)$ iff for all P in $dom(f_i)$: $f_i(P) \in P$

With the items, the NS reading of the sentence with *either* in its base position is derived as in (15) and the WS reading of the sentence with floated *either* is derived as in (16).

(15) Mary is looking for [$_{TP}$ PRO TO FIND [$_{XP}$ Op_i $either_i$ [$_{DisjP}$ a maid or a cook]]].

a. $[\![XP]\!]^{w,g} = [\![either_i\ DisjP]\!]^{w,g[i \rightarrow f_i]} : f_i \in D_{Chf}$
$= [\![either_i]\!]^{w,g[i \rightarrow f_i]} \left([\![DisjP]\!]^{w,g[i \rightarrow f_i]} \right) : f_i \in D_{Chf}$
$= f_i (\{a\ maid\ in\ w, a\ cook\ in\ w\}) : f_i \in D_{Chf}$

b. $[\![TP]\!]^{w,g} = \lambda w.\ \exists f_i.\ Chf(f_i)$ & Mary to find f_i ({a maid in w, a cook in w a maid in w, a cook in w}) in w

c. $[\![(15)]\!]^{w,g} = \lambda w'.$ Mary is looking for $[\lambda w.\ \exists f_i.\ Chf(f_i)$ & Mary to find f_i({a maid in w, a cook in w}) in w]in w′

(16) Mary is [$_{XP}$ Op_i $either_i$ [$_{DisjP}$ looking for PRO TO FIND a maid or looking for PRO TO FIND a cook]].

a. $[\![XP]\!]^{w,g} = [\![either_i\ DisjP]\!]^{w,g[i \rightarrow f_i]} : f_i \in D_{Chf}$
$= [\![either_i]\!]^{w,g[i \rightarrow f_i]}([[DisjP]]^{w,g[i \rightarrow f_i]}) : f_i \in D_{Chf}$
$= f_i(\{\lambda w'.\ \lambda x.$ x is looking for [λw. Mary to find a maid in w] in w′, λw′. λx. x is looking for [λw. Mary to find a cook in w] in w′}): $f_i \in D_{Chf}$

b. $[\![(16)]\!]^{w,g} = \lambda w''.\ \exists f_i.\ Chf(f_i)$ & $f_i(\{\lambda w'.\ \lambda x.$ x is looking for [λw. Mary to find a maid in w] in w′, λw′. λx. x is looking for [λw. Mary to find a cook in w] in w′})(w″)(Mary)

So far, the first and the second hypotheses both account for the set of data examined. In order to tease apart the two hypotheses, I consider AltQ and YNQ data in the next section.

2.2 AltQ/YNQ Data Distinguish Hybrid Analyses

In this section, I turn to AltQ and YNQ data. As for the semantics of AltQs and YNQs, it is assumed here that the Question (Q) operator existent in the CP level in interrogatives has a different denotation in the two constructions. For AltQs, I adopt [10]'s *wh* operator that moves to take CP scope and leaves its restrictor in situ.[1]

[10]'s claim is that there is a *wh* operator (and/or the Q morpheme in C) that moves to the CP domain and takes CP scope while its trace is interpreted as a choice function variable. An AltQ (17a) has the LF representation in (17b). They propose that the Q operator and the *wh* operator in AltQs have the denotations in (18). The *wh* operator combined with the index does the work of rewriting the assignment function.

(17) AltQ example and its LF representation
a. Did John drink coffee or tea?
b. [$_{CP}$ wh i [$_{C'}$ Q [$_{IP}$ John drank [t_i coffee or tea]]]] (cf. [10])

(18) Denotations of items

[1] Another, often cited, analysis of the semantics of AltQs is [11]'s analysis that makes use of focus alternative semantics. I take up the analysis in Sect. 3.

a. $[\![Q]\!] = \lambda q_{st}. \lambda w. \lambda p_{st}. p = q$
b. $[\![wh]\!]^{w,g} = \lambda R_{<Chf, <s, <st, t> > > >} \lambda w. \lambda p.$
$[\exists f. Chf(f) \& R(f)(w)(p)]$, where $f \in D_{Chf}$

The derivation of (17b) proceeds as in (19) in the notation adopted here. The DisjP denotes a set of the disjuncts and the trace of the *wh* operator is taken to be a choice function variable that takes that set as its argument.

(19) Derivation of (17b)
a. $[\![t_i \text{ coffee or tea}]\!]^{g[i \to f_i]} = f_i(\{\text{coffee, tea}\})$
b. $[\![IP]\!]^{w, g[i \to f_i]} = \lambda w'.$ John drank $f_i(\{\text{coffee, tea}\})$ in w'
c. $[\![C']\!]^{w, g[i \to f_i]} = \lambda w. \lambda p.\ p = \lambda w'.$ John drank f_i $(\{\text{coffee, tea}\})$ in w'
d. $[\![CP]\!]^{w,g} = \lambda w. \lambda p.\ \exists f_i. Chf(f_i) \& p = \lambda w'.$ John drank $f_i(\{\text{coffee, tea}\})$ in w'

For YNQs, I assume that there is a distinct Q operator that derives a YNQ reading when the denotation of the IP in a question is a single proposition. This Q operator has a special semantic denotation which takes a single proposition and gives back the set of it and its negation as the question interpretation as in (20).[2] With this operator in the CP level, the interpretation of a YNQ (21a) is as in (21b). The Q operator takes the proposition denoted by the IP, and the meaning of the whole sentence is the set of the proposition and its negation, successfully deriving the YNQ reading.

(20) $[\![Q_{YNQ}]\!]^{w,g} = \lambda p. \{\lambda w.\ p(w), \lambda w. \neg p(w)\}$
(21) A YNQ and its denotation
a. Q_{YNQ} Did John come?
b. $[\![(21a)]\!]^{w,g} = \{\lambda w.$ John came in w, $\lambda w. \neg$John came in w$\}$

Let us now proceed to the discussion of whether the two hybrid analyses can handle the AltQ/YNQ data (8), repeated in (22).

(22) Availability of question readings and the position of *either*
a. Did John see a maid or a cook? (AltQ/YNQ)
b. Did John see either a maid or a cook? (*AltQ/YNQ)
c. Did John either see a maid or a cook? (*AltQ/YNQ)

According to the first version of the hybrid analysis, there is no difference between (22a–c) in that the IPs in all of the sentences denote a single proposition. This is because of the choice function variable introduced by *or*, which is present in all of the sentences. The choice function variable takes the set denoted by the DisjP and gives back a single member of the set, and thus the denotation of the IP ends up as a single proposition. We can derive the YNQ reading for these sentences with the Q operator

[2] There are several other lines of research regarding the semantics of YNQs. [12], for example, takes the assumption that the denotation of a YNQ is a singleton set of its literal meaning (declarative meaning) as in (i).
(i) [[Can Jack come to tea]] = {Jack can come to tea}
Here, however, I maintain the simplest idea that questions denote the set of their possible answers and adopt the semantics of the YNQ operator in (20).

for YNQs in (20). For (23), which is the LF representation of (22b) with an overt *either* in its base position, the Q operator takes the proposition that the IP denotes and gives back the set of it and its negation, as in (24). The same account applies to the availability of the YNQ reading in (22a) and (22c).

(23) Q_{YNQ} John saw either a maid or a cook

(24) $[\![(23)]\!]^{w,g} = \{\lambda w.\ \exists f.$ John saw $f(\{$a maid, a cook$\})$ in w, $\lambda w.\ \neg\exists f.$ John saw $f(\{$a maid, a cook$\})$ in w$\}$

However, the first version of the hybrid analysis cannot derive the AltQ reading in (22a). Making use of the *wh* operator that moves to take CP scope and whose trace is interpreted as a choice function variable (18) will give rise to two choice function variables in the LF structure of (22a): one originating from the *wh* operator and another from *or*. Once one of the two variables takes the set of the disjuncts as its argument, the result is a single member that the other variable is unable to operate over.

For example, consider example (17a) repeated in (25), whose underlying structure is as in (17b) repeated in (25a). If we combine this structure with the first version of the hybrid analysis, the denotation of the DisjP is as in (25b), where *or* introduces a choice function variable that takes as its argument the set of the disjuncts.

(25) Did John drink coffee or tea?
  a. $[_{CP}$ wh i $[_{C'}$ Q $[_{IP}$ John drank $[t_i$ coffee or tea$]]]]$
  b. $[\![$ coffee or tea $]\!]^{w,g} = \lambda w.\ f\ (\{$coffee in w, tea in w$\})$

It is clear that (25b) cannot be the argument of the choice function variable introduced in the position of the trace of the *wh* operator, since (25b) is a single semantic interpretation that is not a set. It is impossible to derive the AltQ interpretation of (25) with the first version of the hybrid analysis.

How about the second version of the hybrid analysis? I take there to be two possible structures for (22a): *either* being completely absent and *either* being covert. When there is a covert *either* adjacent to the DisjP in (22a), the structure is identical to (22b), analyzed in (24) above. The existence of *either* accounts for the availability of the YNQ reading in (22a–c) in a way similar to (24). The second version of the hybrid analysis also successfully obtains the AltQ reading of (22a) with the Q operator and the *wh* operator in (18). Since *either* is absent, the only choice function variable in the structure is the one originating from the *wh* operator. The computation thus proceeds in exactly the same manner as (19):

(26) Did John see a maid or a cook? (= (22a))
  a. [cp Wh i [c′ Q [ip John saw [t_i a maid or a cook]]]]
  b.
$$
\begin{aligned}
[\![\mathrm{CP}]\!]^{w,g} &= [\![\mathrm{Wh}]\!]^{w,g} \left([\![\mathrm{i\,C'}]\!]^{w,g} \right) \\
&= [\![\mathrm{Wh}]\!]^{w,g} \left(\lambda f_i .\ [\![\mathrm{C'}]\!]^{w,g[i \to f_i]} \right) \\
&= [\![\mathrm{Wh}]\!]^{w,g} \left(\lambda f_i .\ [\![\mathrm{Q}]\!]^{w,g[i \to f_i]} \right) \left([\![\mathrm{IP}]\!]^{w,g[i \to f_i]} \right) \\
&= [\![\mathrm{Wh}]\!]^{w,g} (\lambda f_i .\ [\![\mathrm{Q}]\!]^{w,g[i \to f_i]} (\lambda w'.\ \text{John saw } f_i(\{\text{a maid, a cook}\}) \text{ in } w')) \\
&= [\![\mathrm{Wh}]\!]^{w,g} (\lambda f_i . \lambda w.\ \lambda p.\ p = \lambda w'.\ \text{John saw } f_i(\{\text{a maid, a cook}\}) \text{ in } w') \\
&= \lambda w.\ \lambda p. [\exists f_i .\ \mathrm{Chf}(f_i)\ \&\ p = \lambda w'.\ \text{John saw } f_i(\{\text{a maid, a cook}\}) \text{ in } w'] : f_i \in D_{\mathrm{Chf}}
\end{aligned}
$$

Now it has been shown that the second version of the hybrid analysis, namely the ellipsis analysis + the choice function analysis of *either*, accounts for both the wide scope *or* reading data and the AltQ/YNQ data.

3 Comparison with Other Analysis

3.1 The Focus Alternative Semantics Analysis

[11] investigate the semantics of AltQs based on the focus alternative semantics of [13] and comment on the role of *either* in the *either/or* construction.

The basic idea of focus alternative semantics is that focused items have two semantic values: an ordinary semantic value and a focus semantic value. For example, in sentence (27), the focused item *John* has its ordinary denotation as its ordinary semantic value (27a) and a set of alternatives (of the same semantic type) as its focus semantic value (27b). A sentence that has a focused item in it also has an ordinary semantic value (27c) and a focus semantic value (27d), which is a set of propositions in which the position of the focused item varies according to the focus semantic value of the focused item.

(27) $[\text{John}]_F$ left.

a. $[\![\text{John}_F]\!]^o = \text{John}$

b. $[\![\text{John}_F]\!]^f = \{\text{John, Bill, Amelie, } \ldots\}$

c. $[\![\text{John}_F \text{ left}]\!]^o = \lambda w.\ \text{John left in w}$

d. $[\![\text{John}_F \text{ left}]\!]^f = \{p: p = \lambda w.\ x \text{ left in w} \mid x \in D\}$
$= \{\lambda w.\ \text{John left in w}, \lambda w.\ \text{Bill left in w}, \lambda w.\ \text{Amelie left in w}, \ldots\}$

Building on the idea that *either* is focus-sensitive [11, 14, 15] propose that *either* operates over the focus semantic value of its sister, just like focus-sensitive items like *only* do, as we see immediately below. Their denotation of *either XP* is in (28), where *either* is proposed to be a focus sensitive operator that takes its sister DisjP as its argument as in (29) and gives rise to "closure" as in (30) (note that this denotation is primarily aimed to capture the "epistemic" reading of *or* discussed in [16] among others).

(28) $[\![\text{either XP}]\!]^o = \text{for all q in } [\![\text{XP}]\!]^f :\ \text{may q} \,\&\, \neg\exists p \left[\text{for all q in } [\![\text{XP}]\!]^f :\ p \cap q = \{\} \,\&\, \text{may } p\right]$

(29) $[\![\text{either it is raining or it is snowing}]\!]^o = \text{may r} \,\&\, \text{may s} \,\&\, \neg\exists p\, [p \cap r = \{\} \,\&\, p \cap s = \{\} \,\&\, \text{may p}]$

(30) Either it is raining or it is snowing. ≈ It is possible that it is raining and it is possible that it is snowing and there are no other relevant possibilities.

In order to support the claim that focus-sensitive items such as *only* access the focus alternatives of their sister, [11] present an analysis based on focus alternative semantics

to account for intervention effects in AltQs. *Only*, a focus-sensitive item, has the semantics in (31).

(31) $[\![\text{only } \phi]\!]^o = \left[\lambda w.\ \text{for all p such that } p(w) = 1 \ \&\ p \in [\![\phi]\!]^f\right] (p = [\![\phi]\!]^o)$

(31) means that of all the alternative propositions introduced by the focus semantic value of the sister of *only*, the only true one is the ordinary semantic value of the sister. Thus in the sample sentence (32), the overall meaning is equivalent to (32b).

(32) $[\![\text{Only John}_F \text{ left}]\!]^o$

a. $= \lambda w.\ [\text{for all p such that } p(w) = 1 \ \&\ p \in \{\lambda w.\ x \text{ left in } w \mid x \in D\}]\ (p = \{\lambda w.$ John left in w$\})$

b. $= \lambda w.\ [\text{for all x such that x left in w}]\ (x = \text{John})$

[11] present data like (33a, b) to show that *only* gives rise to intervention effects in AltQs. When *only* structurally intervenes between the DisjP and the Q operator in the CP layer, an AltQ reading is unavailable.

(33) Intervention effects of *only*

a. ? Did John or Susan introduce Sue to only Mary_F?

b. ?* Did only Mary_F introduce Sue to Bill or to Tom?

According to [11], the Q operator in *wh*-Questions takes the focus semantic value of its sister and makes it the ordinary semantic value of the whole sentence as in (34).[3]

(34) Two semantic values of *wh*-Questions

a. $[\![Q\,\phi]\!]^o = [\![\phi]\!]^f$

b. $[\![Q\,\phi]\!]^f = \{ [\![Q\,\phi]\!]^o \}$

[11] argue that this Q operator derives the AltQ reading of (35) (although they argue against the idea that AltQs are a kind of *wh*-Question).

(35) Did the program execute or the computer crash?
= $[_{CP}$ Q $[_{DisjP}$ [the program executed] or [the computer crashed]]] (cf. [11])

[11] further claim that the ordinary semantic value of a DisjP is the union of the disjuncts while the focus semantic value is the set of the disjuncts. Based on [17]'s analysis, [11] argue for an ordinary semantic value in (36a) and a focus semantic value in (36b) for the DisjP in the AltQ in (36).[4]

[3] Note that this semantics for *wh*-Questions and AltQs does not account for the AltQ/YNQ data discussed in the previous section, under either the first or the second version of the hybrid analysis. If we adopt the semantics in (34) in the first hybrid analysis, the choice function variable is closed via Existential Closure and the IP always denotes a single proposition. The semantics of the question would be the singleton set of this proposition. However, this is not the intended AltQ reading. A similar problem arises if we adopt (34) for the second hybrid analysis too.

[4] According to [17], the denotation of *or* is set-theoretic union in both (36a) and (36b). In (36a), *or* takes the ordinary semantic value of the disjuncts, in this case two propositions, and gives back their union. This is equivalent to the meaning in (36a), a set of worlds where the program executed or the computer crashed. In (36b), on the other hand, *or* takes the focus semantic value of the disjuncts,

(36) Did [$_{\text{DisjP}}$ the program execute or the computer crash]?
  a. $[\![\text{DisjP}]\!]^{o} = \lambda w.$ the program executed in w or the computer crashed in w
  b. $[\![\text{DisjP}]\!]^{f} = \{\lambda w.$ the program executed in w,$\lambda w.$ the computer crashed in w$\}$

By combining the denotation of DisjPs with that of the Q operator in *wh*-Questions, the AltQ reading of (35) is obtained. From (34a), the ordinary semantic value of the interrogative (35) is the focus semantic value of the DisjP, i.e. (36b). Based on previous research that analyzes the semantic denotation of questions as the set of their possible answers (cf. [18]), this is equivalent to the AltQ interpretation.

Now let us proceed to the discussion of how *only* intervenes between the DisjP and the Q operator. For (33b), [11] assume a (simpified) underlying structure (37), in which the DisjP has two VPs as disjuncts. Then, the denotation of the DisjP is the set of the denotations of the disjuncts as in (38) and the DisjP combines with *Mary*, which is the associate of *only* and carries a Focus intonation. The result is as in (39). After that, *only* makes use of the two semantic values to derive the semantics in (40). With the semantic work of the Q operator in (34), the overall interpretation of the whole sentence results in (41). Since this is not an AltQ interpretation, [11] account for the intervention effects of *only* in AltQs.

(37) Q [$_{\text{XP}}$ only [$_{\text{IP}}$ Mary$_{\text{F}}$ [$_{\text{DisjP}}$ [introduce Sue to Bill] or [~~introduce Sue~~ to Tom]]]?

(38) Denotation of DisjP
  a. $[\![\text{DisjP}]\!]^{o} = \lambda x.\ \lambda w.$ x introduces Sue to Bill in w or x introduces Sue to Tom in w
  b. $[\![\text{DisjP}]\!]^{f} = \{\lambda x.\ \lambda w.$ x introduces Sue to Bill in w, $\lambda x.\ \lambda w.$ x introduces Sue to Tom in .w$\}$

(39) Denotation of IP
  a. $[\![\text{IP}]\!]^{o} = \lambda w.$ Mary introduces Sue to Bill in w or Mary introduces Sue to Tom in w
  b. $[\![\text{IP}]\!]^{f} = \{\lambda w.$ x introduces Sue to Bill in w, $\lambda w.$ x introduces Sue to Tom in w $\mid$ x $\in D_e\} = \{\lambda w.$ Mary introduces Sue to Bill in w, $\lambda w.$ Jane introduces Sue to Bill in w , $\lambda w.$ Mary introduces Sue to Tom in w, $\lambda w.$ Amy introduces Sue to Tom in w, . . .$\}$

(40) Denotation of XP
  a. $[\![\text{XP}]\!]^{o} = \lambda w.$ [for all p such that p(w) = 1 & p $\in \{\lambda w.$ x introduces Sue to Bill in w, $\lambda w.$ x introduces Sue to Tom in w $\mid$ x $\in D_e\}$] (p = $\lambda w.$ Mary introduces Sue to Bill in w or Mary introduces Sue to Tom in w)
  b. $[\![\text{XP}]\!]^{f} = \{\ [\![\text{XP}]\!]^{o}\ \}$

(41) $[\![(37)]\!]^{o} = \{\ [\![\text{XP}]\!]^{o}\ \}$

(Footnote 4 continued)
namely two singleton sets, and gives back their union. This is equivalent to (36b), a set of the focus semantic values of the disjuncts. Here I use the original analysis of [17] in (36), and not the version of [11] in which the focus semantic value of a DisjP is a set containing the two ordinary meanings of the disjuncts.

Thus, adopting focus alternative semantics enables us to account for the semantics of *only* and the intervention effect it induces in AltQs, and [11] suggest extending this analysis to *either*.

There are, however, problems in the analysis. I discuss them next.

3.2 Problems of the Focus Alternative Semantics Analysis

The focus alternative semantics analysis faces several difficulties when we try to explain the data introduced in the previous section. I first describe an empirical problem, and then move on to theoretical problems.

The first problem is that the analysis makes a wrong prediction for the scope of disjunction. Recall that, as repeated below, (42a) is ambiguous between wide scope and narrow scope *or* readings whereas (42b–d) only have a wide scope *or* reading.

(42) Narrow and wide scope *or*
   a. Mary is looking for either a maid or a cook.
   b. Mary is either looking for a maid or looking for a cook.
   c. Mary either is looking for a maid or is looking for a cook.
   d. Either Mary is looking for a maid or Mary is looking for a cook.

According to the denotation in (28), *either* makes use of the focus semantic value of its sister and gives back an ordinary semantic value. We thus have no way to get the wide scope *or* reading of (42a). Claiming that *either* projects up the focus semantic value is not a possible move, taking into consideration AltQ/YNQ data:

(43) Availability of question readings and the position of *either*
   a. Did John see a maid or a cook? (AltQ/YNQ)
   b. Did John see either a maid or a cook? (*AltQYNQ)
   c. Did John either see a maid or a cook? (*AltQ/YNQ)

According to [11], the AltQ reading available for sentences like (43a) comes from the focus semantic value that projects up to the TP level and is lifted to the ordinary semantic value by the work of the covert Q operator in the C position. Given that the AltQ reading is unavailable when *either* comes in, it is clear that *either* does not pass up the focus semantic value of its sister node but closes the alternatives in the position it occupies. It thus seems difficult to explain the availability of the wide scope *or* reading available for sentences with *either* adjacent to the DisjP by giving *either* some semantic role related to focus.

Aside from the empirical problem, the focus alternative semantics analysis in the form introduced in the previous section has a theoretical problem in the semantics of the DisjP and *only*. Consider again the derivation of (37) in (38)–(41) above. Two problems exist in this derivation. First, the ordinary semantic value of the XP shown in (40) means that, of all p such that p is true and p is a member of the focus semantic value of the IP (a set of propositions of the form λw. *x introduces Sue to Bill in w* or of the form λw. *x introduces Sue to Tom in w*, where x is a focus alternative to *Mary*), the only true one is the proposition λw. *Mary introduces Sue to Bill in w or Mary introduces Sue to Tom in w*. However, note that in the focus semantic value of the IP, there are the propositions λw. *Mary introduces Sue to Bill in w* and λw. *Mary introduces Sue*

to Tom in w. These propositions are presupposed to be false according to the semantics of *only*, since they are not equal to the proposition that is asserted to be true, *λw. Mary introduces Sue to Bill in w or Mary introduces Sue to Tom in w*. Thus, for the disjoined proposition to be true, at least one of its disjuncts has to be true, but the given semantics requires both disjuncts to be false. This renders (37) necessarily false. Although (37) is a degraded example, it is not intuitively necessarily false. It is easy to see that the problem lies at least in part in the semantics of *only* itself and the problem is carried over to acceptable sentences.

Following [19], we can avoid this problem by modifying the semantics of *only* to make use of entailment (cf. [20]):

(44) $[\![\text{only } \phi]\!]^{o} = \lambda w.\, \forall p\left[p(w) = 1 \,\&\, p \in [\![\phi]\!]^{f}\right] (p \supseteq [\![\phi]\!]^{o}) : [\![\phi]\!]^{o} = 1$

I next turn to the second problem of (38)–(41). Adopting the revised interpretation of *only* in (44), the ordinary semantic value of the XP shown in (40) means that, of all *p* such that *p* is true and *p* is a member of the focus semantic value of the IP (a set of propositions of the form *λw. x introduces Sue to Bill in w* or of the form *λw. x introduces Sue to Tom in w*, where *x* is a focus alternative to *Mary*), the only true one(s) is entailed by the proposition *λw. Mary introduces Sue to Bill in w or Mary introduces Sue to Tom in w*. However, neither the proposition *λw. Mary introduces Sue to Bill in w* or the proposition *λw. Mary introduces Sue to Tom in w* is entailed by the proposition *λw. Mary introduces Sue to Bill in w or Mary introduces Sue to Tom in w* (and in fact, there is no such proposition in the focus semantic value of IP that is entailed by *λw. Mary introduces Sue to Bill in w or Mary introduces Sue to Tom in w*). Thus there is no *p* which is a member of the focus semantic value of the IP and, at the same time, is entailed by the ordinary semantic value of IP, and the semantics in (40) then comes out true only if nobody introduced Sue to Bill and nobody introduced Sue to Tom. This difficulty, which still exists when the revised denotation of *only* is adopted, arises from the semantics of DisjPs, in which the ordinary semantic value is not a member of the focus semantic value.

Notice that this problem is avoided by adopting the compositional semantics of DisjPs proposed in this paper. I have proposed that *or* has a set-forming function. In its ordinary semantic value, *or* takes two arguments of the same type and forms a set of them as in (45a). Its focus semantic value is a singleton set of this function, as in (45b).

(45) Compositional semantics of DisjPs
  a. $[\![\text{or}]\!]^{g,o} = \lambda x_{\sigma}.\, \lambda y_{\sigma}.\, \{x, y\}$
  b. $[\![\text{or}]\!]^{g,f} = \{\lambda x_{\sigma}.\, \lambda y_{\sigma}.\, \{x, y\}\}$

With this semantics, the semantics of sentence (46) can be computed fully compositionally with the semantics of *either* in the present proposal. On the assumption that subjects reconstruct at LF in their base position, inside the VP, the LF representation has *John* below *only* and covert *either* in its base position.[5]

[5] Note that there is another, perhaps a more salient reading, in which John only saw Bill, among other candidates, or John only saw Sue, among other candidates, but the speaker forgot which John

(46) John only saw Bill_F or Sue_F. = Only [$_{IP}$ John saw [$_{XP}$$\text{Op}_i$ either_i Bill_F or Sue_F]].

The ordinary semantic value is the result of applying the choice function introduced by *either* to the set of disjuncts, as in (47a). The focus semantic value is the result of combining a singleton set of a choice function, which is the focus semantic value of *either*, and the set of the sets of the alternatives of the disjuncts, which is the focus semantic value of the DisjP, via pointwise function application. This is shown in (47b). The alternatives of the focus semantic value expand up to the IP level, resulting in (48b). Notice that *either* and Op are necessarily above the DisjP to resolve a type mismatch that would occur without them when *saw* combines with the DisjP.

(47) Denotation of XP

a. $[\![\text{XP}]\!]^{g[i \to f_i],o} = f_i(\{\text{Bill}, \text{Sue}\}) : f_i \in D_{Chf}$

b. $[\![\text{XP}]\!]^{g[i \to f_i],f} = \{f(A): f \in \{f_i\} \ \& \ A \in \{\{x,y\} \mid x \in [\![\text{Bill}_F]\!]^{g,f} \text{ and } y \in [\![\text{Sue}_F]\!]^{g,f}\}\}: f_i \in D_{Chf}$

(48) Denotation of IP

a. $[\![\text{IP}]\!]^{g[i \to f_i],o} = \text{John saw } f_i(\{\text{Bill}, \text{Sue}\}) : f_i \in D_{Chf}$

b. $[\![\text{IP}]\!]^{g[i \to f_i],f} = \{\text{John saw x}: x \in \{f(A): f \in \{f_i\} \ \& \ A \in \{\{x,y\} \mid x \in [\![\text{Bill}_F]\!]^{g,f} \text{ and } y \in [\![\text{Sue}_F]\!]^{g,f}\}\}\}: f_i \in D_{Chf}$

Now the revised denotation of *only* with entailment in (44) comes into the structure. The interpretation of (46) is given in (49), assuming that Existential Closure of the choice function variable takes place above the whole proposition. This means that, for a particular way of picking out a value from a pair of disjuncts, every true sentence of the form *John saw A or B* using that way of picking values is entailed by the result of using that way of picking values in *John saw Bill or Sue*. This is the intended reading.

(49) $[\![(46)]\!]^{g[i \to f_i],o} = \exists f_i . f_i \in D_{Chf}$ and for all p such that $p(w) = 1$ & $p \in \{\text{John saw x}: x \in \{f(A): f \in \{f_i\} \ \& \ A \in \left\{\{x, y\} \mid x \in [\![\text{Bill}_F]\!]^{g,f} \text{ and } y \in [\![\text{Sue}_F]\!]^{g,f}\right\}\}\}: p \supseteq \text{John saw } f_i(\{\text{Bill}, \text{Sue}\})$

(Footnote 5 continued)
actually saw. This reading falls out from the present analysis by assuming that the covert *either* floats up to a higher position and (46) can have the LF representation in (i).

(i) Op_i either_i [John only saw Bill_F or John only saw Sue_F]

From the discussion in this section, it is clear that the present claim not only covers most of the data but also has theoretical advantages over [11]'s claim reviewed in the previous section.[6]

4 Conclusion

In this paper, I have investigated in detail the semantics of the *either/or* construction and AltQs in English. It has been shown that the proposed analysis, namely a hybrid analysis of an ellipsis analysis and a choice function analysis of *either*, accounts for the availability of the wide scope *or* reading and the distribution of AltQ/YNQ readings in English.

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[6] It seems, however, that the intervention effect of *only* cannot be obtained without a focus alternative semantics for questions. Since, as noted in footnote 3, a focus alternative semantics for questions does not account for AltQ/YNQ data, this point remains as a problem. I leave this point for future research.

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