On the syntax of multiple sluicing and what it tells us about *wh* scope taking

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Abstract

This paper takes as its starting point the observation that across many languages multiple sluicing obeys a clause-mate constraint. It develops an account of this constraint which is based on the assumption that covert *wh*-movement is clause bound and subject to superiority. With this analysis as background, the fact that the distribution of multiple sluicing is substantially narrower than that of multiple *wh*-questions, under both the single pair and the pair-list interpretation, then entails that there must be mechanisms for scoping in-situ *wh*-phrases that do not rely on covert *wh*-movement. While long distance cases are handled straightforwardly by existing theories, we develop a novel approach to pair-list readings in questions with quantifiers and in questions with superiority configurations. The analysis is couched in the functional approach to pair-list readings. The paper supports the claim that there is syntactic structure at the ellipsis site, that movement operations within the ellipsis site are subject to locality constraints, and that pair-list readings of multiple questions are rooted in functional readings.

Keywords: syntax, locality, sluicing, ellipsis, multiple sluicing, syntax-semantics interface, *wh*-scope, covert movement, *wh*-in-situ, multiple *wh*-questions

1 Introduction

This paper begins with the observation that multiple sluicing across many languages obeys a clause-mate condition: all remnants of multiple sluicing must originate in the same clause. This observation requires an explanation with cross-linguistic validity. Our explanation of it has three ingredients. First, multiple sluicing is a way of making covert *wh*-movement overt. Second, covert *wh*-movement is clause bound. Third, covert *wh*-movement is sensitive to superiority. These claims are independently supported.

Clearly, if covert *wh*-movement is clause bound, there must be at least one additional mechanism to interpret in-situ *wh*-phrases with long-distance scope. For single pair readings we adopt Reinhart's (1998) binding based proposal. For pair-list readings we end up with two mechanisms. Long-distance cases of covert scope taking are handled without covert *wh*-movement in the way proposed in Dayal 1996; Sternefeld 2001. However, since this mechanism does not generalize to pair-list readings in superiority violating questions, we introduce a separate mechanism for those cases. The latter is again based on binding. For reasons of space, we cannot discuss the question of whether both of these mechanisms are truly necessary and under what conditions a reduction might be feasible.

Our syntactic analysis, we believe, is an improvement on earlier work, which largely relied on language particular properties (such as Takahashi's 1994 idea that *wh*-cluster formation in Japanese is A-movement or Lasnik's 2014 idea that additional *wh*-phrases in multiple sluices in English are extraposed) or on mistaken assumptions about the readings of multiple sluices and multiple questions (Nishigauchi 1998). These accounts are therefore inherently incapable of capturing the cross-linguistic nature of the clause-mate condition.

Our semantic proposals are inspired on the one hand by Dayal 1996, who, building on her own prior work in Srivastav 1991a,b, argued for the appealing but overly strong position that all covert scope taking was strictly local in the same way that QR is local. On the other hand, we draw inspiration from Pesetsky 1987, who first floated the idea that there is more than one mechanism of covert scope taking. We increase the coverage of previous accounts by paying special attention to the fact that mechanisms not based on covert *wh*-movement must be found that are capable of deriving both single pair and pair-list interpretations.

The structure of the paper is as follows. Section 2 introduces our assumptions about the syntax of sluicing and documents the clause-mate condition. Section 3 introduces the three assumptions underpinning the account of the clause-mate condition mentioned above. Section 4 defends clause boundedness and sensitivity to

superiority of covert *wh*-movement. Section 5 lays out our proposal about the interpretive properties and mechanisms of covert *wh*-movement and of long-distance in-situ *wh* scope. Finally section 6 addresses the issue of how to generate pair-list readings in questions with quantifiers and superiority violating questions without covert *wh*-movement.

2 The curious locality of multiple sluicing

Sluicing is a form of clausal ellipsis (Ross 1969). Sluices have the syntactic distribution (Levin 1982; Merchant 2001; Ross 1969) and interpretation (Culicover and Jackendoff 2005; Ross 1969) of full *wh*-questions but are incomplete in that they consist only of a *wh*-phrase. The sluices in examples (1a-b) consist only of the word *what*:

(1) a. I just did something really exciting, but I am not going to tell you what.
b. Joe is reading, but god only knows what.

It will be useful to settle some terminology before proceeding.

(2) [John bought [a car]] but I don't know [[which one] ____]

[correlate] [remnant] ellipsis site

[antecedent] [sluice]

We refer to *which one* as the remnant. The clause intuitively the meaning of the elliptical question (*John bought a car*) is the antecedent. The indefinite (*a car*) whose identity is queried is the correlate. The gap immediately following the remnant, where the remainder of the question would come in a canonical *wh*-question, is the ellipsis site (E-site), and the clausal structure containing remnant and ellipsis site form the sluice.[1] Examples (2) and (1a) with an indefinite correlate whose identity is queried are called merger type sluices (Chung, Ladusaw, and McCloskey 1995). When there is no overt correlate in the antecedent, we speak of sprouting, (1b). When discussing theories of sluicing that assume the presence of unpronounced syntactic structure at the ellipsis site, we will use the term "pre-sluice" from Dayal and

[1]The distinction between remnant and sluice is important. The sluice is a clause (CP) while the remnant in (2) is a noun phrase (DP).

Schwarzschild (2010) to refer to the fully pronounced version of the sentence that gives rise to the sluice. A range of plausible pre-sluices for (2) is given in (3).

(3) a. which car he bought
b. which car it is

Ross, 1969 not only discovered that sluices have the category, distribution, and interpretation of interrogative clauses, he also discovered two further properties of sluicing that have set the agenda for subsequent research on sluicing.

First, Ross, 1969 noted that correlate and remnant must match in a number of properties. In particular, nominal remnants generally match in case with the antecedent (see Abels, 2017b; Levin, 1982; Merchant, 2001; Ross, 1969; Vicente, under review; Wood, Barros, and Sigurðsson, 2016 for discussion). We will refer to this observation as case connectivity.

Case connectivity is often taken as compelling evidence for two assumptions: that there is an unpronounced case assigner in the E-site and that the case assigner in the E-site is identical to the case assigner in the antecedent. These two assumptions lead fairly naturally to a theory of sluicing where antecedent and E-site are syntactically identical and clausal ellipsis is preceded by extraction of the remnant from the E-site by *wh*-movement.

However – and this is Ross' second crucial observation – while the hypothesized *wh*-movement operation at the E-site shares many properties with regular *wh*-movement (such as pied-piping properties), it appears to be insensitive to syntactic islands. This is illustrated by (4a), whose pre-sluice under Ross' syntactic identity account of sluicing is (4b). (4b) violates the complex NP constraint.

(4) a. They want to hire someone who speaks a Balkan language, but I don't know which (Balkan language).
b. *They want to hire someone who speaks a Balkan language, but I don't know which Balkan language they want to hire someone who speaks.

Culicover and Jackendoff, 2005; Ginzburg and Sag, 2000; Levin, 1982 take the apparent island insensitivity of sluicing to argue for the absence of syntactic structure at the E-site.

Proponents of syntactic identity accounts face the difficulty of explaining why movement within the E-site is insensitive to island effects (see Boeckx 2008; Hornstein, Lasnik, and Uriagereka 2007; Müller 2011) while proponents of accounts without syntactic structure at the E-site face the problem of explaining the case matching facts. The difficulties for both sides are compounded further by the observation that

island insensitivity seems to be selective (Abels 2011, 2017a,b; Barros 2014; Barros, Elliott, and Thoms 2014; Fox and Lasnik 2003; Griffiths and Lipták 2014; Lasnik 2001; Reinhart 1991; Winkler 2013).

A particularly perplexing observation concerning locality comes from the phenomenon at the heart of this paper, multiple sluicing, that is, from elliptical questions with more than one *wh*-remnant. The phenomenon is found in languages which otherwise have *wh*-in-situ, (5), single *wh*-fronting, (6), and multiple *wh*-fronting, (7) (see already Merchant 2001).

(5) Japanese (from Nishigauchi 1998, 121 ex. 1)
John-ga [dareka-ga nanika-o katta to] it-ta. Mary-wa [dare-ga
John-NOM someone-NOM something-ACC bought that said Mary-TOP who-NOM
nani-o ka] siri-tagat-te iru.
what-ACC Q know-want is
John said someone bought something. Mary wants to know who what.

(6) German
Jeder Student hat ein Buch gelesen, aber ich weiss nicht mehr wer welches.
every student has a book read, but I know no longer who which
Every student read a book, but I can remember which student which book.

(7) Slovenian (from Marušič and Žaucer 2013, 419 ex. 3a)
Vid je rekel, da je Rok predstavil nekomu nekoga, pa ne vem
Vid AUX said that AUX Rok introduce one.DAT one.ACC, but not know
komu koga.
who.DAT who.ACC
Vid said that Rok introduced someone to someone, but I don't know who to who.

In these languages, multiple sluicing obeys the following two generalizations:

(8) a. All remnants in multiple sluicing must originate in the same (finite) clause.
b. The clause in which the remnants originate may be inside of an island.

Examples (5)–(7) are acceptable and all obey the clause-mate condition, (8a). The German examples in (9) show that multiple sluices may not violate the clause-mate condition, (9a), but that the remnants may originate in a clause inside of an island, (9b).

(9) a. Fatal violation of the clause-mate condition:

*Vor jedem Vorfall hat ein Student behauptet, dass Maria mit
before each incident had a student claimed that Maria with
einem Professor geredet hatte, aber ich weiss nicht welcher Student
a professor talked had but I know not which student
mit welchem Professor
with which professor
Before each incident a student claimed that Maria had talked with a professor, but I don't know which student with which professor.

b. Unproblematic violation of the complex NP condition:
Ich kenne einen Lehrer, der jedem Kind ein Geschenk gegeben
I know a teacher who every.DAT child a.ACC present given
hat, aber ich weiss nicht genau welchem Kind welches Geschenk.
has but I know not exactly which.DAT child which.ACC present.
I know a teacher who gave a present to each child, but I can't remember which present to which child.

The clause-mate condition holds across a very broad range of languages. In addition to German, it applies in Japanese (see Takahashi, 1994, pp. 285–287; Nishigauchi, 1998; Abe, 2015, chapter 6, and below), and in Slovenian (Marušič and Žaucer 2013). It also holds in Dutch (A. Neeleman, p.c.), English (Lasnik 2014b), Brazilian Portuguese (Rodrigues, Nevins, and Vicente 2009), Spanish (Rodrigues, Nevins, and Vicente 2009), Italian (E. Callegari, p.c., who argues in Callegari 2015 that Italian does allow multiple questions, contra Calabrese 1984, but only in embedded contexts), Lithuanian (Adliene 2014), Bangla (Bhattacharya and Simpson 2012), Hindi, Greek (E. Molimpakis, A. Vergou, C. Vlachos, p.c.), Czech (J. Kaspar, I. Kucerova, P. Caha, p.c.), Norwegian (Ø. Nilsen, p.c.), Polish (D. Grabska, M. Dedan, p.c.), Russian (N. Slioussar, p.c.), Kîîtharaka (P. Muriungi, p.c.), Bulgarian (A. Koumbarou, p.c.) , and Hungarian (K. Szendroi, B. Szendroi, p.c.). The clause-mate condition is the main fact to be explained in this paper.

A few caveats are in order. Lasnik, 2014b notes that in Serbo-Croatian the clause-mate condition fails to hold for just those of his informants for whom it also fails to hold under regular multiple *wh*-fronting. These speakers' judgments suggest that overt multiple *wh*-movement can overcome the restriction, which we trace to covert *wh*-movement.[2] Similarly, Bhattacharya and Simpson (2012, 194 fn. 9 ex.

[2]A similar claim for Kashmiri, a multiple *wh*-fronting language where non clause-mates are possible in multiple *wh*-questions, can be found in Manetta 2017. The example of multiple sluicing violating the clause-mate constraint provided by Manetta is somewhat dubious, however: Manetta claims that multiple questions in Kashmiri generally disallow single pair readings. However, the

ii) observe that overt long movement of the correlate can overcome the clause-mate restriction in Bangla, suggesting that in Bangla, this type of long movement feeds covert *wh*-movement. These are descriptive counterexamples but unproblematic for the theory.

Furthermore, Nishigauchi 1998, 133–34 ex. 34 noticed the following counterexample to the clause-mate condition in Japanese: If a quantifier in the matrix clause binds the subject in the embedded clause, resulting in the bound subject pronoun and the *wh*-phrase being clause-mates, then multiple sluicing becomes possible across clauses. This counterexample to the clause-mate condition is quite systematic. The pattern can be reproduced in other languages including English (below), German, Hungarian (K. Szendrői, p.c.), Norwegian (Ø. Nilsen, p.c.), Italian (N. Grillo, p.c.), and Czech (P. Caha, I. Kučerova, p.c.).

(10) a. *Everybody claimed that Fred had talked to some professor, but I can't remember who to which professor.
b. Everybody$_k$ claimed that they$_k$ had talked to some professor, but I can't remember who to which professor.

Barros and Frank 2016, 2017a,b; Grano and Lasnik 2016 suggest that (10) is part of a larger pattern, a pattern where the clause-boundedness of a variety of processes including, for example, quantifier raising is suspended under certain circumstances. Grano and Lasnik 2016 investigate the effect of bound subject pronouns, Barros and Frank 2016, 2017a,b claim that the effect is actually much broader.[3] Both sets of authors suggest that the difference between bound versus free subjects arises because binding shifts a locality boundary (phase), with the effect quantifier raising, multiple sluicing, etc., can overcome their usual clause boundedness. Under our approach, the additional *wh*-phrases in multiple sluicing reach their landing sites by clause bounded covert (except in ellipsis contexts) *wh*-movement. The fact that its clause boundedness can be modulated in the same way we observe for quantifier raising and other movement operations is welcome indirect evidence in favor of our proposal. For the sake of simplicity, we continue to talk about the clause-mate condition on multiple sluicing and the clause boundedness of covert *wh*-movement with the understanding

crucial multiple sluicing example violating the clause-mate constraint has a single-pair reading. The proper analysis of the example might therefore involve asyndetic coordination of two sluices rather than multiple sluicing.

[3]Barros and Frank 2016, 2017a,b observe that the approach to Nishigauchi's example in Abels and Dayal 2016 in terms of short paraphrases within the ellipsis site does not extend to all relevant cases.

that both can be modulated by the factors discussed in Barros and Frank 2016, 2017a,b; Grano and Lasnik 2016.

We are aware of only one true counterexample to the clause-mate condition: Sato (CamCoS 5, May 06 2016) claims that in Indonesian multiple *wh*-phrases can be separated not only by clause boundaries but even by islands and that either or both of the *wh*-phrases can strand prepositions. We have no insight to offer on Indonesian.

The clause-mate condition cannot be reconciled with non-syntactic approaches to sluicing. Under such accounts, sluicing is exempt from island effects, because there is no structure at the E-site. To interpret a sluice, a suitable interpretation must be found. No more, no less. In the case of multiple sluicing, this search should generally produce well-formed interpretations whether or not the remnants are clausemates. (11a) is a well-formed multiple question with a pair-list reading. The *wh*-phrases are separated by an island. The corresponding multiple sluice, (11b), is unacceptable; it violates the clause-mate condition.

(11) Jeder dieser Philosophen wird sich ärgern, wenn wir einen bestimmten
Every these philosophers will self annoy if we one particular
Linguisten einladen, aber ich weiss nicht,
linguist invite but I know not
Every one of these philosophers will be annoyed if we invite a particular linguist but I don't know

a. … welcher Philosoph sich ärgern wird, wenn wir welchen Linguisten
which philosopher self anger will if we which linguist
einladen.
invite
…which philosopher will be annoyed if we invite which linguist.

b. *… welcher (Philosoph) welchen (Linguisten)
which philosopher which linguist
…which (philosopher) which (linguist)

This problem for non-syntactic approaches is not an argument for syntactic identity accounts, however. The latter are based on the premise that, ceteris paribus, movement within the E-site is free from locality constraints. Such models therefore have little leeway to impose a clause-mate condition.

We follow instead the account of the island insensitivity of sluicing in Merchant (2001) (see also Abels, 2011, 2017a,b; Baker and Brame, 1972; Barros, 2014; Barros, Elliott, and Thoms, 2014). The account is based on the assumption that there is syntactic structure at the E-site, however, the identity condition on ellipsis is

semantic instead of syntactic. Basically, the content of the E-site must entail and be entailed by the antecedent. Island violations can then be evaded by choosing appropriate paraphrases as pre-sluice at the E-site. Thus, the pre-sluice for (4a) is not the ungrammatical (4b) but rather one of the following:[4]

(12) Possible pre-sluices for (4a):

a. …which Balkan language they should speak.
b. …which Balkan language it is.

Similarly for the multiple sluicing examples above where the remnants originate inside of an island. We suggest that the pre-sluice for (9b) is (13).

(13) … welchem Kind er welches Geschenk gegeben hat
which.DAT child he which.ACC present given has
…which present he gave to which child

The island evasion approach assumes that constraints on movement are operative at the E-site, an assumption that will play a crucial role in our account of the clause-mate condition, while allowing island insensitivity when a suitable paraphrase of the antecedent is available as pre-sluice. The interested reader is referred to Abels 2017a; Barros, Elliott, and Thoms 2014 for detailed discussion and a defense of the island evasion approach.

This section has introduced the phenomenon of multiple sluicing and its two most important, cross-linguistically stable properties: the clause-mate condition and the island insensitivity of (single and multiple) sluicing. The clause-mate condition is the main fact to be explained in this paper. We adopted the evasion approach as the explanation of the second property. The next section introduces our explanation for the clause-mate condition.

3 The account of the clause-mate condition

Recall that we are positng the presence of syntactic structure subject to normal constraints at the E-site. We can then account for the existence of multiple sluicing and for the clause-mate condition if we assume that: (i) Movement of the additional

[4]We are aware of the fact that unrestricted versions of Merchant's (2001) theory fail to derive case connectivity (see Lasnik 2005). For possible solutions see Abels 2017b; Barros 2016; Chung 2013. Such unrestricted versions of the theory also face the too-many-paraphrases problem (see Abels 2017a; Chung, Ladusaw, and McCloskey 2006). We continue on the assumption that these open problems for island evasion will ultimately be solved.

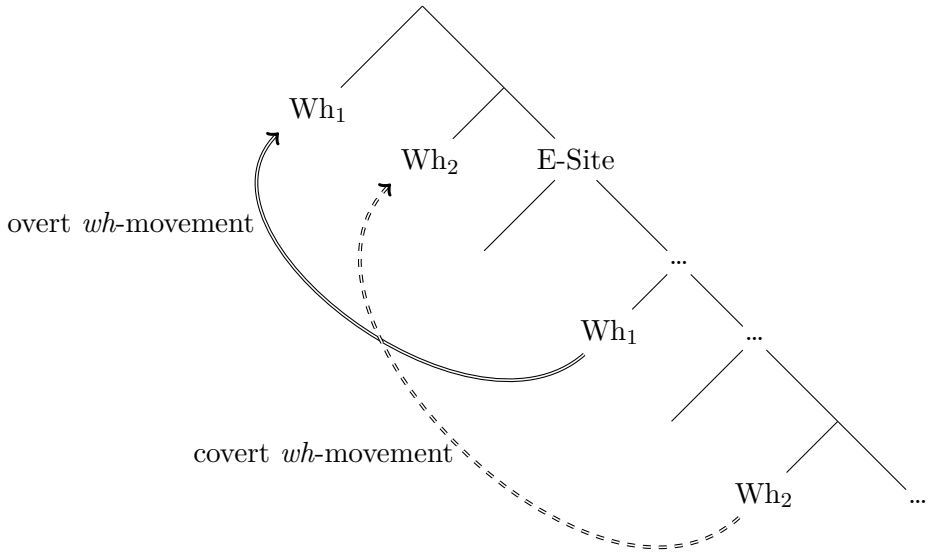
wh-phrases represents a normal syntactic movement operation, and (ii) movement of the additional *wh*-phrases is clause bound.[5] Later, it will be necessary to assume that this movement also obeys superiority.

We postulate, in other words, a clause bound movement operation affecting the additional *wh*-phrases. We will refer to this movement as covert *wh*-movement. In the following paragraphs, we give substance to our account of the clause-mate condition.

Before deriving the clause-mate condition on multiple sluicing, we need to address the question of how multiple sluicing is possible in the first place. The assumptions we have introduced so far lead us to assuming the following schematic structure for grammatical instances of multiple sluicing, where wh_1 and wh_2 originate in the same clause.

Wh$_1$ has undergone regular *wh*-movement. English being a single *wh*-fronting language, the movement of wh_2 is usually covert. Covert *wh*-movement targets a position in the left periphery outside of the ellipsis site.

(14)



If movement of wh_2 is usually covert, how can it become overt under sluicing? Under a single cycle model of syntax with a copy or multidominance view of movement, this is quite straightforward (see Gribanova and Manetta 2016; Manetta 2013;

[5]Movement of additional *wh*-phrases would thus be much like quantifier raising under the standard view, though see Syrett and Lidz 2011; Tanaka 2015; Wurmbrand 2015.

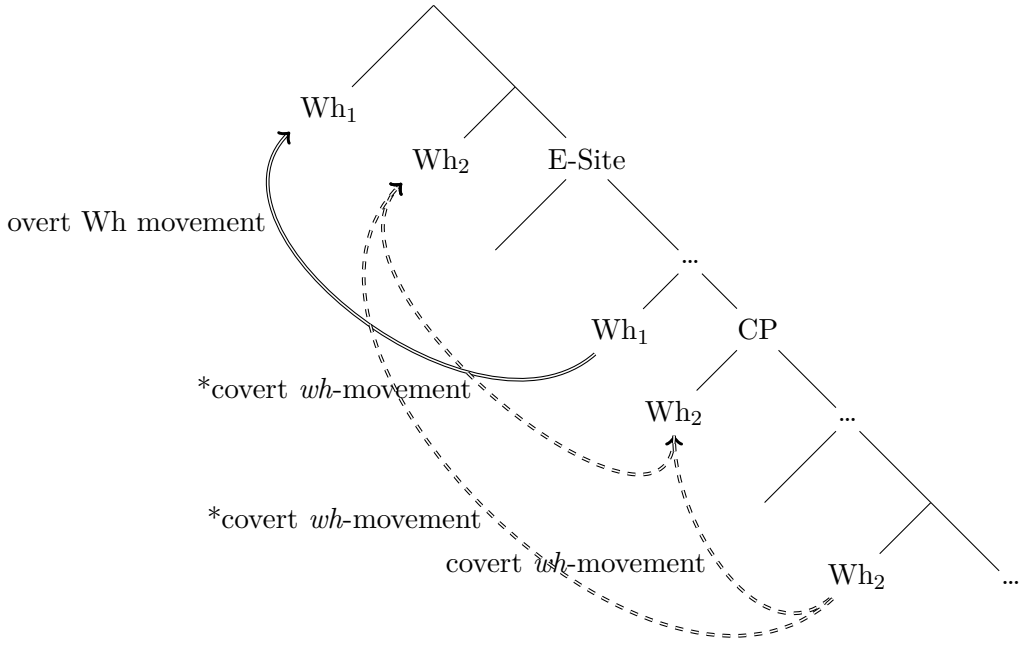
Ortega-Santos, Yoshida, and Nakao 2014; Richards 1997b, 2001). A general purpose chain pronunciation algorithm will make sure that for overt movement the highest copy/occurrence in a chain will be pronounced and for covert movement — the lowest available copy (see Gärtner 2002). If we approach ellipsis as PF non-pronunciation of the structure at the E-site, pronunciation of a covertly moved element outside of the E-site becomes the expected outcome: this is the lowest copy that remains after ellipsis.[6] We should note though that this approach as it stands predicts that covert movement can become overt in many more cases than it actually does. For example, the sketch here leads to the incorrect expectation that quantifier raising out of an elided VP should become visible when an object quantifier takes scope over the subject. We have no insights to contribute to the discussion of which covert movements can become overt under ellipsis and which ones cannot. On the view argued for here, movement of the second *wh*-phrase in multiple sluicing is neither PF movement (as proposed for fragments in Weir 2014) nor exceptional overt movement (as proposed for fragments in Shen to appear), but covert movement made overt by ellipsis.

We can now turn to the clause-mate condition on multiple sluicing.

Tree (15) represents two derivations for a multiple sluice violating the clause-mate condition (where CP is intended to signify the boundary of a tensed clause). Both derivations are straightforwardly ruled out. By assumption covert *wh*-movement is clause bounded. But both derivations violate the clause-boundedness of covert *wh*-movement: either in the form of successive cyclic movement or in the form of long one-fell-swoop movement.

[6] We will continue to refer to the movement of additional *wh*-phrases in multiple sluicing as *covert* wh-*movement*, despite the fact that it is exceptionally overt in those cases.

(15)



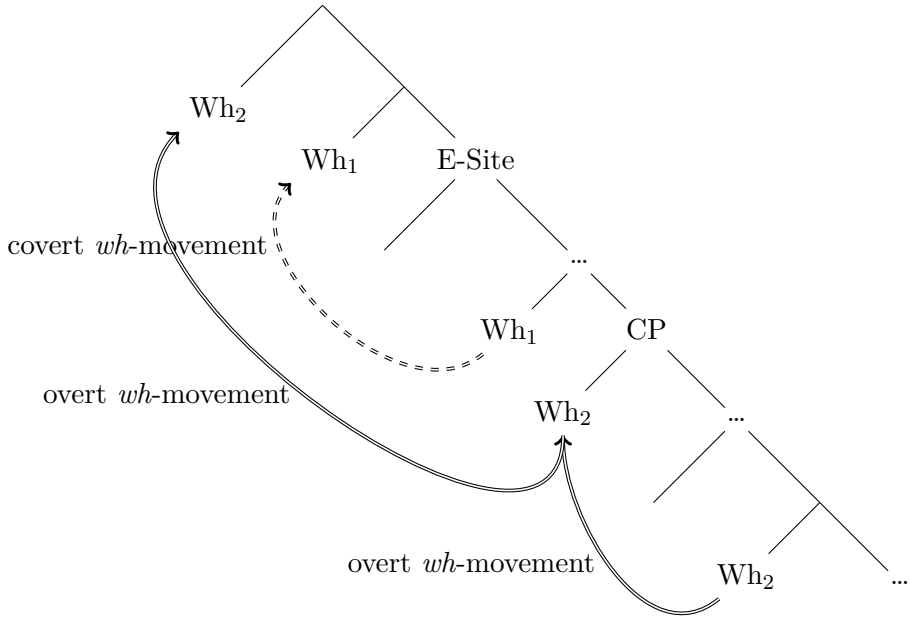
The more challenging structure to rule out is the one in (16). Here, overt *wh*-movement has been cyclic and covert *wh*-movement clause bound.[7]

[7]Lasnik 2014b fails to discuss or rule out the structures homologous to (16) under his account (replacing clause bounded covert *wh*-movement with clause bounded rightward extraposition), (ia). The example is much worse than Lasnik would expect. Indeed, given that Lasnik assumes that locality violations of *wh*-movement are repaired by ellipsis, the problem runs even deeper, as Wh_2 in (16) should be able to originate inside of an island. Clearly, this is a wrong prediction, as (ib) shows. (The discussion and account of the clause-mate condition of *wh*-stripping in Ortega-Santos, Yoshida, and Nakao (2014, pp. 78–79) suffers from the same shortcomings.)

(i) a. In each instance, Fred said *(?*to someone) that Sally bought a book, but I don't know which book to whom.

b. *In each case, the fact that some enthusiast had photographed Old Faithful proved useful to some researcher, though I couldn't tell you which enthusiast to which researcher.

(16)



Nothing in what we have said so far rules out structure (16). The two main properties distinguishing this illicit structure from the licit structure in (14) are the fact that overt *wh*-movement is cyclic in (16) and short in (14) and that overt *wh*-movement crosses the trace of covert *wh*- movement in (16) while in (14) covert *wh*-movement crosses the trace of overt *wh*-movement. We see no reason to exclude successive cyclic overt *wh*-movement, but note that the configuration in (16) represents a superiority configuration: Overt *wh*-movement crosses a c-commanding overtly unmoved *wh*-phrase.[8] We conjecture that it is this superiority configuration which is responsible for the ill-formedness of (16). To achieve this, we impose the following additional constraint:

(17) Only those *wh*-phrases may undergo covert *wh*-movement that have not been crossed by overt *wh*-movement.

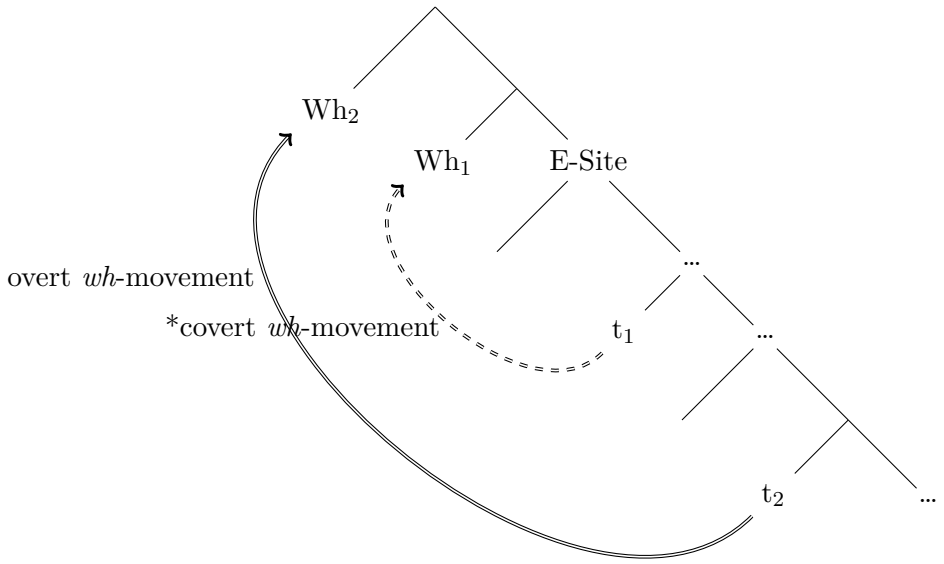
This condition, of course, is by no means novel. It comes directly from Pesetsky 2000. We review independent evidence for this constraint in section 4.1.

[8]The wording is deliberately circumspect. Standard superiority effects have well known exceptions. In particular, they disappear when both *wh*-phrases are D-linked. However, the clause-mate condition on multiple sluicing has no such exception for D-linked *wh*-phrases. We can therefore not treat the badness of (16) as a straightforward standard superiority effect. We do see a superiority configuration, though.

3.1 Multiple sluicing's surfeit of superiority

While our derivation of the clause-mate condition on multiple sluicing is now complete, we hasten to point out that (17) predicts that (18) should be as ill-formed as (16). This is so, because the trace of covert *wh*-movement is again crossed by overt *wh*-movement.

(18)



This expectation is borne out across an interesting range of languages. Consider the Dutch paradigm in (19)–(20). (19) shows that there is no superiority effect in a multiple *wh*-question when both *wh*-phrases are D-linked. Example (20) provides sluicing counterparts of these examples. As predicted by (17), a superiority effect shows up under sluicing.[9]

(19) Dutch (A. Neeleman, P. Ackema, H. van de Koot, H. Zeijlstra, p.c.)

[9]Superiority obeying and superiority violating questions have different pair list interpretations. Anticipating our discussion in later sections, one can describe the difference in terms of which *wh*-element sets the domain of the function and which sets the range. A wide scope universal in the antecedent corresponds to the *wh*-phrase setting the domain, a narrow scope existential in the antecedent corresponds to the *wh*-phrase setting the range. The antecedents in examples (19) and (20) leave it open how the functional relation is constructed and should therefore be semantically compatible with both interpretations. See Barros and Kotek 2017 for further discussion.

a. Ik vraag me af welk meisje de verdachte welk boek gegeven heeft.
I ask me prt which girl the suspect which book given has
b. Ik vraag me af welk boek welk meisje de verdachte gegeven heeft.
I ask me prt which book which girl the suspect given has
I wonder which girl gave the suspect which book.

(20) (P. Ackema, H. van de Koot, H. Zeijlstra, p.c.)

a. Bij elke gelegenheid gaf een meisje de verdachte een boek, maar ik
in each case gave one girl the suspect one book, but I
weet niet welk meisje welk boek.
know not which girl which book
In each case one girl gave the suspect a book, but I don't know which girl which book.
b. *Bij elke gelegenheid gaf een meisje de verdachte een boek, maar ik
in each case gave one girl the suspect one book, but I
weet niet welk boek welk meisje.
know not which book which girl

Essentially the same situation we find in Dutch appears to hold in English (Barros and Kotek 2017), in Norwegian (Ø. Nilsen, p.c.) and in Italian (N. Grillo, E. Callegari, p.c.). This is as expected, if covert *wh*-movement is subject to superiority.[10]

4 On the properties of covert *wh*-movement

In the previous section we relied crucially on the following two properties of covert *wh*-movement: (i) covert *wh*-movement is subject to superiority and (ii) covert *wh*-movement is clause bounded. Here we summarize independent evidence that (i) and (ii) hold.

4.1 On superiority

Pesetsky 2000 was the first to point out that that covert *wh*-movement is subject to superiority. He offers two pieces of evidence: Intervention effects and Antecedent

[10]The situation in languages where arguments can scramble across each other is somewhat more complicated but appears not to threaten the general picture painted here on the assumption that, at least in some of these languages, scrambling feeds *wh*-movement. See Barros and Kotek 2017; Bhattacharya and Simpson 2012; Grebenyova 2007, 2009; Scott 2012; Stjepanović 2003 for relevant discussion.

Contained Deletion. Regarding the first, he observes that in superiority obeying configurations like those in (21a)–(21c) both a single pair and a pair-list interpretation are accessible. However, in superiority violating configurations like (21d)–(21f), the pair-list reading disappears just in case there is an intervener (in the sense of Beck 1996) along the path between the crossed, in-situ *wh*-phrase and its scope: (21f). In other words, Pesetsky claims that a *wh*-phrase is subject to intervention in case three things come together: The *wh*-phrase is in situ, has been crossed by *wh*-movement, and is intended to support a pair-list interpretation.

(21) Based on Pesetsky 2000, p. 60

Superiority obeying configuration (no crossing)

a.	Which person read which book?	SP | PL
b.	Which person did not read which book?	SP | PL
c.	Which person didn't read which book?	SP | PL

Superiority violating configuration (crossing)

d.	Which book did which person read?	SP | PL
e.	Which book did which person not read?	SP | PL
f.	Which book didn't which person read?	SP | *PL

Pesetsky explains this generalization as follows: There are two paths to pair list readings. The first relies on covertly *wh*-moving the in-situ phrase. This movement is subject to superiority and therefore fails when the *wh*-phrase has been crossed. However, covert *wh*-movement is not subject to Beck-style intervention effects. The second path to pair list interpretations does not rely on moving the in-situ *wh*-phrase. It is not subject to superiority but it is subject to intervention effects. (Single pair readings are generated in ways immune both to superiority and to intervention effects.)

To further support this approach, Pesetsky shows that an in-situ *wh*-phrase may license ACD if it is not in a superiority violating configuration but may not license ACD if it is in a superiority violating configuration. The *wh*-phrase in situ in (22a) has not been crossed by overt *wh*-movement. It is therefore free to undergo covert *wh*-movement. The application of covert movement then allows successful ACD resolution without the regress problem.

(22) Pesetsky 2000, p. 30

a. I need to know which girl ____ ordered [which boy that Mary (also) did Δ] to congratulate Sarah.

b. I need to know for which girl x and for which boy y such that Mary ordered y to congratulate Sarah], x also ordered y to congratulate Sarah. [i.e., I need to know the girl-boy pairs such that both the girl and Mary ordered the boy to congratulate Sarah]

In (23a) by contrast, the in-situ *wh*-phrase has been crossed. Thus, it cannot undergo covert *wh*-movement and ACD resolution is blocked. Hence, the example is unacceptable.

(23) Pesetsky 2000, p. 31

a. *I need to know which girl Sue ordered [which boy that Mary (also) did Δ] to congratulate ____.

b. I need to know for which girl x and [which boy y such that Mary ordered y to congratulate x], Sue also ordered y to congratulate x. [i.e., I need to know the girl-boy pairs such that both Sue and Mary ordered the boy to congratulate the girl]

These are the two arguments Pesetsky gives for the assumption that one path to Pair List interpretations involves a type of covert movement subject to superiority.

4.2 On clause boundedness

Extending the ACD diagnostic, Elliott 2015 asks whether the capacity of an in situ *wh*-phrases to license ACD is clause bounded. The crucial paradigm to look at is the following:

(24) a. Which boy asked out which girl that his brother asked out? PL, SP

b. Which boy asked out which girl that his brother did? PL, SP

c. Which of these boys believes Mary likes which teacher Sally also believes that Mary likes? PL, SP

d. Which of these boys believes Mary likes which teacher that Sally also does Δ?

(i) Δ = like t

(ii) *Δ = believe Mary likes t

The in-situ *wh*-phrase can undergo covert *wh*-movement in (24b) and (24d); consequently, ACD is licensed. However, in (24d) ACD resolution targets only the lower VP. Elliott takes this as an argument that covert *wh*-movement is clause bounded. K. Syrett (p.c.) suggests that a clearer test might be based on unambiguous examples:

(25) Which of these boys is surprised that Mary likes which teacher that Sally also {does | is} Δ?

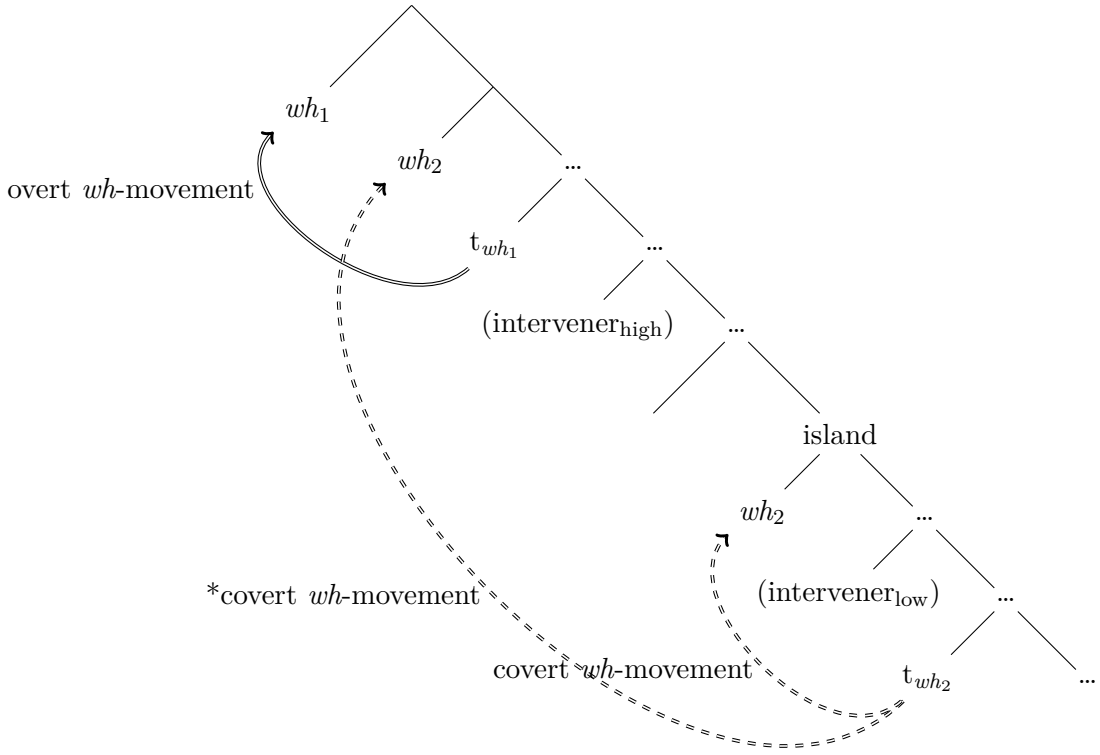
Does forces embedded ACD resolution (Δ=like t) while *is* forces the long construal (Δ=suprised that Mary likes t). To our ear the version with *is* sounds ungrammatical. This is in line with Elliott's conclusion that covert *wh*-movement is clause bounded.

Second, Kotek 2014, 2015; Kotek and Erlewine 2016 observe that the placement of an intervener along the path of covert *wh*-movement in superiority obeying structures can act as a probe for the locality of covert *wh*-movement. Recall that covert *wh*-movement is not subject to intervention effects. Kotek 2015 deploys this diagnostic to demonstrate the island sensitivity of covert *wh*-movement by contrasting high with low interveners in structures schematically like (26). This confirms Pesetsky's (1987) conjecture mentioned in the introduction. The logic is the following. If covert *wh*-movement is island sensitive, then an intervener outside of the island should block a pair list interpretation even in superiority obeying structures while an intervener inside of an island should not have this effect. The data in Kotek 2015 suggest that covert *wh*-movement is indeed island sensitive.[11]

[11]There are some complications here. Not all interveners interact with all kinds of island the same way, as the impossibility of a Pair List reading in (ia) with *only* as an intervener and its availability in (ib) with negation illustrate (judgment: S. Charlow and S. Hansen, p.c.).

(i) a. Which student only knows where Mary bought which book? PL unavailable
b. Which student doesn't know where Mary bought which book? PL available

(26)



With the same logic one can also evaluate whether covert *wh*-movement is clause bounded: We simply replace the island boundary in (26) with a CP in a bridge context. If covert *wh*-movement is clause bounded, then high (non clause-mate) interveners will suppress pair list readings but low (clause-mate) interveners will not. The closest Kotek comes to this structure is example (27). The example features a weak island created by the manner of speaking verb. The asterisk indicates the lack of a pair list reading.

(27) a. *Which protester didn't shout [that we invited which politician]?
b. Which protester shouted [that we didn't invite which politician]?

The judgment for bridge contexts seems to conform to our expectations, as the following example indicates. Consider the example in a context where there are two newspapers (say the New York Times and the Washington Post) and two candidates

(Hilary Clinton and Bernie Sanders). The asterisk again indicates the absence of a pair list reading.

(28) a. Which newspaper reported that Obama wouldn't support which candidate?
b. *Which newspaper didn't report that Obama would support which candidate?

The fact that the pair list reading is absent when the intervener is in the higher clause but not when it is in the lower clause points to the clause boundedness of covert *wh*- movement.

A final argument for clause boundedness of covert covert *wh*-movement comes from trapped lists (see Cheng and Demirdache 2010; Raţiu 2011). To understand trapped lists, we need to consider questions with at least three *wh*-phrases. Triple questions can get lists of triples, single triples, but also partial lists as answers where a single individual is paired with a list of the other two terms. This last option is illustrated by the three answers in (29).

(29) Which parent gave which child which toy?
a. Anna gave Ken a train, Leo a car, and Martin a kite.
b. Anna gave Ken a train, Bill gave Klaus a car, and Charles gave Klaus a kite.
c. Anna gave Ken a train, Bill gave Leo a train, and Charles gave Martin a train.

Cheng and Demirdache, 2010 discuss the following observation due to Raţiu 2011: Only *wh*-phrases that are clause mates are eligible to form a pair in such an individual+pair list structure, though they may be separated from the fixed individual even by an island boundary. This is schematized in (30), where only wh_2 and wh_3 can form a partial list to the exclusion of wh_1. List formation is 'trapped' inside of the CP/island.

(30) [wh_1 [$_{\text{CP/island}}$ ...wh_2 ...wh_3]]

The claim is illustrated below with a triple question where one *wh*-phrase is in the main clause and two are embedded in a finite CP. Only answer (31a) is available.

(31) Which guest$_1$ promised that he would give which toy$_2$ to which child$_3$?
a. Bill promised that he would give the plane to Sybren and the train to Amina.

b. #Bill promised that he would give the plane to Amina and Mary promised that she would give the train to Amina.
c. #Bill promised that he would give the plane to Sybren and Mary promised that she would give the plane to Amina.

It should be clear that a clause-bounded mechanism of covert *wh*-movement provides an important hook into understanding this pattern (see Dayal 2016 for discussion of the compositional mechanisms involved in such examples and references to the literature).

To summarize, in this section we have reviewed Pesetsky's two arguments for the superiority sensitivity of covert *wh*-movement and provided three arguments for its clause boundedness. These assumptions were crucial in our account of the clause-mate condition on multiple sluicing and find independent support in the interpretive asymmetries discussed throughout this section.

5 Scope Taking in Multiple Sluicing

In this section we turn to the semantic mechanisms for *wh*-scope taking. We start, section 5.1, by introducing three scope taking mechanisms widely considered in the literature: *wh*-phrases as existential quantifiers, *wh*-phrases as inherent foci, *wh*-phrases as choice function variables. For single *wh*-questions and single-pair readings of non-eliptical multiple *wh*-questions, these mechanisms deliver the same result. Section 5.2 shows that multiple sluicing allows single pair readings. Single pair readings were, for the sake of simplicity, not considered above in section 2, but we show here that multiple sluicing with single pair readings is subject to the clause-mate condition. To handle the broader distribution of single pair readings in non-elliptical contexts, we adopt the choice function based approach to in-situ *wh*-phrases in single pair questions. In section 5.3 we turn to pair list readings. The section provides a novel implementation – relying on covert *wh*-movement to feed multiple sluicing – of the functional approach to pair-list readings. For non-elliptical multiple questions with pair-list readings that violate the clause-mate condition we can rely on well-established mechanisms without having to invoke covert *wh*-movement.

The empirical residue are pair list readings in superiority violating questions, (21d). Such examples are not handled by the accounts in section 5.3 but, according to our syntax for multiple sluicing, require an in-situ treatment. We turn to this issue in section 6.

5.1 Mechanisms for Covert Scope Taking

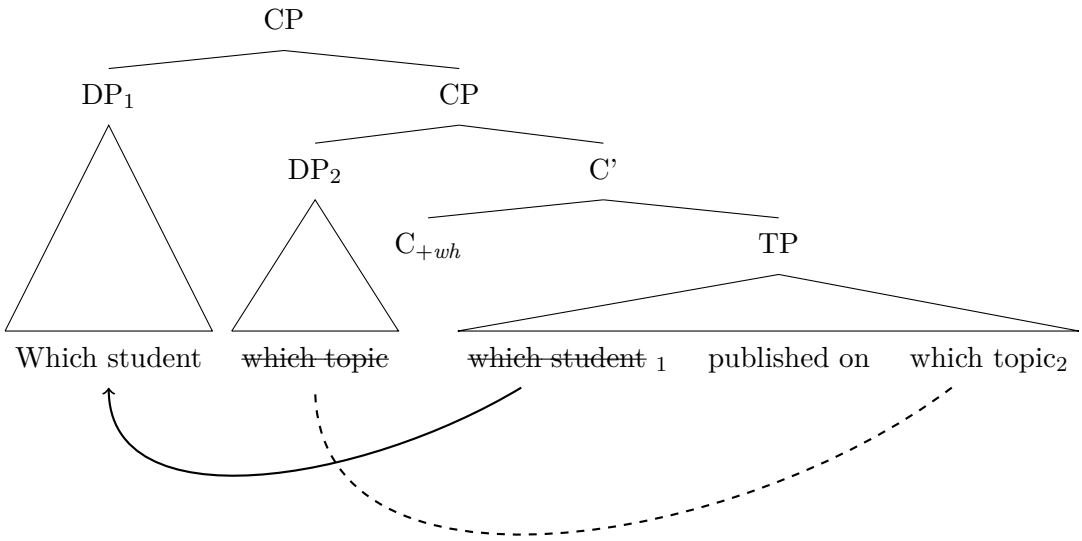
There exist at present at least three distinct semantic mechanisms for *wh* scope-taking: *wh*-phrases as inherently focused expressions (Hamblin 1973), *wh*-phrases as existential generalized quantifiers (Karttunen 1977), and *wh*-phrases as existentially bound choice functional expressions (Reinhart 1997, 1998).[12] While there is a natural correlation between *wh*-movement and the interpretation of *wh*-expressions as generalized quantifiers and between *wh*-in-situ and a focus-based or choice-functional account of *wh*-expressions, the syntax and semantics are, in fact, independent of each other. Here we will start by remaining neutral on the connection between the position of the *wh*-phrase and its mode of interpretation in order to ensure that the conclusions we draw are based on the evidence from multiple sluicing that we have identified in the preceding sections.

Let us assume, for simplicity, that the interpretation of *wh*-dependencies of any kind involves mechanisms that make the content of the *wh*-expression available both within and outside the question nucleus. For lack of a better term but without prejudice to a syntactic movement account, we can call the class of such scoping mechanisms chains. We will assume, as is standard at this point, that C_{+wh} is the locus for the shift from declarative to interrogative meaning, making TP the structure that provides the nucleus (Stechow 1996, among others). Fronted *wh*-phrases have the head of their chain pronounced, *wh*-in-situ involves pronunciation at the bottom of the chain. The precise details of the interpretation of these chains differ but suffice it to say that it is possible to interpret such structures compositionally, using any of the three mechanisms mentioned above, and with equivalent results (see Dayal 2016 for discussion).

Let us illustrate with an example. The solid line in (32a) corresponds to the overtly moved expression, and the dashed line — to the expression that takes scope covertly. The arrow on the solid line is indicative of fronting, the absence of an arrow on the dashed line is meant to indicate that in situ *wh*-phrases can take scope with or without covert movement:

[12] We set aside here the possibility of interpreting *wh*-expressions as lambda abstracts (George 2011; Groenendijk and Stokhof 1982, 1984). We also set aside recent work on *wh* scope-taking in the framework of Inquisitive Semantics (Groenendijk and Roelofsen 2009).

(32) a.



b. $\lambda p\ \exists x\ \exists y$ [student(x) $\wedge$ topic(y) $\wedge$ p = ^x has published on y]
c. $\lambda p\ \exists x\ \exists f$ [student(x) $\wedge$ CF(f) $\wedge$ p = ^x has published on f(topic)]
d. {^x has published on y: x $\in$ student $\wedge$ y $\in$ topic}

Assuming covert movement for *which topic*, we could interpret it as an existential generalized quantifier and get (32b) as its logical representation. If *which topic* is left in situ and interpreted as a choice function variable, existentially bound from outside C_{+wh}, we get (32c). If *wh*-expressions are treated as foci, we get (32d). The final denotation is the same in each case: a set of four propositions such as the one in (33a), in contexts where there are two students and two topics:

(33) a. {^John has published on NPI, ^John has published on FCI, ^Sue has published on NPI,^Sue has published on FCI}
b. Ans-D(Q)(w) = ι p [p $\in$ Q $\wedge$ p(w)]
c. Ans-D (33a) (w@) = ^Sue has published on NPI.

Applying the answerhood operator from Dayal 1996, we get the single-pair reading straightforwardly.[13] It picks out the unique proposition in the set which is true

[13]Since we are focusing on singular *wh*-terms, we give a simplified version of the answerhood operator here. If more than one proposition happens to be true at a world, a plural *wh*-expression is needed. This requires a generalization of (33b), with uniqueness calibrated to maximality and quantification ranging over plural individuals. These are standard semantic adjustments that plural terms call for in operations built on iota. See Dayal 2016 for motivation and discussion.

at the world of evaluation w@, and is undefined if there is no or more than one true proposition.

Of course, multiple *wh*-questions have pair-list readings in addition to single-pair readings. We tackle the former in the sections to follow. For now, we simply note that sluicing, because it provides an explicit antecedent, disambiguates between the two readings. In (34) we have an antecedent that forces the multiple sluice in (34a) and its pre-sluice in (34b) to have the single-pair reading. In (35) the antecedent sets up a distributive context and forces the sluice in (35a) and its pre-sluice in (35b) to have a pair-list reading:[14]

(34) Some student has published on some topic, but I couldn't tell you

a. …which student on which topic.

b. … which student has published on which topic.

c. …[$_{\text{CP}}$ which student$_1$ [$_{\text{CP}}$ on which topic$_2$ ~~[$_{\text{TP}}$ t_1 has published t_2]~~]]

(35) Every student has published on some topic, but I couldn't tell you

a. …which student on which topic.

b. …which student has published on which topic.

c. …[$_{\text{CP}}$ which student$_1$ [$_{\text{CP}}$ on which topic$_2$ ~~[$_{\text{TP}}$ t_1 has published t_2]~~]]

In a theoretical setting like the one assumed here, in which ellipsis can make covert movement overt, the examples in (34)–(35) do not tell us very much beyond the fact that some form of covert *wh*-movement must be part of natural language.

We assume, for now, that the antecedent clauses have LFs roughly like (36), where the indefinite and universal DPs have both undergone QR, leaving traces inside the innermost TP, the part that corresponds to the question nucleus in the sluice and pre-sluice. Covert movement allows the elided TP in both structures to meet relevant identity conditions:[15]

(36) a. [$_{\text{TP}}$ some student$_1$ [$_{\text{TP}}$ some topic$_2$ [$_{\text{TP}}$ t_1 has published on t_2]]]

b. [$_{\text{TP}}$ every student$_1$ [$_{\text{TP}}$ some topic$_2$ [$_{\text{TP}}$ t_1 has published on t_2]]]

[14]English is probably not the best example of a multiple sluicing language as there is some variation among speakers. There are those who are willing to accept examples like (34) and (35), where the second *wh*-phrase is inside a PP but not if it is a simple DP. As our focus now is on the semantic underpinnings of our claims about the clause-mate requirement on multiple sluicing, we abstract away from this non-trivial issue and present examples like (34)–(35) as representative of multiple sluicing patterns more generally.

[15]While the LF representations in (36) are compatible with a strict syntactic identity condition on ellipsis resolution, recall from above that we are not endorsing such a view.

We also adopt the standard view that a structure where the indefinite has scope over the universal is compatible only with single sluicing, (37a). The reading we get is the individual reading of the pre-sluice where every student is working on the same topic. Although such cases will not concern us for the moment, they will become relevant in section 6:

(37) Every student is working on some topic but I couldn't tell you

a. …which topic.

b. …which topic every student is working on.

c. [$_{TP}$ some topic$_2$ [$_{TP}$ every student$_1$ [$_{TP}$ t_1 is working on t_2]]] but I couldn't tell you
[$_{CP}$ which topic$_2$ ~~[$_{TP}$ every student$_1$ [$_{TP}$ t_1 is working on t_2]]~~]

We now return to multiple sluicing. Section 5.2 is devoted to single-pair readings and section 5.3 to pair-list readings of multiple sluicing. Comparing judgments for multiple sluicing structures with their respective pre-sluices, we can distinguish factors that bear on *wh*-scope taking generally from factors that bear specifically on sluicing. Observationally, multiple sluicing obeys the clause-mate condition but *wh* scope-taking in general does not. Theoretically, this finding suggests a bifurcation of *wh* scope-taking mechanisms into one that feeds multiple sluicing (covert *wh*-movement) and those that do not.

5.2 Single-pair Readings and Multiple Sluicing

As we have seen, local multiple *wh*-questions and multiple sluices show the existence of covert *wh*-movement—but no more. Structures with islands, however, exhibit some distinctions. Single-pair readings across islands do not lead to felicitous sluices:[16]

(38) Some linguist was upset because Harry spoke to some philosopher but Bill doesn't know

a. *…which linguist to which philosopher.

b. …which linguist was upset because Harry spoke to which philosopher.

c. *[$_{CP}$ which linguist$_1$ [$_{CP}$ which philosopher$_2$ [C_{+wh} [$_{TP}$ t_1 was upset [$_{ISLAND}$ because Harry spoke to t_2]]]]]

[16]Note that we can get coordinate sluices: *but Bill doesn't know which linguist and which philosopher*. These are derived from a different pre-sluice, such as, *which linguist and which philosopher it was/they were*. The examples of multiple sluicing in section 2, which motivated the clause mate condition, were all provided with contexts favoring pair-list readings to avoid complications that might have arisen from structures with (potentially silent) coordination.

What does the ungrammaticality of the multiple sluice in (38a) and the grammaticality of the pre-sluice in (38b) imply? The unacceptability of (38a) rules out the possibility of an LF like (38c) in which both *wh*-expressions are at the left periphery of the matrix CP. That is, (38a) tells us that covert *wh*-movement across islands is not possible. The grammaticality of (38b) tells us that there must exist in natural language another scope mechanism that is not subject to the same constraints as movement.

One such mechanism is the choice functional account of indefinites and *wh*-phrases, proposed by Reinhart 1997, 1998 (see also Winter 1997). We adopt it here.[17] Taking the antecedent clause first, we see in (39a), that the indefinite inside the island can be interpreted with a choice function variable, existentially bound from the matrix. The single pair reading in (38b) must derive from an LF like (39b) where the choice function variable over the *wh*-in-situ is bound from the matrix C $_{+wh}$ by a null $\exists$ operator:[18,19]

(39) a. [$\exists$**f$_2$** [$_{\text{TP}}$ Some linguist$_1$ [$_{\text{TP}}$ t$_1$ was upset [$_{\text{ISLAND}}$ because [$_{\text{TP}}$ Harry spoke to **f$_2$ (philosopher)**]]]]

b. [$_{\text{CP}}$ which linguist$_1$ [$_{\text{CP}}$ $\exists$**f$_2$** [$_{\text{TP}}$ t$_1$ was upset [$_{\text{ISLAND}}$ because [$_{\text{TP}}$ Harry spoke to **f$_2$ (philosopher)**]]]]

This correctly predicts the grammaticality of the pre-sluice under a single-pair reading, and the ungrammaticality of the sluice. When the TP is elided there is only one *wh*-remnant at the left edge – the null $\exists$ that binds the choice function variable is not a *wh*-indefinite and the *wh* meaning is lost. What we can get is a pre-sluice that yields a single sluice: *…but Bill doesn't know which linguist was upset because Harry spoke to a philosopher*.[20]

The same point can be made with single-pair answers across *wh*-islands:

[17]In principle, these data could also be accounted for under a focus-based semantics for *wh*-in-situ and indefinites. See section 6.3 for reasons why we do not endorse that approach here.

[18]We adopt, for convenience, a choice functional analysis with a null existential. There is, of course, much discussion about whether the choice functional variable should remain free. There is also an analysis of wide scope indefinites that treats them as quantifiers with singleton domains. These issues, as far as we can tell, do not bear on the points under discussion here. We refer the reader to the survey in Heusinger 2011 for relevant discussion.

[19]Note that a choice functional analysis coupled with (covert) *wh*-movement to matrix Spec CP would incorrectly predict the acceptability of (38a).

[20]One might be tempted to argue that the sluice in (38a) is not ruled out because the *wh*-phrase in situ cannot undergo movement to the left periphery of the matrix but that the status of the examples instead arises from a violation of parallelism: the correlate of *wh*$_2$ in the antecedent QRs only locally. Under such a treatment, the antecedent clause in (ia) has local QR of *some philosopher*, while the *wh*-remnant would require island insensitive covert movement of the kind in (ib):

(40) Some student knows what Mary said to some professor but I don't know
   a. *…which student to which professor.
   b. …which student knows what she said to which professor.

The point that covert *wh*-movement is island sensitive is worth stressing again. Although many arguments against the view that covert movement can violate islands (Dayal 1996; Hagstrom 1998; Nishigauchi 1990; Pesetsky 1987) have been presented, the idea continues to have currency. For example, Cheng and Demirdache 2010 while arguing for adjunct islands as traps for *wh*-in-situ nevertheless resort to island insensitive covert *wh*-movement in the face of pair-list answers across *wh*-islands.[21] The following paradigm (made famous by Baker 1970) is illustrative of the type of structure in question:

(41) a. Which student knows what Mary said to which professor?
   b. John knows what Mary said to which professor.
   c. John knows what Mary said to Professor Smith and Sue knows what she said to Prof. Brown.
   d. John knows what Mary said to Professor Smith.

The previous literature has recognized answers like (41b) and (41c) but the single-pair answer in (41d) is also possible. It needs special prosody and context, as single-pair readings often do. The pre-sluice in (40b) provides an antecedent with the right properties to bring out the single-pair reading.

(i) a. [$_{TP}$ Some linguist$_1$ [$_{TP}$ t_1 was upset [$_{ISLAND}$ because [$_{TP}$ some philosopher$_2$ [$_{TP}$ Harry spoke to t_2]]]]]
   b. [$_{CP}$ which linguist$_1$ [$_{CP}$ which philosopher$_2$ [$_{TP}$ t_1 was upset [$_{ISLAND}$ because [$_{TP}$ Harry spoke to t_2]]]]

However, it is a well established fact that correlates of *wh*-remnants in sluicing can be specific indefinites taking wide scope from inside islands. This phenomenon of island amelioration under sluicing cannot be understood under the joint assumptions that make a parallelism-based account of (38a) plausible: clause-bounded QR and strict syntactic parallelism (see Abels 2017a for relevant discussion in the context of Griffiths and Lipták's (2014) parallelism based account of the island sensitivity of contrast sluicing).

Concretely, adopting an analysis of the indefinite inside of the island as a variable over choice functions, which is suggested by the literature on specific indefinites, would void the argument. Such indefinites are licit correlates and do not incur parallelism violations in cases of island amelioration under single sluicing.

[21]This is an internal inconsistency in their account, as pointed out in Dayal 2016. Lisa Cheng and Hamida Demirdache (p.c.) inform us that they are addressing this issue in ongoing work.

Single pair readings across islands, then, turn out to be revealing at two levels. Their impossibility under multiple sluicing suggests that covert *wh*-movement is island sensitive and remains so under sluicing (section 3 above). The multiple sluicing facts thus provide a novel argument against the view that overt and covert *wh*-movement differ with respect to island sensitivity. Specifically, the data argue against Huang 1982 and much subsequent work. The clause-mate condition goes even further: Not only is covert *wh*-movement not less restricted than overt movement, it is more restricted than overt movement (Dayal 1996) in that it is clause-bounded. At the second, more general level, the acceptability of single pair readings across islands in non-elliptical structures therefore provides evidence that natural language has a further scope taking mechanisms for *wh*-in-situ. We assume here that this second mechanism relies on binding rather than movement and that this is what makes it insensitive to islands. Concretely, we have assumed that it involves binding of choice functional variables by a null $\exists$ operator.

5.3 Pair-list Readings and Multiple Sluicing

The conclusions reached in section 5.2 are corroborated by pair-list readings of multiple sluices. As noted earlier, and repeated in (42), the pair-list reading of a multiple sluice can be brought out by adjusting the antecedent clause appropriately:

(42) Every student has published on some topic, but I couldn't tell you which student on which topic.

There are two accounts of pair-list readings, which we discuss below to provide a frame of reference. The first involves a functional account of *wh*-expressions, drawing on Chierchia 1993; Engdahl 1980, 1986; Groenendijk and Stokhof 1983. The initial justification comes from functional answers to questions with quantifiers:

(43) a. Which topic has every student published on?
b. On NPI. Individual answer
c. His/her dissertation topic. Functional answer

We briefly present the account of individual and functional answers:

(44) a. [$_{\text{CP}}$ which topic$_2$ [$_{\text{C'}}$ C$_{+wh}$ [$_{\text{TP}}$ every student$_1$ [$_{\text{TP}}$ t$_1$ has published on t$_2$]]]]
λp $\exists$x [topic(x) $\wedge$ p = ^ $\forall$y [student(y) $\rightarrow$ published-on(y,x)]]
{^ $\forall$y [student(y) $\rightarrow$ published-on(y,NPI)], ^ $\forall$y [student(y) $\rightarrow$ published-on(y,FCI)]}

b. [$_{CP}$ which topic$_2$ [$_{C'}$ C$_{+wh}$ [$_{TP}$ every student$_1$ [$_{TP}$ t$_1$ has published on t$_2^1$]]]]
λp $\exists$F [$\forall$x(topic(F(x)) $\wedge$ p = ^ $\forall$y [student(y) $\rightarrow$ published-on(y,F(y))]]
{^ $\forall$y [student(y) $\rightarrow$ published-on(y,y's dissertation topic)],
^ $\forall$y [student(y) $\rightarrow$ published-on(y,y's qualifying paper topic)]}

In both structures the quantifier undergoes standard QR to a TP adjoined position and is interpreted inside the nucleus. In the first case, (44a), the *wh*-expression quantifies over individuals and yields propositions relating all students to a (single) topic. The answerhood operator picks out the unique proposition in the set that happens to be true at the evaluation index. In the second case, (44b), the *wh*-expression ranges over skolem functions from individuals to individuals. Here we use capital letters to distinguish variables over such functions from choice functional variables discussed earlier. Once again, the answerhood operator picks out a unique true proposition in the set, relating each student to topics via a single functional relation. Variation at the level of topics is thus obtained even with the existential *wh* taking syntactic scope over the universal quantifier. This account of functional answers to questions with quantifiers is, to the best of our knowledge, uncontroversial.[22] What this means is that natural language admits quantification over functions from individuals to individuals, a point that becomes relevant as we turn to pair-list readings.

For functional readings, we adopted the syntactic proposal from Chierchia 1993. In (44b), for example, the TP that forms the question nucleus has a functional trace for the object *wh*-phrase. The variable F is identified through its subscripted i-index with *which topic* but is bound by *every student* through its superscripted a-index. Chierchia makes crucial use of this syntactic relationship to explain why a functional reading is not available when the *wh*-phrase is in subject position and the quantifier in object position, as in (45a):

(45) a. Which student has published on every topic?
b. *Its chief proponent.
c. [$_{CP}$ which student$_1$ [$_{C'}$ C$_{+wh}$ [$_{TP}$ every topic$_2$ [$_{TP}$ t$_1^2$ has published on t$_2$]]]]

For Chierchia, the a-index is a pronominal element and subject to the same constraints as regular pronouns. (45c) is ruled out because the binding required for the functional reading involves QR over the a-index of the functional trace, resulting in a

[22]Functional answers cannot be considered descriptions of pair-list answers as they are possible with all quantifiers, while pair-list answers are possible with only a subset of quantifiers. Thus, any derivational dependency has to be in the other direction.

weak crossover configuration. Chierchia's explanation in terms of weak crossover has been challenged, by Agüero-Bautista 2001, for example. Here we remain neutral on this point. What is relevant for us is the fact that functional readings display structural sensitivity, a sensitivity that transfers over to pair-list readings of questions with quantifiers, which, where available, can be viewed as the graph of the relevant function:[23]

(46) a. Which topic has every student published on?
b. John has published on NPI and Sue has published on FCI.

(47) a. Which student has published on every topic?
b. *John has published on NPI and Sue has published on FCI.

Chierchia's account has been adopted for multiple *wh*-questions by Comorovski 1996; Dayal 1996, 2002; Hornstein 1995, among others, to explain the observation that the fronted *wh*-expression behaves like a universal (É. Kiss 1993). The paradigm in (48) is illustrative, again assuming a domain with two students and two topics:

(48) a. Which student has published on which topic?
b. John and Sue have both published on NPI.
c. *John has published on NPI and FCI.

Dayal 1996 shows that pair-list answers draw on functional relations, in the sense that they display domain cover and uniqueness. In an answer like (48b) that specifies the topic they have published on for each member of the subject term, leaving out a member of the object term, is fine. The opposite, however, is not acceptable (48c). That is, multiple *wh*-questions replay the subject-object asymmetry observed in (46)–(47). Part of the appeal in adopting the functional account for multiple *wh*-questions, then, lies in the fact that the locus of explanation for the asymmetry is inside the innermost TP, where questions with quantifiers and multiple *wh*-questions can have parallel structures.[24]

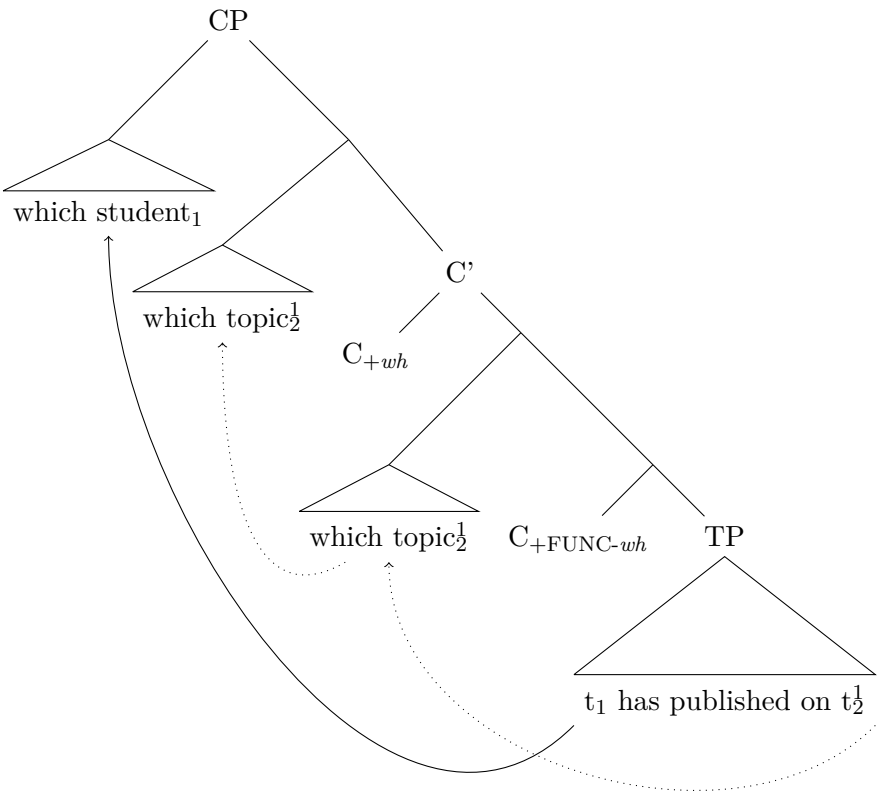
We follow the functional account here:

(49) a. Which student has published on which topic?

[23] See section 6 for further discussion.

[24] Other accounts of the asymmetry with quantifiers (e.g., May's 1985 Scope Principle) do not extend to multiple *wh*-questions, as they capitalizes on the final scope positions, where *wh*-movement and QR part company.

b.



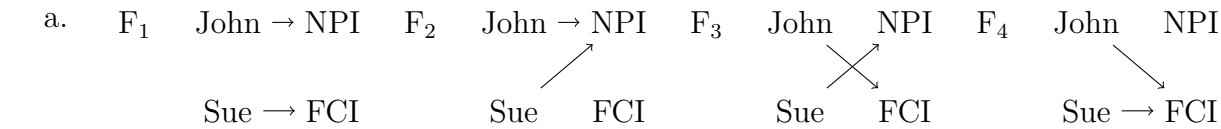
c. λQ $\exists$F [$\forall$z[topic(F(z))] $\wedge$ Q = λp $\exists$f [CF(f) $\wedge$ p = ^f(student) has published on F(f(student))]]

Focusing on the LF in (49b), we note that the structure below TP is inherited from earlier literature but the structure above TP is significantly different and requires some comment. It involves an iterated C$_{+wh}$ structure, with the lower C$_{+wh}$ creating a set of propositions, and the higher C$_{+wh}$ creating a set of sets of propositions. The iterated C$_{+wh}$ approach has antecedents in the literature (Dayal 1996 for echo questions and *wh*-islands, Fox 2012; Kotek 2014; Nicolae 2013 for pair-list answers). However, the current version differs in detail from all of them.

The fronted *wh* with index 1, moves to the higher C$_{+wh}$. We assume, following Richards 1997a, that the object *wh* is tucked in. However, because it is a functional *wh* with two active indices, we allow it to move through the lower C$_{+wh}$, notated +FUNC for expository purposes. Here its superscripted a-index activates the null $\exists$, which we know from our discussion of single pair readings to be able to bind

choice function variables. It then moves on to the higher Spec where its *wh*-scope, associated with its i-index 2 is computed. Assuming a domain with two students, John and Sue, and two topics, NPI and FCI, there are four possible functions of type <e,e> as shown in (50). We also adopt the semantics of functional *wh*-phrases as an existential generalized quantifier over skolem functions from Engdahl 1980, 1986. This allows for a fully compositional mapping from the syntactic structure in (49b) to the semantic representation in (49c):

(50) a.



b. $[\![\text{which}_{\text{FUNC}}]\!] = \lambda Q\ \lambda \mathfrak{F}\ \exists F\ [\ \forall z[Q(F(z))] \wedge \mathfrak{F}(F)]$

The skolem function variable F is existentially bound from the higher C_{+wh}, yielding quantification over topic-valued functions. The chain corresponding to *which student* is effectively interpreted at its base and bound from the lower C_{+wh} through the null $\exists$ operator.

Each cell in the question denotation collects the propositions derived by relating a member of the domain set to a member of the range set. That is, an individual denoted by the fronted subject term is related to exactly one individual denoted by the object term:

(51) a.

$$\left\{\begin{array}{l}\{\text{john has published on } F_1\text{(john)}, \text{Sue has published on } F_1\text{(sue)}\},\\ \{\text{john has published on } F_2\text{(john)}, \text{Sue has published on } F_2\text{(sue)}\},\\ \{\text{john has published on } F_3\text{(john)}, \text{Sue has published on } F_3\text{(sue)}\},\\ \{\text{john has published on } F_4\text{(john)}, \text{Sue has published on } F_4\text{(sue)}\}\end{array}\right\}\ \begin{array}{l}F_1\text{: j}\rightarrow\text{NPI, s}\rightarrow\text{FCI}\\ F_2\text{: j}\rightarrow\text{NPI, s}\rightarrow\text{NPI}\\ F_3\text{: j}\rightarrow\text{FCI, s}\rightarrow\text{NPI}\\ F_4\text{: j}\rightarrow\text{FCI, s}\rightarrow\text{FCI}\end{array}$$

b. Ans-D $(\mathbb{Q})(w) = \cap\ \iota\ Q\ [\forall q \in \mathbb{Q}\ q(w)]$

c. ^John has published on NPI and Sue has published on FCI.

A generalization of the answerhood operator is given in (51b). It extracts the unique member of the set of sets of propositions, such that each of its member propositions is true, and intersects them. The resulting pair-list answer has the crucial properties identified in Dayal 1996 and illustrated in (48): domain cover and point-wise uniqueness. We thus have a defensible account of sluicing under the pair-list reading of multiple *wh*-questions in the functional approach to pair-list answers. Though built up differently, the end result is the same as in Dayal 1996, 2002.[25]

[25] As noted in Dayal 1996, other functional accounts of pair-list readings such as Chierchia 1993 or Comorovski 1996 do not derive the relevant results as their question denotations involve simple atomic propositions that do not reflect functional dependencies.

Skolem functions can also be used to interpret the antecedent clause, allowing for two possible analyses of the antecedent:

(52) a. $[_{TP}$ every student$_1$ $[_{TP}$ some topic$_2$ $[_{TP}$ t_1 has published on t_2]]]
$\Rightarrow \forall x$ [student(x) $\rightarrow \exists y$ [topic(y) $\wedge$ x has published-on y]]

b. $[_{TP}$ some topic$_2$ $[_{TP}$ every student$_1$ $[_{TP}$ t_1 has published on F^1_2]]]
$\Rightarrow \exists F$ [$\forall z$[topic(F(z))] $\wedge \forall x$ [student(x) $\rightarrow$ x has published-on(F(x))]]

In (52a) we have the universal taking scope over the existential, reflecting the reading where topics can vary with students – the reading we are shooting for in the sluice. An LF like (52b) is also possible, where the existential takes syntactic scope over the universal, but does not entail a reading in which every student works on the same topic. As discussed in Hintikka 1986, the use of skolem functions allows for variation without wide scope for the universal. On the analysis in (52b), then, the antecedent TP of the sluice in (42) *every student has published on some topic* would also have a functional trace, ensuring syntactic and semantic identity of the elided TP. Coupled with the account of pair-list readings in (49)–(51) where both *wh*-expressions are at the left periphery, multiple sluicing under a pair-list reading is correctly predicted.

A second approach to pair-list readings of multiple *wh*-questions that also captures functionality, i.e. domain cover and uniqueness, is due to Hagstrom 1998 and Fox 2012 and is discussed in Nicolae 2013 and Kotek 2014. Here too we have an iterated C^0_{+wh} structure and higher order interpretations but without recourse to functions:[26]

(53) a. $[_{CP}$ which student$_i$ $[C_{+wh}$ $[_{CP}$ which topic$_k$ $[C_{+wh}$ $[t_i$ has published on t_k]]]]]

b. $\lambda Q\ \exists y$ [student(y) $\wedge$ Q = $\lambda p\ \exists x$ [topic(x) $\wedge$ p = ^y has published on x]]

c. $\left\{ \begin{array}{l} \{\text{john published on NPI, John published on FCI}\} \\ \{\text{Sue published on NPI, Sue published on FCI}\} \end{array} \right\}$

d. Ans($\mathbb{Q}$)(w) = $\cap$ {p: $\exists Q \in \mathbb{Q}$ [p = Ans-D(Q)(w)]} *the intersection of answers to each question in* $\mathbb{Q}$

e. John published on NPI and Sue published on FCI.

Almost the same operations are in place though executed in a different order, reflecting the difference in the details of the syntax. The end result is the same in terms of felicitous pair-list answers and in terms of multiple sluicing. Both *wh*-

[26] While (53c) and (51a) both denote a set of sets of propositions, the members of (53c) are questions (*which topic did John publish on? Which topic did Sue publish on?*), the members of (51a) are not. This distinction is non-trivial but orthogonal to our concerns here.

expressions are at the left periphery, predicting the acceptability of multiple sluicing in simple questions.

The core generalizations about multiple sluicing with single pair readings also hold of pair-list readings: Pre-sluices are acceptable across islands but multiple sluices are not:

(54) Every linguist was upset because Harry spoke to some philosopher but I couldn't tell you

a. *…which linguist to which philosopher.

b. …which linguist was upset because Harry spoke to which philosopher.

(55) Every student knows what Mary said to some professor but I couldn't tell you

a. *…which student to which professor.

b. …which student knows what Mary said to which professor.

The explanation for this is straightforward. Given that covert movement is local, wh_2 cannot move to matrix C_{+wh}. Thus, there can be no multiple sluicing across the islands.

The challenge, of course, is to find a way to interpret the embedded *wh* inside the island while still getting a pairing of the matrix and the embedded *wh* in the pre-sluice. There are established mechanisms for deriving the relevant readings without island insensitive covert movement which are built on the assumption that such cases involve a pair-list reading between the matrix *wh* and the island as a whole, that is, pied piping analyses of sorts. This, of course, requires an appropriate semantics for the island. There are several proposals currently on the market, Dayal 1996, 2002 for *wh*-islands, Cable 2010; Cheng and Demirdache 2010; Hagstrom 1998 for adjunct islands, for example. For present purposes, the details are not important and we will settle for pointing the reader to these sources as well as to the discussion in Dayal 2016. The point we would like to emphasize is that under these analyses any covert movement would place the whole island in the left periphery.[27] Multiple sluicing would have to derive not from an LF with two *wh*-phrases in the left periphery but from an LF that has a *wh*-phrase and a clause with a *wh* inside in the left periphery. On the assumption that movement of the entire clause is not covert *wh*-movement (but more like quantifier raising, see Dayal 1996), we can explain why it does not feed multiple sluicing.

[27]There are differences across languages between what types of islands support long-distance pair-list readings. To address such complexities would take us too far afield. We set them aside here as they do not bear on the central concerns of this paper.

Recall, that covert *wh*-movement is not only island sensitive but clause bounded. We illustrate this stronger claim with a paradigm built on (42):

(56) a. Every student claimed that Fred had talked to some professor,
b. *…but I can't remember which student to which professor.
c. …but I can't remember which student claimed that Fred had talked to which professor.

Dayal 1996 analyzes pair-list answers to questions like (56c) as a relation between a matrix *wh*, an embedded set of propositions (a question denotation), and a predicate that selects for propositions. We can express this in functional terms, as shown in (57b)

(57) a. ⟦that Fred had talked to which professor⟧=
λp $\exists$x [professor(x) $\wedge$ p = ^Fred had talked to x] =
{Fred had talked to Prof. Smith, Fred had talked to Prof. Brown}
b. [$_{\text{CP}}$ which student$_1$ [$_{\text{CP}}$ that Fred had talked to which professor]$_2$ [$_{\text{CP}}$ C_{+wh} [t_2^1 [$_{\text{C'}}$ C_{+wh} [$_{\text{TP}}$ t_1 claimed t_2^1]]]]
c. λQ $\exists$F [$\forall$z[⟦that Fred had talked to which professor⟧(F(z))] $\wedge$ Q = λp $\exists$x [student(x) $\wedge$ p = ^x claimed F(x)]] = {{ John claimed that Fred talked to Prof. Brown, Sue claimed that Fred talked to Prof. Smith }, { John claimed that Fred talked to Prof. Smith, Sue claimed that Fred talked to Prof. Brown }, { John claimed that Fred talked to Prof. Brown, Sue claimed that Fred talked to Prof.Brown }, { John claimed Fred talked to Prof. Smith, Sue claimed that Fred talked to Prof. Smith }}
d. Ans-D(57c) =
John claimed that Fred had talked to Prof. Brown and Sue claimed that Fred had talked to Prof. Smith.

There are two points worth noting about long-distance pair-list answers of the kind we see here. The first is that contrary to the representation shown in (57b–d), it is not the matrix *wh* but the embedded *wh* that sets the domain in examples of this kind. That is, it is the embedded *wh* that must be exhaustively paired, not the matrix subject. This is an open problem for all theories of long-distance pair-list answers, including those that favor long-distance covert *wh*-movement of the embedded *wh* in situ. We address the issue only partially in section 6.2 by pointing to other cases where the object term sets the domain (see also Dayal 2016 for discussion). The second point worth noting is that pair-list readings with islands seem to favor one-

one pairings over many-one pairings. We leave this open here as it does not bear directly on the issue of local vs. non-local scope, noting that this too is a problem for all theories, those that posit covert long-distance *wh*-movement as well as those that appeal to non-functional iterated C_{+wh} structures.

We end this section by reiterating our central claim. Covert *wh*-movement is local, as evidenced by the unacceptability of multiple sluicing across clauses. Alternative strategies for deriving single-pair and multiple-pair readings across clauses must exist, as shown by the acceptability of the pre-sluices. Long distance binding of choice function variables yields single-pair readings across clauses. Pair-list readings across clauses involve a generalization of the strategy for clause-mate pair-list readings. Instead of relating sets of individuals, long distance pair-list readings have been analyzed as relating individuals to higher order objects such as sets of propositions and/or sets of sets of propositions. Here we have suggested capturing these relations in terms of a dependency involving skolem functions. While the sluicing facts discussed so far could also be handled without appeal to skolem functions, they will become crucial in the next section.

6 Pair-list readings in questions with quantifiers and superiority violating questions

We will now consider simple mono-clausal questions with quantifiers and superiority violating multiple *wh*-questions, both of which allow pair-list readings but do not allow multiple sluicing. We extend the functional account of pair-list readings to account for these cases. We also note that alternative approaches to pair-list readings in these structures do not provide a straightforward explanation for the absence of sluicing.

6.1 Questions with Quantifiers and Multiple Sluicing

As indicated earlier, pair-list readings are possible not only in multiple *wh*-questions but also in questions with quantifiers, and with essentially equivalent results. To recap:

(58) a. Which student has published on which topic?
b. Which topic has every student published on?
c. John has published on NPI and Sue has published on FCI.

Given this, it is worth asking how questions with quantifiers behave with respect to multiple sluicing. The answer is unequivocal. They are unacceptable, as we see in (59a–c). Since the pre-sluice in (59c) is unproblematic, we take this to be a sluicing specific effect:

(59) Every student has published on some topic but Bill doesn't know
  a. *…[$_{CP}$ which topic$_2$ C$_{wh}$ [$_{TP}$ every student$_1$ ~~[$_{TP}$ t$_1$ has published on t$_2$]~~]]
  b. *…[$_{CP}$ which topic$_2$ [$_{CP}$ every student$_1$ C$_{wh}$ ~~[$_{TP}$ t$_1$ has published on t$_2$]~~]]
  c. *…[$_{CP}$ every student$_1$ [$_{CP}$ which topic$_2$ ~~[$_{TP}$ t$_1$ has published on t$_2$]~~]]
  d. …which topic every student has published on.

This is not entirely surprising. Let's assume that *wh*-movement is to positions above C^0 while quantifier raising is adjunction to TP (or below). Everything then follows from the requirement that the C$^0_{+wh}$ is the crucial demarcation point for the ellipsis in sluicing. (59a) is ungrammatical because it requires ellipsis to target too small a phrase. (59b–c) are ruled out as violations of the locality of QR. (59d) is acceptable and has a pair list reading.

The challenge, obviously, is not for an analysis of sluicing but for an account of pair-list answers to questions with quantifiers. Let us consider the options currently on the market. There are two accounts that essentially posit structures in which the universal has scope over the *wh*. Nicolae 2013, pp. 186–87 extends the Hagstrom-Fox approach by moving the universal to Spec of the higher C$_{+wh}$ and interpreting the question as a multiple *wh*, along the lines of (53), as shown in (60a). The only extra machinery is in the operation used to extract the witness set of the universal, a natural enough move, and one that any account of the phenomenon ultimately must resort to. Another approach to questions with quantifiers, one that also gives wide scope to quantifiers, is due to Krifka 2001. Here the universal term is treated as a topic that quantifies into a question speech act, as shown in (60b):

(60) a. [$_{CP}$ every student$_1$ [C$_{+wh}$ [$_{CP}$ which topic$_2$ [C$_{+wh}$ [t$_1$ has published on t$_2$]]]]
  b. [$_{TopP}$ every student$_1$ [$_{ForceP}$ which topic$_2$ [$_{F}$ QUEST [$_{TP}$ t$_1$ has published on t$_2$]]]]

Neither of these accounts gives us a straightforward explanation why questions with quantifiers cannot be sluiced under their pair-list reading.

The functional approach to pair-list readings of questions with quantifiers referred to in section 5 fares no better. Chierchia 1993, for example, posits an absorption operation that pulls the universal out of the TP and interprets it above C$_{+wh}$. But the

question arises why ellipsis after absorption should not yield a well-formed multiple sluice. Similar objections arise in connection with Dayal 1996. The sluicing facts can support the functional approach to pair-lists only if such answers can be derived while interpreting the quantifier inside TP, the site for sluicing-related ellipsis. Building on Dayal 2017, we attempt such an analysis below. We propose the LF in (61b), where the universal remains in situ and the *wh*-phrase leaves a functional trace, whose a-index is bound by the universal:

(61) a. Which topic has every student published on?

b. $[_{\text{CP}}$ which topic$^1_2$ $[_{\text{C'}}$ C_{+wh} $[_{\text{CP}}$ which topic$^1_2$ $\exists_1$ $[\text{C}_{+wh}$ $[_{\text{TP}}$ every student$_1$ has published on t^1_2]]]]

c. $[_{\text{CP}}$ which topic$^1_2$ $[_{\text{C'}}$ C_{+wh} $[_{\text{CP}}$ which topic$^1_2$ $\exists \text{f}_1$ $[_{\text{C'}}$ C_{+wh} $[_{\text{TP}}$ f_1 ($\downarrow$(every student)) has published on $\text{F}(\text{f}_1$ ($\downarrow$(every student))]]]]

d. λQ $\exists$F [$\forall$z[topic(F(z))] $\wedge$ Q = λp $\exists$f [CF(f) $\wedge$ p = ^f(student) has published on F(f(student))]
$\Leftrightarrow$ λQ $\exists$F [$\forall$z[topic(F(z))] $\wedge$ Q = λp $\exists$x [p = ^student(x) $\wedge$ x has published on F(x))]]

Let us walk through some of the key elements of the proposed LF. As in the case of pair list readings of multiple *wh*, here too we have an iterated C_{+wh} structure. The functionally interpreted *wh*-phrase moves through the lower C_{+wh}, activating the null choice functional operator through its a-index. The universal quantifier undergoes downshift to denote its unique witness set *student*, represented here with $\downarrow$.[28] Now the conditions are right for the null Choice Functional operator to existentially bind into TP. As we know, existentially bound choice functional variables are equivalent, modulo locality constraints, syntactically scoping (existential or *wh*) DPs via quantifier raising or *wh*-movement. Thus we get the equivalence shown in (61d). The result is a question denotation of the kind shown in (62a). Applying Ans-D to it gives us the pair list answer in (62b):

(62) a. = (51a)

b. Ans-D (62a)(w) = John has published on NPI and Sue has published on FCI.

[28] As mentioned earlier, the extraction of sets is a well-motivated operation on generalized quantifiers and is standard in any semantic account of pair-list readings of questions with quantifiers. We follow Dayal 1996 in favoring the restriction of this operation to unique witness sets as it not only rules out downward entailing quantifiers, it also restricts indefinites and *most* etc from participating in pair-list answers. This is not directly relevant to the present discussion.

An interesting consequence of this approach is that it captures the pair-list reading of (63a) without positing non-standard long-distance QR for the universal:

(63) a. Which topic does Bill think every student has published on?
b. Bill thinks that John has published on NPI and (Bill thinks) that Sue has published on FCI.
c. [$_{CP}$ Which topic$^1_2$ [$_{C'}$ C_{+wh} [$_{CP}$ t^1_2 $\exists f_1$ [$_{C'}$ C_{+wh} [$_{TP}$ Bill thinks [$_{CP}$ t^1_2 [$_{TP}$ f_1 ($\downarrow$(every student)) has published on F(f_1 ($\downarrow$(every student))]]]]]]]
d. $\lambda Q\ \exists F$ [$\forall z$[topic(F(z))] $\wedge$ Q = $\lambda p\ \exists f$ [CF(f) $\wedge$ p = ^Bill thinks that f(student) published on F(f(student))]]
$\Leftrightarrow \lambda Q\ \exists F$ [$\forall z$[topic(F(z))] $\wedge$ Q = $\lambda p\ \exists x$ [student(x) $\wedge$ p = ^Bill thinks x has published on F(x)]]

Here the matrix clause has an iterated C structure and the fronted *wh*-expression, which originates in the embedded clause, is interpreted functionally. It moves through the lower C_{+wh} at the matrix level, and activates the null $\exists$ operator through its a-index. The universal in the embedded clause is interpreted with a choice function variable over its unique witness set, and is bound long distance by the null $\exists$ in the matrix. The rest follows as in (62):

(64) a. $\left\{\begin{array}{l}\text{\{Bill thinks John has published on } F_1\text{(john), Bill thinks Sue has published on } F_1\text{(sue)\},}\\ \text{\{Bill thinks John has published on } F_2\text{(john), Bill thinks Sue has published on } F_2\text{(sue)\},}\\ \text{\{Bill thinks John has published on } F_3\text{(john), Bill thinks Sue has published on } F_{3(}\text{sue)\},}\\ \text{\{Bill thinks John has published on } F_4\text{(john), Bill thinks Sue has published on } F_4\text{(sue)\}}\end{array}\right\}$
b. Ans-D(64a)(w) = Bill thinks John has published on NPI and (Bill thinks) Sue has published on FCI.

Note that we also predict a pair-list reading for (65a) which has a matrix universal and an embedded *wh* which has been fronted, but we do not predict it for (65b) which has a matrix *wh* and an embedded universal:[29]

(65) a. Which topic$^1_2$ does every teacher$_1$ think John should publish on t^1_2? %PL
b. Which teacher$^1_2$ thinks that every student$_1$ should publish on NPI? *PL

The relevant LFs are given in (66). Crucially, the a-index 1 on the matrix *wh* in (65b) cannot be bound by the quantifier, which can only QR locally to adjoin to the lower TP:

[29]Thanks to M. Barros for discussion and amending the examples to bring out the contrast better.

(66) a. $\lambda Q\ \exists F\ [\forall z[\text{topic}(F(z))] \wedge Q = \lambda p\ \exists f\ [CF(f) \wedge p{=}f(\text{teacher})$ thinks that John has published on $F(f(\text{teacher}))]$
Domain of quantification: topic valued functions

b. $\lambda Q\ \exists F\ [\forall z[\text{teacher}(F(z))] \wedge Q = \lambda p\ \exists f\ [CF(f) \wedge p{=}\ F(x_1))$ thinks that f(student) should publish on NPI]
Domain of quantification: teacher valued functions – no relationship between $\mathbf{x_1}$ and **f(student)**.

It has been reported that there are speakers for whom (65a) is unacceptable on the pair-list reading. May 1977 and Lasnik 2014a, for example, do not allow a PL reading while May 1985 and Agüero-Bautista 2001 do. We do not know what lies behind this variation.[30,31]

To conclude this discussion, we suggest that the possibility of a pair-list reading for questions with quantifiers should be explained without invoking movement of the universal, at any level of syntax, above C_{+wh}. An account of pair-list readings that leaves the universal inside TP is possible if skolem functions, functions from individuals to individuals, are used to capture the dependency in pair-list readings.

[30]We could tentatively adopt Nishigauchi's (1998) position, who takes the a-index on the trace of *which topic* to be a strong anaphor for those speakers who do not accept (65a). Under this hypothesis, the violation for such speakers would lie in the question nucleus: $[_{TP}$ John should publish on t^1_2 $]$ where the index 1 does not have a local antecedent. This explanation predicts that speakers who reject (65a) should enforce the clause mate condition on multiple *wh*-questions quite generally, including in examples like (54b), (55b), and (56c). We are not aware of work addressing this prediction and have to leave open the issue of the exact formulation of the constraint operative in speakers of the more restrictive dialect.

[31]There is a further issue closely related to the discussion of example (61). Consider (ia1). (ia2) is the most obvious structure for the example, so we expect a single sluice with a pair-list interpretation to emerge. (Nicolae's and Krifka's accounts make the same prediction under the reasonable assumption that quantifier raising cannot be made overt by ellipsis, see section 3 above.) Our account of pair-list readings in superiority violating questions in section 6.2 predicts that a pair list reading should also be available for (ib1) under the analysis in (ib2).

(i) a. 1) Each student has published on a different topic, but I can't remember which topic.
2) …$[_{CP}$ which topic ~~$[_{TP}$ each student has published on t$]$~~$]$

b. 1) A different student has published on each topic, but I can't remember on which topic
2) …$[_{CP}$ which topic ~~$[_{TP}$ which student has published on t$]$~~$]$

While Agüero-Bautista 2008 reports for examples structurally similar to (ia1) that they do have a genuine pair list reading, those judgments seems at best fragile and subject to variation. We are dubious about the availability of a pair list reading for (ib1). If the pair list reading for such examples is not available, it is an interesting question for the theory of single sluicing why not.

We have shown how this can be achieved by tapping into functional dependencies combined with choice functions over the unique witness set of the universal. Universal quantifiers, on this view, behave like *wh*-phrases in their ability to allow choice functional variables over their witness sets. But since they lack *wh*-features in their morphological make-up, they need to enter into a functional dependency with a *wh*-expression in order to behave like one. While this allows them to be bound locally or at a distance from outside TP, it blocks them from actually moving beyond the TP domain to the left periphery. The elegant account of (63), (65a) – for the speakers who accept it – and (65b) provide independent justification for this particular analysis.

6.2 Superiority Violations and Multiple Sluicing

We now turn to superiority violating multiple *wh*-questions. The discussion in the previous subsection prepared the ground, since superiority violating multiple *wh*-questions show a very similar behavior to questions with quantifiers. They allow pair-list readings but not multiple sluicing. We will account for this pattern by extending the functional account of pair-list readings in questions with quantifiers from the previous subsection. The examples involve inverse scope in the antecedent clause because the overtly moved *wh*-phrase sets the domain for the function. The relevant identity and recoverability condition on ellipsis could not be satisfied (see Barros and Kotek 2017 for discussion):

(67) a. On which topic has which student published?
b. *A different student has published on each topic, but I couldn't tell you (on) which topic which student.
c. A different student has published on each topic, but I couldn't tell you which topic which student has published on.

Since we are dealing with a *wh*-phrase, the ban against pronouncing the head of the chain does not apply. However, given what we have said about covert *wh*-movement being subject to superiority (section 3), we will derive the pair-list reading through choice functions applying to that *wh* in situ. Note that this general line of approach is consistent with the view expressed most clearly in Pesetsky 1987, 2000, according to whom superiority violations involve an alternative, in-situ *wh* scope mechanism.

Before we develop this idea using the functional dependency account from sections 5 and 6.1, we do need to point out a difference between superiority violating multiple *wh*-questions and questions with quantifiers. What we saw in section 6.1

was the universal in subject position setting the domain of the function while the object *wh* set the range. In superiority violating questions, however, the domain is set by the fronted object, not by the subject *wh* that remains inside TP. This might cast doubt on the parallel between the two.

However, functional relations between *wh*-phrases can be modulated in a number of ways. For example, scrambling presents a case where the normal domain-range of a function is reversed, as illustrated in (68) from from Dayal 1996, 113 ex. 44:

(68) a. dono kyaku-ga dono wain-o tanonda no
which customer-NOM which wine-ACC asked-for Q
b. dono wain-o dono kyaku-ga tanonda no
which wine-ACC which customer-NOM asked-for Q
"Which customer asked for which wine?"

With the normal (SO) word order in (68a), customers have to be exhaustively listed.[32] That is, the subject term displays the domain cover property. With scrambled word order (OS) in (68b), instead, wines have to be exhaustively listed. As mentioned above (see footnote 10) scrambling feeds multiple sluicing. It is thus distinct from superiority violations, which disallow sluicing. While scrambling thus does not block further *wh*-movement at LF, superiority freezes the crossed *wh*-expression inside TP. The facts from scrambling clearly indicate a role of discourse in word order alternations and in functional dependencies.

Further evidence pointing in the same direction comes from questions with quantifiers. It turns out that even in questions with quantifiers it is not always the subject that determines the domain and the object that sets the range. Instead of comparing superiority violating multiple *wh*-questions to questions with *every N* we might compare them to questions with *each N*. The latter are known to allow the quantifier, which always sets the domain, in subject as well as in object position (Agüero-Bautista 2001; Karttunen 1977; Williams 1986):

(69) a. Which student read every book? *PL
b. Which student read each book? OKPL

Without going into the reasons for this difference, we note another interesting difference between *every N* and *each N*, noted in Dayal 2013, 119 note 20, Dayal 2016,

[32] In the original account of Chierchia 1993 the inability of object terms to serve as domains was ascribed to weak crossover. The data in (68) was presented by Dayal 1996 in keeping with this line of explanation. (A-)Scrambling, because it does not give rise to weak crossover violations, was argued to make it possible for an object to serve as a domain term.

p. 123. While the functional answer to the former allows for a generic construal, the functional answer to the latter does not:

(70) a. Which woman does every man love? His mother.
b. Which woman does each man love? His mother.

One way to think of this is to characterize *each N* as "inherently" D-linked in the same way that Pesetsky 1987 characterized *which N* phrases. This again suggests a role for discourse notions in determining what sets the range and what the domain of a given function.

Based on the considerations above, we suggest the following derivation for the pre-sluice in a superiority violating case. The LF in (71b) has a discourse topic (X^2_1) signaling the reversal in functional dependency. We do not have further independent justification to offer for positing this discourse topic but giving it syntactic status provides a way for navigating the relationship between discourse conditions and the nature of the pairing we observe in superiority violations:

(71) a. Which topic has which student published on?
b. [$_{CP}$ X^2_1 [$_{C'}$ C_{+wh} [$_{CP}$ which topic$_2$ [$C_{FUNCTIONAL\text{-}WH}$ [$_{TP}$ which student$^2_1$ has published on t_2]]]]]

Here the fronted *wh* carries only one index. The *wh*-feature is checked at the lower C_{+wh}, where the domain variable must be interpreted. The *wh* that is interpreted functionally is trapped inside TP. However, it enters into a binding relation with the discourse topic, interpreted as an existential generalized quantifier over functions to yield the following:

(72) a. $\lambda Q\ \exists F\ [\ \forall z[\text{student}(F(z))]\ \wedge\ Q = \lambda p\ \exists x \in \text{topic}\ \wedge\ p = \text{has published on}\ (F(x),\ x)]]$

b.

F_1	NPI → John	F_2	NPI → John	F_3	NPI John	F_4	NPI John
	FCI → Sue		FCI Sue		FCI Sue		FCI → Sue

c.

{F_1(NPI) has published on NPI, F_1(FCI) has published on FCI}	F_1: NPI→j, FCI→s
{F_2(NPI) has published on NPI, F_2(FCI) has published on FCI}	F_2: NPI→j, FCI→j
{F_3(NPI) has published on NPI, F_3 (FCI) has published on FCI}	F_3: NPI→s, FCI→j
{F_4(NPI) has published on NPI, F_4(FCI) has published on FCI}	F_4: NPI→s, FCI→s

d. Ans-D(72c)(w) = John has published on NPI and Sue has published on FCI.

This, then, provides a way of deriving the pair-list reading of superiority violating questions while preserving a syntactic analysis that does not support multiple sluicing.

In Abels and Dayal 2016 we noted that the following example from Lasnik and Saito 1992 provides a particularly interesting testing ground for theories of *wh*-interpretation. The curious fact about this example is that it is ungrammatical if we try to interpret both *wh*-phrases with embedded scope but grammatical on the matrix construal of the embedded subject. Given our assumption that covert *wh*-movement is subject to superiority, the available interpretation must be derived without moving the embedded subject covertly.[33]

(73) Who knows what who bought?

The mechanism introduced above allows us to correctly interpret this example without having to move the embedded subject.

In this section we have made crucial use of functional *wh*-phrases, and in particular the double indices on them proposed by Chierchia 1993. We have shown that a functional account of pair-list readings allows for the flexibility needed to capture a wide range of data related to multiple sluicing. Indeed, we would like to suggest that sections 6.1 and 6.2 show that the functional approach to pair-list readings allows a wider range of data to be captured than the type of approach advocated in Fox 2012; Hagstrom 1998; Kotek 2014; Nicolae 2013 and briefly introduced in section 5.3. The main advantage we have discussed here is the ability of the functional approach to treat pair list readings in questions with quantifiers without doing violence to the syntax of quantifier raising.

In the final subsection, we briefly comment on focus semantics for *wh*-phrases.

6.3 Remarks on Focus Semantics for *wh*-phrases and Sluicing

Before we conclude, we would like to comment briefly on how the focus based semantics for questions (Hamblin 1973; Kratzer and Shimoyama 2002; Shimoyama 2001, 2006) fits into our discussion of sluicing. We have argued for an island insensitive scope mechanism for interpreting *wh* in situ. Kratzer and Shimoyama 2002 and Shimoyama 2001, 2006 argue that all *wh*-indeterminates are bound by the closest

[33]We do not address the question here of how to formulate the principles that give rise to superiority effects. Recall that above we spoke of superiority configurations. Superiority effects arise in superiority configurations if in addition at least one of the *wh*-phrases involved fails to be D-linked and, as (73) shows both need to be given the same scope.

operator. In the case of *wh*-islands, for example, this entails that all indeterminates take scope within the island. While this is a good result for Japanese examples like (74a), from Nishigauchi 1990, we have seen above, (40b), that both single pair, (41d), and pair-list readings, (41c), can occur across *wh*-islands.

(74) tanaka-kun-wa [Mary-ga doko-de nani-o kat-ta ka] sitte-imasu ka
Tanaka Mary-NOM where what-ACC bought Q knows Q
"Does Tanaka know where Mary bought what?"
NOT: "What is such that Tanaka knows where Mary bought it?"

Example (73) amplifies this argument. Proponents of the focus-semantic approach could argue that in examples like (40b), the in-situ *wh*-phrase covertly moves to a position high enough to escape the embedded *wh*-operator. However, such covert movement is crucially blocked in (73), where the interpretation has to proceed without covert movement. This ought to block high construal of the embedded subject. But this high construal is not only possible here but obligatory.

All of this suggests strongly that if the focus-based mechanism of *wh*-scope exists in natural language, it exists alongside the kinds of mechanisms discussed above. We note this also in connection with intervention effects, which in the account of Beck 2006 provide a strong empirical argument for a focus-based semantics. The idea briefly is that *wh*-phrases have an exclusively focus semantics which is targeted by both the focus sensitive intervener and the Q operator, resulting in an uninterpretable LF. As we saw in section 5.1, the focus semantics for questions delivers single-pair answers straightforwardly. However, the single pair interpretation remains unaffected by the intervening operators that are supposed to disrupt the percolation of focus in superiority violating cases (see (21f) above). While this is not a knockdown argument against the existence of a focus semantic mechanism, it is, once again, an argument in favor of also having a choice functional account that could deliver the available single-pair reading (see Dayal to appear for discussion).[34]

At this point, then, we are convinced that a focus-based semantics for questions cannot be the only in situ scope mechanism, but remain agnostic on the larger question of whether a focus-based semantics for questions is part of natural language grammar.

[34]We have not probed how to make the in-situ mechanism for pair-list readings we have proposed sensitive to intervention effects. We leave this for future work, merely noting that there is a substantive body of work pointing out empirical and theoretical difficulties for Beck's account. See also footnote 11.

7 Conclusion

In this paper we have explored the syntax and semantics of multiple sluicing.

On the syntactic side, the main fact to be explained is the curious locality of multiple sluicing: Across languages, the *wh*-phrases must originate within the same finite clause while that finite clause may be deeply embedded, even inside of islands. To resolve the apparent locality paradox, we have proposed that there is syntactic structure at the ellipsis site. Without such structure, it would be impossible to impose locality constraints. We have proposed to treat island insensitivity of multiple sluicing in terms of island evasion, that is, in terms of island avoiding paraphrases in the E-site. This second step allows us to assume that movement within the E-site is subject to locality constraints. This assumption, that movement within the E-site is not exempt from locality constraints, is again crucial for our account of the clause-mate condition. The account of the clause-mate condition itself rested on three further specific assumptions. (i) Movement of additional *wh*-phrases in multiple sluicing is covert *wh*-movement (made overt by ellipsis). (ii) Covert *wh*-movement is clause bounded. (iii) Covert *wh*-movement is subject to superiority. We showed that there is substantial independent evidence for assumptions (ii) and (iii), which supports the idea in (i) of enlisting covert *wh*-movement as the mechanism behind multiple sluicing.

Our syntactic analysis thus provides novel arguments for three claims that have been subject to vigorous debate. There is syntactic structure at the E-site. Movement inside of the E-site is subject to locality constraints. Covert *wh*-movement is very local.

Considering the semantic consequences of the syntactic findings, we argued that it is (relatively) straightforward to provide interpretations for moved *wh*-phrases that generate single pair and pair-list interpretations of multiple questions. These come into play in multiple sluicing. We also saw (sections 5.2 and 5.3) that semantic mechanisms exist that derive single pair and pair-list interpretations for questions in which the movement mechanisms are blocked because of violations of the clause boundedness of covert *wh*-movement. Section 6 then provided a way of deriving pair-list readings for cases where covert *wh*-movement is inapplicable because of the superiority condition or the item is a quantifier and thus ineligible for *wh*-movement. The functional treatment of pair-list readings has an edge over alternatives, because it allows us to deploy common mechanisms for both cases.

Our analysis of the multiple sluicing facts in superiority violating cases has led us to posit a binding mechanism for dealing with the pair-list readings of their pre-sluices. A question that naturally arises is whether, given such a mechanism, we still

need to appeal to a functional relationship with a pied-piped clause for long-distance pair-list readings of islands. We leave this question open here as the evidence relevant to settling this issue does not bear directly on sluicing specific factors (see Dayal 2017 for discussion).

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