GENERALIZING VON STECHOW'S PROBLEM*

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1 Introduction

As is well known, *which*-phrases in embedded interrogatives give rise to the *de re*/*de dicto* ambiguity (Groenendijk and Stokhof 1982, and much subsequent work). The following scenario-sentence pair, for example, illustrates the possibility of the *de re* reading:

(1) **The party**. *We are at a party, and we know Abe, Bob, and Cal are the only married men. Lisa mistakenly thinks they are single, but she knows that Abe and Bob but not Cal are outside. You ask if anyone knows the identity of the husbands who are outside. I reply*:
Lisa knows which husbands are outside. TRUE

Lisa has mistaken beliefs about who is married, yet the sentence in (1) can still be judged as true. Thus, it seems that this sentence has a reading that can be paraphrased as follows, where *husband* is able to escape the scope of *know*:

(2) For any *x*, if *x* is a husband, then Lisa knows whether *x* is outside.

Now, consider sentence (3), where *husband* is part of a phrase being pied-piped by *who*. In contrast to (1), no English speaker would ever judge (3) to be true in our party scenario—now it seems to be entailed that Lisa has knowledge about which man is married to who. The reading in (2) is then unavailable, and the sentence must instead be interpreted as (4), where *husband* is within the scope of *know*.

(3) Lisa knows whose husband is outside. NOT TRUE in **the party**

(4) For any *x*, then Lisa knows whether *x*'s husband is outside.

The data above exemplifies a constraint first observed by von Stechow (1996): pied-piped material must always be interpreted *de dicto*. This is a rather surprising constraint, as DPs can often be interpreted *de re* relative to some intensional operator no matter how deeply embedded

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they are within their prejacent. The main issue is that analyses of interrogatives that can account for *de re* readings of *wh*-restrictors often end up also predicting *de re* readings for pied-piped material. Following Demirok (2019), I refer to this puzzle as *von Stechow's problem*.

The main goal of this short paper is to disentangle Stechow's problem from pied-piping. I argue that von Stechow's observation is in fact a special case of a more general constraint: a DP containing a *wh*-trace must be interpreted *de dicto*, where "*wh*-trace" is a term I use here to refer to gaps associated with *wh*-phrases or the position in which a *wh*-phrase is pronounced.

The argument in favor of this claim is rather straightforward. Consider the sentences in (5), which both require *capital* to be interpreted *de dicto*. That the *de re* reading is unavailable in (5a) follows von Stechow's generalization, but (5b) involves no pied-piping. Nonetheless, our analyses of interrogatives predict the unattested *de re* reading to be possible for (5b) for the same reasons they are predicted for (5a). I take this to show that it is misguided to tie one's account of von Stechow's problem directly to pied-piping, and that a more general solution is needed.

(5) a. Which country's capital did Ann visit?
b. Which country did Ann visit the capital of?

After presenting this generalized version of von Stechow's problem, I suggest a possible solution to it. I argue that, if we adhere to scope-based theories of intensionality, we can block unattested *de re* readings by simply re-thinking how the pieces of Karttunen's (1977) analysis of interrogatives come together. The core of the idea is that *wh*-phrases are a kind of intensional operator—or rather, that they are contained within one. Full discussion of the consequences of such a move will unfortunately have to be delayed to future work.

The paper is organized as follows: §2 discusses in more detail the semantic problems caused by pied-piping in interrogatives; in §3, I show that the same issues arise in interrogatives *without* pied-piping; §4 sketches a solution to von Stechow's problem; §5 concludes.

2 The problem of pied-piping

2.1 Interpreting interrogatives & accounting for *de re* restrictors

The problem identified by von Stechow is present in nearly all semantic analyses of interrogatives that can also account for *de re* interpretations of *wh*-restrictors—the one exception being Demirok 2019, which was explicitly developed to account for this problem. Here, I adopt Karttunen's (1977) analysis as implemented by Irene Heim in a series of lecture notes (see, e.g., Cresti 1995).

Following Hamblin (1973), interrogatives denote sets of propositions, i.e., sets of possible answers. To account for *de re* restrictors, we follow Karttunen (1977) in taking interrogatives to have contingent denotations: for example, the interrogative in (6) denotes the set of all propositions of the form *x is outside*, where *x* is someone's husband *at the world of evaluation*.

(6) $[\![\text{which husband (of someone) is outside}]\!]^w = \{\ (\lambda v.\ \mathbf{outside}_v(x)) \mid \exists z.\ \mathbf{husband}_w(z)(x)\ \}$

The key idea in Karttunen (1977) is sentences like the one above are interpreted via the interaction of *two* operations, which are are performed by the interrogative complementizer $C_?$ and by *wh*-phrases. First, $C_?$ creates a set of propositions—the set containing its sister's intention:

(7) $[\![C_?]\!]^w = \lambda p_{st}.\ \{\ p\ \}$

The *wh*-phrase is an existential quantifier that then binds a variable from outside the scope of $C_?$, potentially yielding a set of multiple answers:

(8) $[\![\text{which NP}]\!]^w = \lambda m_{e(st)t}.\ \{\ p \mid \exists x \in [\![\text{NP}]\!]^w.\ p \in m(x)\ \}$

The LF of a basic interrogative is given in (9), and its interpretation proceeds as in (10).

(9) $[_{\text{CP}}$ which husband λ_x $C_?$ $[_{\text{TP}}$ *x* is outside$]]$

(10) $$\begin{aligned}[\![(9)]\!]^w &= [\![\text{which husband}]\!]^w(\lambda x.\ [\![C_?]\!]^w(\lambda v.\ [\![\text{outside}]\!]^v(x))) \\ &= [\![\text{which husband}]\!]^w(\lambda x.\ \{\ (\lambda v.\ [\![\text{outside}]\!]^v(x))\ \}) \\ &= \{\ p \mid \exists x \in [\![\text{husband}]\!]^w.\ p \in \{\ (\lambda v.\ [\![\text{outside}]\!]^w(x))\ \}\ \} \\ &= \{\ (\lambda v.\ \textbf{outside}_v(x)) \mid \exists z.\ \textbf{husband}_w(z)(x)\ \}\end{aligned}$$

This analysis of interrogatives allows us to easily account for the *de re* readings of *wh*-restrictors (*de dicto* readings are not discussed here). I show this with the following simplified meaning for question-embedding *know*, where to know Q is to know all true answers to Q:

(11) $[\![\text{Lisa knows Q}]\!]^w = \forall p \in [\![\text{Q}]\!]^w.\ [\![\text{know}]\!]^w(p)([\![\text{Lisa}]\!]^w)$

Importantly, *know* composes with the extension Q: this is the escape hatch that derives the *de re* readings, since *wh*-restrictors are evaluated relative to the same world parameter as the question-embedder. The truth of the sentence *Lisa knows which husband came*, then, does not depend on Lisa knowing who the husbands are: as shown in (12), Lisa knows which husband is outside when she knows all true propositions of the form *x is outside*, where *x* is someone's husband.

(12) $$\begin{aligned}&[\![\text{Lisa knows which husband is outside}]\!]^w \\ &= \forall p \in \{\ (\lambda v.\ \textbf{outside}_v(x)) \mid \exists z.\ \textbf{husband}_w(z)(x)\ \}.\ p(w) \rightarrow \textbf{know}_w(p)(\textbf{lisa}) \\ &= \forall x.\ (\exists z.\ \textbf{husband}_w(z)(x)) \wedge \textbf{outside}_{\text{w}}(x) \rightarrow \textbf{know}_w(\lambda v.\ \textbf{outside}_v(x))(\textbf{lisa})\end{aligned}$$

From this proposal, it follows that $C_?$ is the operator that determines what is interpreted under the scope of *know*. The prejacent of $C_?$ is often referred to as the question's *nucleus*. Anything that is within the question's nucleus is part of the question's answers, and the question-embedding rule in (11) states that *know* only scopes over *answers* rather than the question itself. Thus, because *husband* outscopes $C_?$, it is not interpreted as a part of the question's answers and is able to be interpreted *de re* without ever leaving the embedded clause.

2.2 Interpreting interrogatives with pied-piping

We now turn to the issue of pied-piping. Consider the interrogative in (13), where *who* pied-pipes a possessed DP to Spec,CP. The LF in (14) is not interpretable given our setup so far: because *who* must compose with a function of type $e(st)t$, it must take scope outside of the pied-piped phrase.

(13) Whose husband is outside?

(14) [[who]'s husband] λ_x $C_?$ $[_{\text{TP}}$ t_x is outside]

The most straightforward solution would be to have *who* QR out of the pied-piped phrase:

(15) who λ_x [*x*'s husband] λ_{y} $C_?$ $[_{\text{TP}}$ *y* is outside]

We have now fallen into the trap: even though the LF above is interpretable, it yields the unattested reading where *husband* is interpreted *de re*. This follows from the fact that *husband* is not within

the question's nucleus. The unwelcome result is that (15) is interpreted as the interrogative *Which husband is outside?*, a reading which is completely unavailable for (13):

(16) $[\![(15)]\!]^w = \{\ (\lambda v.\ \textbf{outside}_v(\iota y.\ \textbf{husband}_w(z)(y))) \mid z \in D\ \}$
$= \{\ (\lambda v.\ \textbf{outside}_v(x)) \mid \exists z.\ x = (\iota y.\ \textbf{husband}_w(z)(y))\ \}$

In order to yield the attested reading of (13), the pied-piped material must reconstruct under the scope of $C_?$, as in (17). Since *husband* is now part of the question's nucleus, we get the attested *de dicto* reading, shown in (17).

(17) who λ_x $C_?$ [$_{TP}$ [x's husband] is outside]

(18) $[\![(17)]\!]^w = \{\ (\lambda v.\ \textbf{outside}_v(\iota y.\ \textbf{husband}_v(z)(y))) \mid z \in D\ \}$

As already stated in the introduction, this problem was first observed by von Stechow (1996). His solution was to claim that pied-piped *obligatory* reconstructs. Demirok (2019), however, raises two issues for such a proposal. First, it is unclear *why* reconstruction should be obligatory—the LF in (15) does not seem to violate any known constraint. Furthermore, von Stechow's account of the puzzle only works within the standard scope theory of intensionality. For example, within the theory of intensionality of Percus (2000), where world variables are syntactically represented, reconstruction of pied-piped phrases does not force *de re* interpretations. As shown below, *x's husband* may reconstruct to Spec,TP and still be interpreted *de re* if its world argument is bound by a higher λ-operator:

(19) λ_w who-w λ_x $C_?$ λ_v [$_{TP}$ [x's husband-w] is outside-v]

In light of this, Demirok (2019) proposes his own account of von Stechow's problem, which has two key ingredients: (i) the scope theory of intensionality (specifically, the one proposed in Keshet 2010), and (ii) the semantic theory of pied-piping in Charlow 2019. In his proposal, pied-piping is never syntactically undone, which is what was assumed above. Instead, *wh*-phrases scope within pied-piped phrases, and the interpretation proceeds in a way that guarantees that pied-piped material is always semantically reconstructed. Despite its elegance and empirical adequacy, in the next section I argue that it is a mistake to directly tie von Stechow's problem to pied-piping.

3 Beyond pied-piping

The data below illustrate the puzzle introduced at the beginning of this paper: while *wh*-restrictors can be interpreted *de re*, pied-piped material cannot.

(20) **Ann's trip**. *Lisa knows Ann visited Paris and not Rome, but she thinks neither city is a capital. You ask me if Lisa knows anything about Ann's trip and I tell you*:
   a. Lisa knows which capital Ann visited. TRUE
   b. Lisa knows which country's capital Ann visited. NOT TRUE

But now consider (21), an interrogative that involves no pied-piping. Although DPs within interrogative clauses can typically be interpreted *de re*, the fact that (21) is not true in **Ann's trip** shows that *the capital of* must be interpreted *de dicto*—just like in sentences involving pied-piping.

(21) Lisa knows which country Ann visited the capital of. NOT TRUE in **Ann's trip**

Sentence (21) raises a problem very much akin to von Stechow's problem. In (22), I show two LFs that generate the unattested interpretation, each corresponding to a particular approach to intensionality. Under the traditional scope theory of intensionality, *the capital of* could take scope over $C_?$ as in (22a). Under the world-variable approach, the world pronoun of *capital* could simply be bound by a higher operator, as in (22b). Both LFs are mapped to the question denotation in (23), which is the denotation of *Which capital did Ann visit?*.

(22) a. which country λ_x [the capital of x] λ_y $C_?$ [Ann visited y]

b. λ_w which country-w λ_x $C_?$ λ_v [Ann visited-v [the capital-w of x]]

(23) $\{ (\lambda v.\ \mathbf{visited}_v(x)(\mathbf{ann})) \mid \exists z \in \mathbf{country}_w.\ x = (\iota y.\ \mathbf{capital}_w(z)(y)) \}$

One could attempt to block the LF in (22a) from being generated by postulating some syntactic constraint against having any kind of DP in Spec,CP other than *wh*-phrases. However, as pointed out by Demirok (2019), such a constraint would incorrectly block *any* DP within an interrogative from being interpreted *de re*. Thus, there is no obvious reason as to why (22a) should be ruled out.

The unavailability of the *de re* reading of capital in (21) is also not due to some general constraint against interpreting DPs containing traces. Consider the following sentence, for example, which does have a reading where *the capital of* is interpreted *de re* relative to *think*:

(24) *Lisa has been telling everyone that Ann visited Paris, but she doesn't know Paris is a capital or that it is in France. You ask me which country I would like to visit. I want to visit France, and because we have been hearing Lisa talk about Ann visiting Paris so much, I answer*:

I want to visit the country that Lisa thinks Ann visited the capital of.

This problem, furthermore, arises regardless of the the nature of the *wh*-dependency. For example, we also see it with *wh*-in-situ. The two questions in (25) have clearly different meanings, but if *capital* could be interpreted *de re* in (25a), it would have a reading equivalent to (25b). Since movement out of *the capital of* is possible, there is no reason to believe that this sentence involves any kind of covert pied-piping. This datapoint, then, falls outside the scope of von Stechow's original generalization.

(25) a. Who visited the capital of which country?

b. Who visited which capital of a country?

We also find this problem in structures that do not involve movement at all. Brazilian Portuguese, for example, has a strategy for creating *wh*-interrogatives via resumptive pronouns. Both interrogatives in (26) and (27) are grammatical, but they mean different things, as their English translations suggest. Nonetheless, if (28) was a possible LF for (27), it would yield the same interpretation as (26).

(26) [Qual capital]$_i$ a Ana ficou doente depois que ela visitou ela$_i$?
which capital.FEM the Ana became sick after that she visited she
'What is the capital x s.t. Ana became sick after she visited x?'

(27) [Qual país]$_i$ a Ana ficou doente depois que ela visitou a capital d-ele$_i$?
which country.MASC the Ana became sick after that she visited the capital of-he
'What is the country x s.t. Ana became sick after she visited x's capital?'

(28) λ_w which country-w λ_x C$_?$ λ_v [Ana became.sick-v [after she visited-v [the capital-$\underline{w}$ of x]]]

I thus propose the following generalization: a DP containing a *wh*-trace must be interpreted *de dicto*, where a *wh*-trace is here understood as the variable bound by a *wh*-phrase that is associated with this *wh*-phrase's thematic role (e.g., a gap in the case of *wh*-movement, the position where the *wh*-phrase is pronounced in the case of *wh*-in-situ). Crucially, this new generalization encompasses von Stechow's original formulation in terms of pied-piping, which means that a proposal that is able to account for it will explain both von Stechow's original data and the new data presented here. However, analyses of von Stechow's problem that directly tie it to pied-piping—such as Demirok 2019—are unable to account for the data involving sub-extraction.

Such a constraint was already anticipated in Sudo (2017), who observed that restrictors in nested *which*-phrases must also be interpreted *de dicto*. For example, in the following interrogative, the relation denoted *Russian novel by* must form part of the question's answer:

(29) Which Russian novel by who is on the table?

Sudo suggests that this ban on *de re* readings could follow from the fact that *wh*-phrases must always bind a variable in the question's nucleus. This statement is not restrictive enough, however. Consider (30), where *mother* must be interpreted *de dicto* (the sentence cannot mean *Which mother of a boy took him home?*). Despite this, Sudo's condition could be satisfied even if *mother* was interpreted *de re*, since *which boy* binds *him*. My formulation in terms of the notion of "*wh*-trace" is meant to cover cases such as these.

(30) Which boy$_0$'s mother took him$_0$ home?

4 A solution?

I believe that the source of Stechow's problem is the division of labor between the *wh*-phrase and C$_?$: because these two operators are syntactically independent, DPs containing *wh*-traces can always scope between them, as shown in (31), and yield the unattested *de re* readings.

(31) $*$ *wh* λ_x [$_{\text{DP}}$ $\ldots x \ldots$] λ_{y} C$_?$ [$_{\text{TP}}$ $\ldots y \ldots$]

I now explore a re-thinking of how the pieces of Karttunen's (1977) proposal are lexicalized in order to ban such configurations from being generated.

First, however, a note on the theory of intensionality I adopt. Perhaps one of the most interesting facts about von Stechow's problem is that it is one of the few constraints that block full DPs from being interpreted *de re*—such readings are often always available, no matter how deeply embedded the DP is. I thus side with Demirok (2019) that a solution to this puzzle requires a more restrictive approach to intensionality than Percus (2000). Here, I adhere the traditional version scope theory of intensionality, despite its empirical shortcomings. However, the version of Keshet (2010), which overcomes these issues, would yield the same results.

My proposal is to dispense with the idea that question's nucleus is determined by C$_?$. Instead, I propose that this is done by an operator WH, which is attached directly to *wh*-phrases, as shown in (32). Its denotation, given in (33), is built upon our old entry for C$_?$. Since everything else remains the same, we are not departing too much from Karttunen 1977.

(32) [$_{wh\text{P}}$ WH who]

(33) $[\![\text{WH}]\!]^w = \lambda x_e.\lambda \mathscr{P}_{set}.\ [\![\text{C}_?]\!]^w(\lambda v.\ \mathscr{P}(v)(x))$
$= \lambda x_e.\lambda \mathscr{P}_{set}.\ \{\ \lambda v.\ \mathscr{P}(v)(x)\ \}$

In (34), we see how a simple interrogative clause is interpreted within this proposal. Because a *wh*-phrase is not interpretable within WHP, it must move out of it as in (34a). Interpretation proceeds in a straightforward manner, not too different from before, as can be seen in (34b).

(34) Who is outside?

a. who λ_x [WH x] λ_y C [y is outside]

b. $[\![\text{CP}]\!]^w = [\![\text{who}]\!]^w(\lambda x.\ [\![\text{WH}]\!]^w(x)(\lambda v.\ [\![\text{outside}]\!]^v))$
$= [\![\text{who}]\!]^w(\lambda x.\ [\![\text{C}_?]\!]^w(\lambda v.\ [\![\text{outside}]\!]^v(x)))$
$= \{\ (\lambda v.\ \mathbf{outside}_v(x)) \mid x \in D\ \}$

At first glance, this may appear to be a restatement of Karttunen with a more cumbersome syntax. But consider the following interrogative and its LF after *wh*-movement:

(35) a. Whose husband is outside?

b. [[WH who]'s husband] λ_z C [z is outside]

Neither WH or *who* are interpretable in these positions, so we must apply QR twice as shown in (36), yielding the meaning in (37). Since the question's nucleus is now determined by WH, the pied-piped phrase is interpreted *de dicto* despite not being reconstructed.

(36) who λ_x [WH x] λ_y [y's husband] λ_z C [z is outside]

(37) $[\![(36)]\!]^w = [\![\text{who}]\!]^w(\lambda x.\ [\![\text{WH}]\!]^w(x)(\lambda v.\lambda y.\ \mathbf{outside}_v(\iota z.\ \mathbf{husband}_v(y)(z))))$
$= \{\ (\lambda v.\ \mathbf{outside}_v(\iota z.\ \mathbf{husband}_v(x)(z))) \mid x \in D\ \}$

The above shows that this new proposal can yield the desired interpretation for interrogatives with pied-piping—but can it block the unattested *de re* readings? To derive such readings, we would need the pied-piped phrase to scope out of the question's nucleus, i.e., out of the scope of WH. This would require a kind of LF remnant movement:

(38) $*$ [y's husband] λ_a who λ_x [WH x] λ_y a λ_z [z is outside]

This LF, however, is uninterpretable, since it contains an unbound trace. Therefore, without any additional constraints, we have solved von Stechow's problem.

It is important to stress that we would still want to block this kind of LF remnant movement even if we had a more powerful semantic component capable of interpreting LFs like (38). For example, such an operation would incorrectly allow for *teacher* to be interpreted *de dicto* while *father* is interpreted *de re*, since (40) would be a possible LF (that such readings are unavailable was first observed in Romoli and Sudo 2008).

(39) *Lisa mistakenly thinks the students are teachers and not students, and that their fathers are their supervisors. She thinks the fathers are all outside.*

Lisa thinks that every teacher's father is outside. FALSE

(40) $*$ [z's father] λ_a Lisa thinks that [every teacher λ_z a is outside]

The idea, then, is that pied-piped phrases must be interpreted *de dicto* because WH will always bind a variable within them and freeze their scope under it. It is easy to see that the proposal can

also cover cases that do not involve pied-piping, such as (41). Since WH binds a trace embedded within *the capital of*, this DP must be interpreted *de dicto*, as in (41a). To get a *de re* reading, we would need *capital of* to outscope WH, as in (41b), which again yields an uninterpretable LF.

(41) Which country did Ann visit the capital of?
   a. which country λ_x [WH x] λ_y C [Ann visit [the capital of y]]
   b. $*$ [the capital of y] λ_z which country λ_x [WH x] λ_y C [Ann visit z]

The proposal can also capture why the constraint is on DPs with *wh*-traces rather than DPs with variables bound by *wh*-phrases. In the sentence-scenario pair in (42), we see that *her husband*, a DP bound by a *wh*-phrase, can be interpreted *de re*. We can account for this reading because this pronoun may be bound by the *wh*-phrase itself rather than by WH, as shown in (43).

(42) *Ann is married to Bob and Cleo is married to Dan. Lisa doesn't know about this, but she knows that Ann saw Beth and Cleo didn't see Dan.*
   Lisa knows which woman saw her husband. TRUE

(43) which woman λ_x [her$_x$ husband] λ_z [WH x] λ_y C [y saw z]

Such derivations are not possible in interrogatives with pied-piping due to how movement works: a WHP that moves out of a pied-piped phrase must bind its own trace.

5 Concluding remarks

This paper argued that what is known as von Stechow's problem is not exclusively a problem of pied-piping—the problem occurs whenever a *wh*-trace is within another DP. Therefore, accounts that focus too much on pied-piping are unable to account for the puzzle in its full generality.

Aside from this empirical contribution, I also sketched a possible solution to this puzzle. This proposal is rather conservative: the key idea is to reorganize the components of Karttunen's (1977) analysis of questions in such a way that *wh*-phrases—or rather, the constituent containing them—act as an intensional operator. There are many consequences that need to be further worked out, however. For example, the proposal as stated only yields *de re* readings of restrictors and says nothing about *de dicto* readings. Furthermore, the current proposal predicts that there will be as many WH-operators in a clause as there are *wh*-phrases. This makes it difficult to interpret multiple *wh*-interrogatives, which need only one instance of WH/C$_?$. I leave these issues for future work.

References

Charlow, Simon. 2019. The scope of alternatives: Indefiniteness and islands 43:427–472. URL http://dx.doi.org/10.1007/s10988-019-09278-3.

Cresti, Diana. 1995. Extraction and reconstruction 3:79–122. URL http://dx.doi.org/10.1007/BF01252885.

Demirok, Ömer. 2019. Scope theory revisited: Lessons from pied-piping in *Wh*-questions. Doctoral Dissertation.

Groenendijk, Jeroen, and Martin Stokhof. 1982. Semantic analysis of *Wh*-complements 5:175–233. URL https://doi.org/10.1007/BF00351052.

Hamblin, C. L. 1973. Questions in montague english 10:41–53.

Karttunen, Lauri. 1977. Syntax and semantics of questions 1:3–44. URL http://dx.doi.org/10.1007/BF00351935.

Keshet, Ezra. 2010. Split intensionality: A new scope theory of de re and de dicto. *Linguistics and Philosophy* 33:251–283.

Percus, Orin. 2000. Constraints on some other variables in syntax 8:173–229.

Romoli, Jacopo, and Yasutada Sudo. 2008. *De re/de dicto* ambiguity and presupposition projection. In *Proceedings of SuB13*, ed. Arndt Riester and Torgrim Solstad. Stuttgart. URL https://ojs.ub.uni-konstanz.de/sub/index.php/sub/article/view/563/509.

von Stechow, Arnim. 1996. Against LF pied-piping 4:57–110.

Sudo, Yasutada. 2017. De re readings of nest which-phrases in embedded questions 31.