

*Whether can pied-pipe**

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1. The puzzle

This paper argues that several contrasts between the behavior of *whether* and *if* as introducers of embedded alternative questions can be explained if we assume that *whether* can pied-pipe, but there is no pied-piping in *if*-questions. Strikingly, once we eliminate the pied-piping parse for *whether*, it behaves like *if*.

Consider first the well-known fact that *or not* can immediately follow *whether* (1c), but not *if* (1d) (observed by Kayne (1991), a.o.).

(1)a. I don't know **whether** Pat will arrive this weekend or not.

✓Yes/No (Y/N) Reading: I don't know which of the following is true: (1) Pat will arrive this weekend, or (2) he won't arrive this weekend.

b. I don't know **if** Pat will arrive this weekend or not. (✓Y/N)

c. I don't know **whether** or not Pat will arrive this weekend. (✓Y/N)

d. *I don't know **if** or not Pat will arrive this weekend. (*Y/N)

Whether and *if* contrast in another less well-known manner that will be significant here. Both (2a) and (2b) have the Alt(ernative) reading indicated below.¹ When the disjoined PP *on Saturday or on Sunday* immediately follows *whether*, this Alt reading remains (2c).² But when the disjoined PP immediately follows *if*, the Alt reading is lost (2d).

(2)a. I don't know **whether** Pat will arrive on Saturday or on Sunday.

✓Alt(ernative) Reading: I don't know which of the following is true: (1) Pat will arrive on Saturday, or (2) Pat will arrive on Sunday.

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¹ Examples (2a) and (2b) permit a Y/N reading, but that is not relevant to the current discussion, so I will leave it out of this paper due to limited space.

² Out of 8 native speakers I interviewed, 6 shared this judgment and agreed that (2d) is worse than (2c), although 3 people found (2c) a bit awkward to begin with. Two others found (2c) so awkward that it just sounds bad, and reported (2d) to be ungrammatical. Crucially, no one who accepted (2c) also accepted (2d).

- b. I don't know **if** Pat will arrive on Saturday or on Sunday. (✓Alt)
- c. I don't know **whether** on Saturday or on Sunday Pat will arrive. (✓Alt)
- d. I don't know **if** on Saturday or on Sunday Pat will arrive. (* Alt)

The facts in (1a-2d) can be given a unified explanation. First suppose that in (1a-d) *or not* is a disjunction phrase (DisjP), disjoining the covert positive polarity (*POS*) and the negative polarity (*NEG*) *not* (3a). This DisjP supplies the polarity value to the rest of the clause. In (2a-d), *on Saturday or on Sunday* is a DisjP coordinating two PPs (3b).³

- (3)a. [DisjP (*POS*) or not]
- b. [DisjP [on Saturday] or [on Sunday]]

There is a direct connection between the DisjP and the relevant reading. In the Y/N reading in (1a-d), what is in question is the choice between the two alternatives *Pat will arrive this weekend* and *Pat won't arrive this weekend*. These two alternatives differ only in their polarity value. Notice that the DisjP *or not* provides the polarity values that they differ in. Therefore, I call the Y/N reading a reading where the alternatives presented in the DisjP (*POS*) *or not* are *put under question*.

Likewise, in the Alt reading in (2a-d), what is put under question is the choice between the two alternatives *Pat will arrive on Saturday* and *Pat will arrive on Sunday*. These two alternatives differ only in their PP, which is supplied by the temporal DisjP *on Saturday or on Sunday*. Therefore, I say that in this reading, it is the alternatives presented in the DisjP *on Saturday or on Sunday* that are *put under question*.

The puzzle can then be described as a correlation between the position of the DisjP and the relevant readings we observe. This unified puzzle can be summarized as follows:

(4) Unified puzzle

- a. The alternatives presented in a DisjP can be put under question when that DisjP immediately follows *whether*.
- b. The alternatives presented in a DisjP cannot be put under question when that DisjP immediately follows *if*.

³ One may wonder whether (1a-2d) could be analyzed differently, which would involve clausal disjunction (TP- or VP-disjunction) plus ellipsis, as Han and Romero (2004) argued for disjunction in general. While this analysis may be possible for (1a-b), (5a) and (2b), it is not possible for (1c-d) and (2c-d). Since this paper aims to capture the contrast between (1c) and (1d) as well as the contrast between (2c) and (2d), I won't discuss the ellipsis approach in the paper. Here is the reason why the ellipsis approach is not available. If (2c) and (2d) involve clausal coordination, I can think of two potential analyses to derive the correct word order. One is topicalization of the PP in each TP, plus backward ellipsis of T' (*Pat will arrive*) (i). The other is right-node-raising of T' (ii).

(i) I don't know whether/if [DisjP [TopP on Saturday ~~Pat will arrive~~] or [TopP on Sunday Pat will arrive]].

(ii) I don't know whether/if [DisjP [TP t_i on Saturday] or [TP t_i on Sunday]] [Pat will arrive]_i.

Both analyses are ruled out by independent constraints. Backward ellipsis in coordination is banned by the Backward Anaphora Constraint (see Langacker 1969; Ross 1967). If we posit right-node-raising, the first T' has to move across a TP (the second disjunct), which was shown by Schwarz (1999) to be impossible.

2. The solution

First, I assume the following structure for *whether*- and *if*-questions, following Larson (1985) and Han and Romero (2004). In a *whether*-question, *whether* originates as the sister of the DisjP (assuming it is Spec, DisjP, following Kayne (1994) a.o.), and subsequently moves to Spec, CP:

- (5)a. I don't know [_{CP} *whether*_i [_{C'} C⁰ [_{TP} Pat will arrive this weekend [_{DisjP} *t*_i [_{Disj'} (POS) or not]]]]].
- b. I don't know [_{CP} *whether*_i [_{C'} C⁰ [_{TP} [_{TP'} Pat will arrive] [_{DisjP} *t*_i [_{Disj'} on Saturday or on Sunday]]]]].

In an *if*-question, there is a covert counterpart of *whether* with the same derivational history, that is, origination in Spec, DisjP and movement to Spec, CP. In addition, *if* is C⁰. Let us call this covert counterpart of *whether* Op(erator):

- (6)a. I don't know [_{CP} Op_i [_{C'} *if* [_{TP} Pat will arrive this weekend [_{DisjP} *t*_i [_{Disj'} (POS) or not]]]]].
- b. I don't know [_{CP} Op_i [_{C'} *if* [_{TP} Pat will arrive [_{DisjP} *t*_i [_{Disj'} on Saturday or on Sunday]]]]].

This structure can derive the meaning with existing theories of question semantics. For example, assume that the DisjP denotes a choice-functional trace applying to a set, and the landing site of *whether* / Op existentially quantifies over this trace: “I don't know [$\lambda p: \exists f. p = \text{Pat will arrive } f(\{\text{on Saturday, on Sunday}\})$]” for (6b). The question operator can be an identity function in the sense of Hamblin 1973 and Karttunen 1977.

The reading where the alternatives presented in a DisjP are put under question arises in the following two steps:

- (i) Base-generate *whether* / Op as the sister of the DisjP; and
 (ii) Move *whether* / Op to Spec, CP.

If either step fails to take place, the alternatives in the DisjP cannot be put under question and hence the relevant reading will be lost.

2.1. Why DisjP cannot be put under question when immediately following *if*

The alternatives in the DisjP that immediately follows *if* cannot be put under question because Op fails to move to Spec, CP from the position it would have to move from.

When the DisjP follows *if*, I assume that the DisjP occupies a derived A'-position as a result of what I will assume to be topicalization:⁴

- (7)a. *I don't know [_{CP} Op_i *if* [_{TopP} [_{DisjP} *t*_i [_{Disj'} (POS) or not]]_j Top⁰ [_{TP} Pat will arrive this weekend *t*_j]]]. *Derivation for (1d)*

⁴ While the disjoined PP can be topicalized (7b), it may be difficult to imagine topicalizing a polar disjunction (7a), which may be the reason why (7a) is bad. In any case, this point of view does not conflict with the goal of this subsection, which is to rule out (7a-b).

- b. *I don't know [CP Op_i if [TopP [DisjP t_i [Disj' on Saturday or on Sunday]]_j Top⁰ [TP Pat will arrive t_j]]]. *Derivation for (2d)*

Structures in (7) are excluded because a topicalized phrase may not contain a *wh*-trace:

- (8)*[CP wh_i C⁰ [TopP [... t_i ...]_j Top⁰... t_j]]

The following examples show that this ban is true for English in general:⁵

- (9)a. *I wonder whom_j [to t_j]_i you talked t_i.
 b. *I wonder [what day]_j Pat thinks that [on t_j]_i you left t_i.
 c. *I wonder [whose book]_j Kim claims that [about t_j]_i you talked t_i.

This restriction may form a part of a broader generalization that bans an A'-moved element that contains another A'-trace (see e.g., Lasnik and Saito 1992, Corver 2014), but for the purposes of this paper, the restriction alone suffices. Because the topicalized DisjP cannot contain the *wh*-trace of Op in (7a-b), the alternatives in the DisjP cannot be put under question.

2.2. Why DisjP can be put under question when immediately following *whether*

We may wonder why the alternatives in the DisjP that immediately follows *whether* can be put under question, as the same empirical generalization should rule out extraction of *whether* from the topicalized DisjP as well.

I argue that this is because *whether* as a *wh*-phrase can pied-pipe. Consequently, there is another way to parse (1c) and (2c), where the DisjP following *whether* is pied-piped by *whether* rather than topicalized:

- (10)a. I don't know [CP [DisjP whether [Disj' (POS) or not]]_i C⁰
 [TP Pat will arrive this weekend t_i]]. *Derivation for (1c)*
 b. I don't know [CP [DisjP whether [Disj' on Saturday or on Sunday]]_i C⁰
 [TP Pat will arrive t_i.]] *Derivation for (2c)*

Recall that in order to put the alternatives in the DisjP under question, all we need is to move *whether* to Spec, CP. We do not care if *whether* pied-pipes other material. Example (10) satisfies this requirement because the final position for *whether* is Spec, CP. Thus, the alternatives in the DisjP that is pied-piped by *whether* can be put under question.

Two pieces of evidence support the claim that *whether* can pied-pipe the DisjP. The first comes from sluicing. Assuming that sluicing deletes TP or C', the only element that can survive sluicing is Spec, CP. Material pied-piped by the *wh*-phrase survives sluicing:

- (11)a. Pat talked to someone, but I don't know to whom ~~he talked~~.
 b. Pat left on some day, but I don't know on which day ~~he left~~.

⁵ Lasnik and Saito (1992) claimed that a topicalized DP containing a type-e trace is not completely unacceptable. This does not weaken the claim made here because the topicalized DisjP examined in this paper is not nominal. In addition, *whether* and Op are likely not type e.

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Strikingly, *whether* plus a DisjP may remain after sluicing, indicating that the DisjP must have been pied-piped by *whether*.⁶

(12) I know that Pat will arrive sometime on the weekend. I'm just not sure whether on Saturday or on Sunday.

The second evidence for *whether*'s ability to pied-pipe comes from variants of English that allow overt *whether* and auxiliary inversion to cooccur. In a matrix clause in these dialects, *whether* may overtly occur to the left of the auxiliary in C⁰ (e.g., of the form 'Whether will Pat arrive?'). Assuming that the constituent immediately to the left of C⁰ occupies Spec, CP, then if *whether* and the DisjP can appear together before C⁰, this can be taken as evidence that *whether* and the DisjP are one constituent, and *whether* pied-pipes the DisjP.

Such sentences are attested in legal documents from the 19th (13a-b) and 20th centuries (13c). Even more strikingly, *whether* and the pied-piped DisjP together can be coordinated with other *wh*-elements that occupy Spec, CP, including material pied-piped by other *wh*-phrases like *for what purpose* and *by whom* (13a). The coordination fact again suggests that DisjP, like other pied-piped material, occupies Spec, CP.

- (13) a. And if yea, for what purpose, and when and by whom and whether or not was such counterpart, left with the said complainant?⁷
b. Whether or not were the judge desirous to find a special verdict; ...⁸
c. I will ask you whether or not did the defendant make any voluntary statement to you after he was placed under arrest?⁹

If (1c) and (2c) have the relevant readings because the DisjP is pied-piped by *whether* rather than topicalized, then this analysis makes a prediction. If we prevent the structure from being parsed as involving pied-piping, then *whether*-sentences without pied-piping should behave like *if*-sentences, and the relevant reading should disappear.

One way to rule out the pied-piping parse is by interpolating an adverb or a parenthetical between *whether* and DisjP, adapting a test first developed by Rudin (1988) for Bulgarian. For instance, regular *wh*-sentences with pied-piping become ungrammatical once the *wh*-word and the pied-piped material are interpolated:

(14) *I wonder to, {according to Kim/actually/fortunately}, whom you talked.

Interpolation between *whether* and the DisjP makes the *whether*-sentences *if*-like, as the relevant readings are no longer available:

⁶ All my 6 informants accepted (12), which is striking because *whether* on its own resists sluicing, see (i):

(i) *I know that Pat will arrive on either Saturday or Sunday, I just don't know whether.

The acceptability of (12) suggests that *whether*-sluicing is actually possible, but only possible when *whether* pied-pipes. I leave it to future research why this is the case.

⁷ <https://books.google.com/books?id=v2VjAAAAcAAJ>

⁸ <https://books.google.com/books?id=-rQDAAAAQAAJ>

⁹ <https://law.justia.com/cases/texas/court-of-criminal-appeals/1962/34019-3.html>

(15) *I don't know whether, {according to Kim/actually/fortunately}, or not Pat will arrive this weekend.

(16) I don't know whether, {according to Kim/actually/fortunately}, on Saturday or on Sunday Pat will arrive. (*Alt)

The interpolation test shows that pied-piping is the reason why the alternatives in the DisjP that follows *whether* can be put under question. Once we rule out the pied-piping parse by interpolation, the relevant readings disappear.

If *whether*-sentences allow the relevant readings because of a parse in which *whether* pied-pipes DisjP, we may wonder whether Op can pied-pipe DisjP as well.

Even if it can, the *if*-sentences (7a-b) that were under analysis in section 2.1 cannot be analyzed as Op pied-piping because of the incorrect word order. If Op can pied-pipe DisjP, we should be able to see the following word order, which is also ungrammatical:

(17) a. *I don't know [DisjP Op [Disj' (POS) or not]]_i if Pat will arrive this weekend t_i.
 b. *I don't know [DisjP Op [Disj' on Saturday or on Sunday]]_i if Pat will arrive t_i.

There are two possible reasons why (17a-b) are bad. First, they violate the Doubly-Filled Comp Filter, which prohibits overt occurrence of both the head (*if*) and its specifier (DisjP). Second, it is possible that phonologically null elements cannot pied-pipe overt material, so Op cannot pied-pipe the DisjP, unlike *whether*. I do not commit to a particular reason here, noting only that (17a-b) can be ruled out by one of them.

Because the pied-piping parse is unavailable for *if*-sentences, we predict the *if*-counterpart of (12) to be ungrammatical, which is the case:

(18) *I know that Pat will arrive sometime on the weekend. I'm just not sure if on Saturday or on Sunday.

3. Polish

This section shows that Polish has *whether*. In addition, Polish has multiple lexical items for 'or'. In particular, Polish 'or' is identical in form to the initial coordinator ('either', 'whether', 'neither') it is local to. Taking this morphological identity as an indication of an agreement relation between them, I offer an analysis of how pied-piping occurs in Polish, which in turn can be applied to English as well.

3.1. Polish has *whether*

Example (19) shows the neutral word order of an embedded alternative question in Polish. I will argue that the first *czy* should be analyzed as *whether*. Note its identical form to the disjunction coordinator, glossed as 'or1' (in contrast to 'or2', to be discussed in section 3.2). Section 3.2 discusses why it lacks the Y/N reading.

(19) Nie wiem czy Jan przyjedzie w sobotę czy w niedzielę.
 Not know.1sg whether Jan arrive.perf.3sg in Saturday or1 in Sunday
 Literal Meaning: 'I don't know whether Jan will arrive on Saturday or on Sunday.'

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✓Alt Reading: I don't know which of the following is true: (1) Jan will arrive on Saturday, or (2) Jan will arrive on Sunday.

*Y/N Reading: Which of the following is true: (1) Jan will arrive on a weekend day, or (2) Jan won't arrive on a weekend day?

In parallel to (2c), when the temporal DisjP immediately follows *czy* 'whether', the Alt reading remains:

(20) Nie wiem czy w sobotę czy w niedzielę Jan przyjedzie.
Not know.1sg whether in Saturday or1 in Sunday Jan arrive.perf.3sg
Literal Meaning: 'I don't know whether on Saturday or on Sunday Jan will arrive.'
(✓Alt)

This fact can be explained if we analyze *czy* as the Polish counterpart to *whether*, and propose that *czy* can pied-pipe the DisjP. Then in (20), *czy* pied-pipes the DisjP, generating the Alt reading.

The argument from sluicing that we saw for English applies to Polish, as *czy w sobotę czy w niedzielę* 'whether on Saturday or on Sunday' can survive sluicing. Furthermore, Wiland (2017) observed that *czy* 'whether' has *wh*-morphology. Since Polish *wh*-phrases can pied-pipe in general, *czy* should also be able to.

3.2. Two 'or's in Polish and English

This subsection discusses the additional fact that Polish (and English, actually, as we will see) have two 'or's, which prompted the gloss 'or1' on *czy* in (19). My analysis of the multiple 'or's provides an account of how pied-piping occurs in English and Polish. Recall the absence of Y/N reading for (19). To get this reading, the disjunction coordinator in (19) must be replaced by *albo*, glossed as 'or2':

(21) Nie wiem czy Jan przyjedzie w sobotę **albo** w niedzielę.
Not know.1sg whether Jan arrive.perf.3sg in Saturday or2 in Sunday
(*Alt; ✓Y/N)

When 'or1' surfaces, we can only get the Alt reading (19); when 'or2' surfaces, we can only get the Y/N reading (21). I argue that the reason for the complementary distribution of the two 'or's is that their presence indicates different syntactic structures.

Note the identical form of *czy* 'whether' and *czy* 'or'. Notice also that the Polish word for 'either' (the [-WH] counterpart to 'whether') is identical in form to *albo* 'or2' ('neither' and 'nor' are identical too, but I won't discuss it here).¹⁰

(22) **Albo** Jan przyjedzie w sobotę **albo** przyjedzie w niedzielę.
Either Jan will.arrive in Saturday or2 will.arrive in Sunday

¹⁰ Example (30) is a counterexample to an alternative analysis that claims that *czy* 'or1' only coordinates clauses, and *albo* 'or2' only coordinates phrases that are smaller than clause.

‘Either Jan will arrive on Saturday or he will arrive on Sunday.’

I propose that the appearance of the coordinator ‘or’ depends on the initial coordinator it has been local to. ‘Or’ appears as *czy* ‘or1’ if and only if it has been local to *czy* ‘whether’, and as *albo* ‘or2’ if and only if it has been local to *albo* ‘either’. In (19), *czy* ‘whether’ must have been the sister of the temporal DisjP formed by *czy* ‘or1’, so it has the Alt reading. Example (21) lacks the Alt reading because ‘whether’ cannot have originated as the sister of the temporal DisjP.

Furthermore, I propose that the morphological identity between ‘whether’ and ‘or’ is a reflex of an agreement relation between them. When ‘whether’ originates as the sister of a DisjP, it agrees with ‘or’, and copies its morphological feature to ‘or’ under agreement.

In the same way that ‘whether’ agrees with ‘or’, ‘either’ also agrees with ‘or’ it is local to, and copies its morphological features to ‘or’ under agreement. The surface form of ‘or’ can thus be taken as an indication of the origination site of ‘either’/‘whether’. ‘Or’ surfaces as *czy* under locality to ‘whether’, and as *albo* under locality to ‘either’.

In fact, this sharing of morphological feature exists in English as well. English has two morphologically related ‘or’s: *nor* appears when it has been local to *neither*, and *or* appears when it has not been local to *neither*. *Neither* has been analyzed as the [+NEG] counterpart of *either* (e.g., Hendriks 2004; den Dikken 2006). Den Dikken argues that similar to *whether*, *neither* originates as the sister of a DisjP and may move up later, triggering auxiliary inversion. Thus, the negative morphology on *nor* can be taken as a reflex of agreement between *neither* and *nor* when *neither* is local to *nor*.

I will now show that English *or* and *nor* have complementary distribution, in the same way that Polish ‘or’s do. First, note that *neither* can generate two readings. In one reading, *neither* is associated with a disjunction coordinated by *nor* (23). In the other reading, *neither* is used in a continuation to a previous negative statement about an individual, and says the same negative statement applies to another individual (24).

(23) There will be terrible weather all this weekend, therefore...
... neither will Pat arrive on Saturday nor on Sunday.

(24) Chris won’t arrive on Saturday...
... neither will Pat arrive on Saturday.

These two readings differ syntactically. In the first reading, *neither* originates as the sister of the DisjP coordinated by *nor*, while in the second reading, there is no overt *nor* (we might assume for now that there is a covert *nor*-phrase that *neither* originates from, so the underlying structure for (24) is *Neither will Pat (nor Chris) arrive on Saturday*). Following the generalization drawn from Polish, we’d expect the coordinator to appear as *nor* in the disjunction that *neither* originates in, and thus *nor* and *or* are in complementary distribution. Since in the first reading *neither*

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starts from the disjunction, that DisjP must be coordinated by *nor*, not *or* (25).¹¹ In the second reading, *neither* does not originate from any overt disjunction, so any overt disjunction cannot be coordinated by *nor* (26):

(25) There will be terrible weather all this weekend, therefore...
... neither will Pat arrive on Saturday *or/nor on Sunday.

(26) Chris won't arrive on Saturday or on Sunday...
... neither will Pat arrive on Saturday or/*nor on Sunday.

If we generalize beyond *neither*, and claim that English *whether* also agrees with *or* (despite no overt shared morphology), this provides an answer to how pied-piping occurs in English and Polish. As I have argued, 'whether'/'neither'/'either' agrees with 'or'. For example, as Polish *czy* 'whether' agrees with 'or', it spreads its [+WH] feature to 'or', which then projects the [+WH] feature to the entire DisjP. As the interrogative C probes for the [+WH] feature, the entire DisjP and its specifier 'whether' are both eligible goals and equidistant to the C probe because of the [+WH] feature on them (Pesetsky and Torrego 2001). If C agrees with the DisjP, the entire DisjP moves to Spec, CP, creating pied-piping effects. If C agrees with 'whether' alone, 'whether' moves by itself.

By pooling 'neither' and 'whether' together, this analysis makes a prediction: *neither* should also be able to pied-pipe. As the entire DisjP inherits the [+NEG] feature through agreement between *neither* and *nor*, the entire DisjP and *neither* are equidistant to the probe for [+NEG]. This prediction is borne out:

(27) There will be terrible weather all this weekend, therefore...
a. *No pied-piping*
... [neither]_i will Pat arrive t_i on Saturday nor on Sunday.
b. *Pied-piping*
... [neither on Saturday nor on Sunday]_i will Pat arrive t_i.

In (27b), *neither* and the DisjP appear to the left of C⁰, an indication that they occupy Spec, CP, and the DisjP is pied-piped by *neither*.

4. Conclusion

In addition to the observation that polar DisjP cannot immediately follow *if*, this paper has made the novel observation that temporal DisjP can't immediately follow *if* either to derive the relevant Alt reading. This puzzle can be subsumed under the generalization that topicalized phrases may not contain a *wh*-trace. *Whether*-questions are different because they have another parse in which *whether* pied-pipes the DisjP, putting its alternatives under question. Then I showed that Polish 'whether' and English *neither* can pied-pipe, too. The possibility of pied-piping is created by the agreement between 'whether'/'neither' and 'or'.

¹¹ Some speakers allow the coordinator to appear as *or* when it is local to *neither* (possibly because *neither ... nor ...* is a somewhat archaic construction, and is lost in some speakers' grammar), so they accept both *nor* and *or* for (25). But for speakers who require *neither ... nor/*or ...*, they only accept *nor* for (25).

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