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 rooted in the view that covert phrasal *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 phrasal *wh*-movement. While long distance single-pair readings are handled straightforwardly by existing theories, we develop a novel approach to pair-list readings adopting a functional analysis in cases where phrasal *wh*-movement is ruled out, as in superiority violating configurations. The paper provides independent evidence for the idea that there is syntactic structure at the ellipsis site, that movement operations within the ellipsis site are subject to locality constraints, that pair-list readings of multiple questions are rooted in functional readings and presents a new perspective on pair-list readings of questions with quantifiers.

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 phrasal *wh*-movement overt. Second, covert phrasal *wh*-movement is clause bound. Third, covert phrasal *wh*-movement is sensitive to superiority. These claims are independently supported.

Clearly, if covert phrasal *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 develop an account based on skolem functions (Engdahl, 1986) and extend it to structures where one member of the dependency does not undergo movement to the left periphery.

Our syntactic analysis of multiple sluicing, 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 accurately capturing the clause-mate condition and the fact that it holds across languages.

Our semantic proposals are inspired on the one hand by Dayal 1996a, who, building on her own prior work in Srivastav 1991a,b, argued for the appealing but overly strong position that all covert scope taking is strictly local, analogous to the fact that QR is local. On the other hand, we draw inspiration from Pesetsky 1987, who first floated the idea that there are two mechanism for covert scope taking, both of which can be non-local but only one of them can violate islands. We come to a more nuanced understanding of scope taking by comparing the availability of single pair and pair-list interpretations in a range of constructions where the ungrammaticality of multiple sluicing rules out the possibility of multiple phrasal *wh*-movement.

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 turns to the semantic implications of our findings about multiple sluicing, opting for an account of single-pair readings based on choice functions over one based on focus semantics. Section **??** introduces

our proposal for pair-list readings in terms of dependencies based on Skolem functions, comparing it again to an account in terms of focus semantics. Section 7 extends the functional approach to pair-list readings where at least one *wh* remains in situ. Section **??** considers dependencies where one member of the dependency is not a *wh*-phrase but a quantifier or an island containing a *wh*-expression.

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 providing 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, following again the terminology in Chung, Ladusaw, and McCloskey 1995, 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

[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).

and 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 three 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, 2017; Kidwai, 2018; Levin, 1982; Merchant, 2001; Molimpakis, 2016; Ross, 1969; Vicente, 2015; 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. Ross's second observation is that possible sluicing remnants are possible occupants of Spec,CP in the sense that sluicing obeys constraints on pied-piping (see Abels 2019b for recent discussion). This strengthens the case for a *wh*-move-and-delete approach to sluicing.

However – and this is Ross's third crucial observation – *wh*-movement within the ellipsis site appears to be insensitive to syntactic islands. This is illustrated by (4a), whose pre-sluice under Ross's 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 with-

out 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 under ellipsis seems to be selective in various ways (Abels 2011, 2017, 2019a; Barros 2014; Barros, Elliott, and Thoms 2014; Fox and Lasnik 2003; Griffiths and Lipták 2014; Lasnik 2001; Merchant 2008; 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 of multiple sluicing 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't 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.

Some of the literature on multiple sluicing presents data that is potentially confounded in various ways. Truly convincing examples of multiple sluicing should always involve singular *which*-phrases in a context that forces a pair-list reading. The German data in (6) above creates a context for a pair-list interpretation by realizing one of the correlates as a universal quantifier that distributes (in the relevant interpretation) over the second correlate, which is an existential quantifier. Another type of context that favors pair list readings is shown in (9a), where there is a wide scope adverbial quantifier distributing over both indefinite correlates.

By contrast, a context that allows a single pair interpretation would be compatible with the following type of elliptical structure, which is simply the coordination of two single sluices: *which student ~~was reading~~ (and) which book ~~they were reading~~*. If a silent conjunction is possible here, we cannot know for sure whether we are dealing with multiple sluicing or with several independent instances of single sluicing, resulting in confounded data.

The parse as several asyndetically coordinated single sluices is blocked in (6) and (9a); the singular morphology in the *which*-phrases and the uniqueness presupposition carried by them make sure that the coordination of single sluices does not provide a semantically adequate parse.

Unambiguous cases of multiple sluicing require both a context for pair list interpretations and singular *which*-phrases. This is so because even in contexts in which the antecedent strongly favors a pair-list interpretation a coordination of *who* and *what* can still be used, presumably because of their potential to be interpreted as a plural: *Many guests brought something to the party, but I am not sure who ~~brought something~~ and what ~~they brought~~*. Convincing examples of and counterexamples to the clausemate condition should therefore always involve singular *which*-phrases in contexts that enforce pair-list interpretations.

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 2014), 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 syntactic fact to be treated in this paper.

A few caveats are in order. Lasnik, 2014 notes that in Serbo-Croatian the clausemate 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 phrasal *wh*-movement. Similarly, Comorovski (1986, p. 175 ex. 10), C. Rudin (1988b, p. 452 ex. 10) report that in Romanian multiple *wh*-phrases can originate in different clauses. Indeed, Buciuleac 2019 reports that native speakers of Romanian consulted by her accept violations of the clause-mate condition in full multiple questions and multiple sluices to a comparable degree.[2] This line of reasoning suggests that whenever overt multiple *wh*-fronting can overcome the clause-mate condition, it should be able to do so in multiple sluicing as well. We have no reason to doubt

[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 crucial multiple sluicing example violating the clause-mate condition has a single-pair reading. The proper analysis of the example might therefore involve asyndetic coordination of two sluices rather than multiple sluicing. See comments just below (9b).

that this is true.[3] A similar case comes from Bhattacharya and Simpson 2012, 194 fn. 9 ex. ii. Bhattacharya and Simpson (2012) 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 phrasal *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.

We return to Nishigauchi's counterexample below after introducing our assumptions about island amelioration.

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.

[3]The other multiple *wh*-fronting languages in our sample are not particularly informative: Slovenian does not allow long distance multiple *wh*-movement (Marušič and Žaucer 2013, p. 419 ex. 2) and non-elliptical multiple *wh*-questions obey the clause-mate condition (Marušič and Žaucer 2013, p. 421 ex. 10). Lithuanian allows long distance multiple *wh*-movement (Adliene 2014, p. 29 ex. 138) but disallows violations of the clause-mate condition in non-elliptical questions. The same is true in Bulgarian (C. Rudin 1988b, p. 452 fn. 7, C. Rudin 1988a, p. 8 for the facts regarding non-elliptical questions pace Richards 1997), and maybe Czech (Meyer 2003, J. Kaspar, p.c., though Toman 1982 describes Czech along the lines of Slovenian and Lithuanian above). Russian lacks long-distance *wh*-movement from finite indicative clauses altogether (Müller and Sternefeld 1993; Stepanov 1998). Polish behaves in relevant ways like Russian (see Toman 1982, p. 296–7. D. Grabska, p.c.).

Pursuing the intriguing connection between the clause-mate condition under overt multiple *wh*-movement and under multiple sluicing would take us too far afield here.

The clause-mate condition cannot easily 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 Barros, Elliott, and Thoms (2014) (see also Abels, 2011, 2017, 2019a; Baker and Brame, 1972; Barros, 2014; Barros, Elliott, and Thoms, 2014; Merchant, 2001). 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. Very roughly, the content of the E-site must entail and be entailed by the antecedent.[4] Island violations can then be evaded by choosing an appropriate paraphrase as the pre-sluice at the

[4]The account developed here works equally well with pragmatically based approaches to ellipsis identity (AnderBois 2010, 2011; Barros 2014; Kroll 2018; D. Rudin 2019; Weir 2014).

E-site. Thus, the pre-sluice for (4a) is not the ungrammatical (4b) but rather one of the following:[5]

(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 2019a; Barros, Elliott, and Thoms 2014 for detailed discussion and a defense of the island evasion approach.

We will invoke paraphrases in the E-site for two additional kinds of cases. We hinted above that the clause-mate condition will be reduced to the clause-boundedness of covert phrasal movement. This will entail that even in bridge contexts the two *wh*-phrases have to originate in the highest clause of the pre-sluice. Thus, for an example like the following (from Lasnik 2014, p. 12 ex. 58), we follow Lasnik (2014) and Park (2014b) in postulating a short source along the lines of (15a) instead of the long source in (15b), which would require cyclic covert movement of *which girl*. (See Lasnik's and Park's papers for further discussion.)

(14) Fred thinks that a certain boy talked to a certain girl.
   I wish I could remember which boy to which girl.

(15) Lasnik 2014, p. 12 ex. 60
   a. I wish I could remember which boy talked to what girl.
   b. I wish I could remember which boy Fred thinks talked to what girl.

[5] 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 2017; Barros 2016; Barros and Vicente 2016; Chung 2013; Kidwai 2018; Wood, Barros, and Sigurðsson 2016. Such unrestricted versions of the theory also face the too-many-paraphrases problem (see Abels 2019a; Chung, Ladusaw, and McCloskey 2006). We continue on the assumption that these open problems for island evasion will ultimately be solved.

Of course, there have to be constraints on the available paraphrases to solve the too-many-paraphrases problem (Abels, 2019a). It seems to us that what we say here is fully compatible with D. Rudin 2019, where it is proposed that the thematic kernel of a clause is subject to syntactic identity under ellipsis. Rudin's proposal ensures that examples that violate the clausemate condition have no licit paraphrase in the ellipsis site since that paraphrase can be identical neither to the thematic kernel of the higher clause nor to the thematic kernel of the lower clause.[6]

A final type of case for which we invoke paraphrases in the ellipsis site – at least as one option – are examples like Nishigauchi's counterexample above, (10b), repeated below as (16a). Notice that in the example the embedded subject is bound by the matrix quantifier. This property allows a short pre-sluice along the lines of (16b) instead of the fully isomorphic pre-sluice (16c), which would require successive cyclic movement of the embedded *wh*-phrase. This is so, because the two *wh* phrases are co-arguments within the lower clause and are thus fully in line with the constraints on identity developed in D. Rudin 2019.[7]

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

[6]The copula verbs that appear in some of the paraphrases argued for in Barros, Elliott, and Thoms 2014 either require a special stipulation or need to be analyzed as substructures of the original thematic kernel.

[7]Barros and Frank 2017b point out that this approach to Nishigauchi's counterexample might still undergenerate. To show this, Barros and Frank 2017b, p. 2 ex. 8 give example (i) (attributed to L. Horn) and a variety of other examples, which successfully violate the clause-mate condition but lack a short source.

(i) Some student claimed [$_{CP}$ that there was a problem with some professor], but I can't recall which student with which professor.

Notice that this example forces a single pair reading. It is thus compatible with a competing parse as an asyndetic coordination of two single sluices. We leave more detailed exploration of Barros and Frank's examples for future research noting only that for Barros and Frank (2016, 2017a,b) and Grano and Lasnik (2018) Nishigauchi's counterexample 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. Since under our approach, the additional *wh*-phrases in multiple sluicing reach their landing site by clause bounded usually covert phrasal *wh*-movement. If, as suggested by Barros and Frank, its clause boundedness can be modulated in the same way we observe for quantifier raising and other movement operations, this would provide further indirect evidence in favor of our proposal. For the sake of simplicity and pending further investigation of the issue, we continue to talk about the clause-mate condition on multiple sluicing and the clause boundedness of covert phrasal *wh*-movement. See also footnote 16.

c. …but I can't remember who$_k$ claimed that they$_k$ had talked to which professor

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 island 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 positing 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 *wh*-phrases represents a normal syntactic movement operation, and (ii) movement of the additional *wh*-phrases is clause bound.[8] 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 phrasal *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 – when and if it happens – is usually covert. Covert *wh*-movement targets a position in the left periphery outside of the ellipsis site. Overt movement is marked by a solid arrow below; covert movement by a dashed arrow.

(17) [Wh$_1$ [Wh$_2$ [$_{\text{E-site}}$ …Wh$_1$ […Wh$_2$…]]]]

[8] Phrasal movement of additional *wh*-phrases is much like quantifier raising under the standard view, which holds quantifier raising is clause bound, though, unlike quantifier raising, covert *wh*-movement targets a position above C. But see Syrett and Lidz 2011; Tanaka 2015; Wurmbrand 2018 for a more nuanced view of the locality of quantifier raising.

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 phrasal movement, this is quite straightforward: 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.[9] Popular though this general line of thinking is (see Gribanova and Manetta 2016; Manetta 2013; Ortega-Santos, Yoshida, and Nakao 2014; Park 2014b; Richards 1997, 2001), we should note that the approach predicts that covert phrasal 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 overt when an object quantifier takes scope over the subject and that VP ellipsis, like sluicing, should lead to high pronunciation of an in-situ *wh*-phrase. Both of these expectations are thwarted. On the other hand, Johnson:2001 suggests that pseudogapping is VP ellipsis fed by scrambling, an operation which is usually covert in English (though this is by no means uncontroversial, as Lasnik 2005 suggests that pseudogapping involves extra-low realization of the verb rather than extra-high realization of the pseudogapping remnant).

While high pronunciation of covert movement chains is the default expectation in a single-cycle model, we need to restrict the system to avoid overgeneration. The interaction of *wh*-movement with sluicing on the one hand and with VP ellipsis on the other hand shows that high pronunciation is not licensed by an inherent property of the moving element alone,[10] otherwise *wh*-chains should be realized high both under VP ellipsis and in sluicing. Exceptionally high pronunciation seems to be quite a limited phenomenon, possibly restricted to chains whose head occupies the specifier of the ellipsis licensor.

We have no further insight to contribute to the discussion of which covert movements can become overt under ellipsis and which ones cannot and under what further conditions. On our view, 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 2018), but covert phrasal movement made overt by ellipsis. The effect of high pronunciation under ellipsis, although the

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

[10] A candidate property–suggested by a reviewer and invoked for this purpose in in-situ analyses of sluicing like (Abe, 2015)–is an inherent focus feature on *wh*-phrases.

default expectation for all movement chains under a single cycle model of syntax, may be restricted to chains whose head occupies a specifier position of the ellipsis licensor.

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

Structure (18) 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 phrasal *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.

(18) a. [Wh_1 [Wh_2 [$_{\text{E-site}}$ …Wh_1 …[$_{\text{CP}}$ …Wh_2 …]]]]

*long covert *wh*-movement

b. [Wh_1 [Wh_2 [$_{\text{E-site}}$ …Wh_1 …[$_{\text{CP}}$ Wh_2 […Wh_2 …]]]]]

*cyclic covert *wh*-movement

The more challenging structure to rule out is the one in (19). Here, overt *wh*-movement has been cyclic and covert *wh*-movement clause bound.

(19) [Wh_2 [Wh_1 [$_{\text{E-site}}$ …Wh_1 …[$_{\text{CP}}$ Wh_2 […Wh_2 …]]]]

Nothing in what we have said so far rules out structure (19). Indeed, as far as we know, all recent work on the clause-mate constraint has overlooked the necessity to rule out (19). For example, Lasnik (2014) attempts to capture the clause-mate condition simply by assuming that movement of the second *wh*-phrase is clause bound. Specifically, Lasnik treats movement of the second *wh*-phrase as extraposition, subject to clause-boundedness (right roof constraint). While he thus manages to correctly capture why the analogue of (18) is ungrammatical, he fails to address derivations analogous to (19). In other words, Lasnik's theory leads to the incorrect expectation that the following examples are well-formed with the analysis in (20c):

(20) 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 instance, Fred said that Sally bought a book, but I don't know which book to whom.

c. …which book <Fred said $t_{\text{to whom}}$ [$_{\text{CP}}$ that Sally bought $t_{\text{which book}}$]> to whom

The same trouble also affects Ortega-Santos, Yoshida, and Nakao's (2014, pp. 78–79) attempt at deriving the clause-mate condition on *wh*-stripping and Park's (2014) approach to clause-mate conditions in ellipsis with multiple remnants more generally.[11] It is crucially not sufficient to impose clause-boundedness on the second movement operation. Something further needs to be said to rule out (19).

The two main properties distinguishing the illicit (19) from the licit structure in (17) are the fact that overt *wh*-movement is cyclic in (19) and short in (17) and that overt *wh*-movement crosses the trace of covert *wh*-movement in (19) while in (17) 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 (19) represents a superiority configuration: Overt *wh*-movement crosses a c-commanding overtly unmoved *wh*-phrase.[12] We conjecture that it is this superiority configuration which is responsible for the ill-formedness of (19). To achieve this, we impose the following additional constraint:

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

The crucial additional restriction compared to an account like Lasnik's comes from the fact that superiority regulates the interaction between movements. As we showed above, a restriction simply on the locality of the second movement is too weak.

[11] The trouble for Lasnik 2014 is actually worse in several ways. Given that Lasnik assumes that locality violations of *wh*-movement are repaired by ellipsis, there are no constraints on the first movement as long as movement of the second *wh*-phrase obeys the right-roof constraint. Thus, (i) is wrongly predicted to be grammatical.

(i) *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.

Two further points should be noted. First, Lasnik's account remains language specific; extraposition of *wh*-phrases is not available in a number of the languages treated here (German, Hindi), leaving a Lasnik style account without a source of multiple sluicing in these languages. Second, it remains unclear under Lasnik's account why ellipsis would repair locality violations for *wh*-movement but not for extraposition.

[12] 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 (19) as a straightforward standard superiority effect. We do see a superiority configuration, though.

The structure in (19) corresponds to a superiority violation in (22b), where the two *wh*-phrases originate in different clauses, rather than to the standard case of clause-mate superiority.

(22) a. *Who did who see?
b. *Who does who believe that John saw?

The cross-linguistic picture regarding the sentence types in (22a) and (22b) is not uniform. English disallows both, of course, but languages like German are often described as allowing the equivalent of (22a) (see for example Grewendorf 2001, pace Featherston 2005a,b), but the equivalent of (23b) is undoubtedly ungrammatical in German (Bošković 1997a; Büring and Hartmann 1994; Grewendorf 2001):[13]

(23) Grewendorf 2001, p. 112 ex. 29
a. *Wen$_i$ glaubt wer, dass Hans t$_i$ gesehen hat?
who believes who that Hans seen has
b. Wer glaubt, dass Hans wen gesehen hat?
who believes that Hans who seen has
Who believes that Hans has seen who?

The German pattern of judgments is also reported for Spanish in Bošković 1997a, p. 243 ex. 23–24 and for Dutch Bošković 1997a, p. 247 fn. 28, crediting M. den Dikken (though our own informants do report a degradation in examples like (22a)). The restriction against (19) therefore seems well-founded also as a restriction on overt movement. A plausible account of the German type of pattern relies on local movement (A-movement, or scrambling) feeding *wh*-movement (Wiltschko, 1998).

It might seem mysterious how a single cycle system like the one we have been presupposing can correctly distinguish between overt movements and covert movements. We have to assume that the relevant distinction exists. For concreteness, assume again a mark-up of positions as strong or weak. *Wh*-chains with a strong head are 'overt' and *wh*-chains with a weak head are 'covert.' We can then paraphrase

[13]One might have hoped to get further insights into this kind of pattern from Romanian and Serbo-Croatian. (The other multiple *wh*-fronting languages mentioned in footnote 3 are not informative, since they disallow structures like (18) and (19) independently of ellipsis.) According to C. Rudin 1988b, p. 474 However, like English Romanian obeys superiority even in the short-distance case, (22a). Serbo Croatian is abstractly similar to German. Superiority violations in Serbo Croatian are the exception rather than the norm Bošković 1997b, 1998; Stjepanović 1999 and occur only in "short distance null C matrix questions" (Stjepanović 1999, p. 152). Superiority apparently cannot be violated multiple sluicing (see Stjepanović 1999 for a possible approach and Puskas 2000, ch. 4 for relevant discussion).

(21) as follows: Only those *wh*-phrases may have a weak head that are not crossed by an A'-chain with a strong head.

Condition (21), of course, is by no means novel. It comes directly from Pesetsky 2000. We review independent evidence for this constraint in section 4.1.

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 (21) predicts that (24) should be as ill-formed as (19). This is so, because the trace of covert *wh*-movement is again crossed by overt *wh*-movement.

(24) * [Wh_2 [Wh_1 [$_{E\text{-site}}$ …[Wh_1 […Wh_2 …] …] …]]]

This expectation is borne out across an interesting range of languages. Consider the Dutch paradigm in (25)–(26). (25) shows that there is no superiority effect in a multiple *wh*-question when both *wh*-phrases are D-linked. Example (26) provides sluicing counterparts of these examples. As predicted by (21), a superiority effect shows up under sluicing.[14]

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

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.

(26) (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

[14]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 (25) and (26) 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.

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.[15]

3.2 Conclusions and discussion

In this section we have given an account of the clause-mate condition that crucially relies on additional *wh*-phrases undergoing clause-bounded movement sensitive to superiority. We have called this movement covert *wh*-movement. One justification for the claim that this is *wh*-movement comes from the fact that the landing site of the movement shares a landing site above C and outside of the ellipsis site (TP) with overt *wh*-movement.

However, as stressed by one of the anonymous reviewers, a range of ellipsis phenomena with multiple remnants share the clause-mate constraint with multiple sluicing. Gapping, pseudogapping, and mutltiple fragments all have been analyzed as elliptical structures and all are subject to the clausemate condition. This might suggest that there is a kind of movement, ellipsis enabling movement, which is clause bound and subject to superiority and which enables ellipsis with multiple fragments. This movement could then be overt but would make the later application of ellipsis obligatory.

While it is true that our account of multiple sluicing does not capture the generalization about ellipsis structures with multiple remnants, we do not think that postulating a movement process specific to ellipsis is the theoretically favored move. Instead, it seems to us that reductive strategy of capturing the clause-mate condition in terms of independently necessary processes with independently verifiable properties is theoretically favored. Indeed, in the next section we give three pieces of independent empirical evidence that covert *wh*-movement has exactly the properties

[15]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.

required to capture the clause-mate condition: clause boundedness and superiority. *Wh*-scope taking more generally does not have these properties. It is this last fact, the empirical distinction between *wh*-scope taking and *wh* movement, that animates the discussion in sections 5–**??**.

Assuming that the logic here is sound, one might still wonder what the theoretical merits are of endowing covert *wh*-movement with properties distinct from its overt cousin. Indeed, Pesetsky (1987) criticized Huang 1982 precisely for introducing such an asymmetry between overt and covert movement. The point is well taken, but the weight of the evidence regarding covert *wh*-movement reviewed in section 4 suggests that a distinction between overt and covert movement is necessary on empirical grounds.

We are then faced with a learnability question: How can the clause-boundedness of covert movement and the distinction between overt and covert movement be acquired. We conjecture that clause-boundedness is the default. It is given up by learners only in the face of triggering experience in the form of clear evidence. For overt movement, such evidence is readily forthcoming in the form of long-distance filler-gap dependencies, but for covert movement there is no clear evidence and the parameter retains its default setting. Indeed, Yamane (2003) found that Japanese beginning learners of English who had been taught the grammar of English *wh*-movement on the basis of short distance *wh*-movement failed to generalize this strategy to long-distance *wh*-movement and instead spontaneously produced *wh*-scope marking structures for long-distance *wh*-questions, further supporting the view that clause-boundedness is the default and cyclic movement is an acquired deviation from the default.

A separate issue arises with respect to the implementation of our proposal. Since a number of the pieces of the puzzle are not quite in place at this stage of the discussion, we postpone the issue of implementation and return to it only in the concluding section **??**.

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: Antecedent Contained Deletion and intervention effects.

Regarding the first, 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 (27a) has not been crossed by overt *wh*-movement and it can license ACD.

(27) 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 (28a) by contrast, the in-situ *wh*-phrase has been crossed by overt *wh*-movement; it cannot license ACD, which makes the example overall unacceptable.

(28) 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]

Pesetsky explains this pattern as follows: There are several paths to an appropriate question interpretation. The first relies on covert phrasal movement of the the entire in-situ *wh*-phrase. This movement is subject to superiority and therefore fails when the *wh*-phrase has been crossed. Phrasal movement licensing ACD is thus possible in (27a) but impossible in (28a). This explains the contrast. The second path to pair list interpretations, according to Pesetsky, relies on feature movement. Feature movement is not subject to superiority but it cannot license ACD.

Pesetsky's second argument relies on intervention effects. While it is still not clear what exactly intervention effects diagnose (see Beck 1996, 2006; Grohmann 2006; Kotek 2014; Mathieu 2002; Mayr 2014; Pesetsky 2000; Tomioka 2007 for various

theoretical interpretations), Pesetsky suggests that they track the same phrasal vs. non-phrasal movement distinction we saw at work with ACD. Pesetsky ovserves that in superiority obeying configurations like those in (29a)–(29c) both a single pair and a pair-list interpretation are accessible. However, in superiority violating configurations like (29d)–(29f), the pair-list reading disappears just in case there is an intervener along the path between the crossed, in-situ *wh*-phrase and its scope: (29f). In other words, Pesetsky claims that a *wh*-phrase is subject to intervention by negation in case three things come together: The *wh*-phrase is in situ, has been crossed by overt *wh*-movement, and is intended to support a pair-list interpretation.

(29) 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

This second pattern is explained as follows by Pesetsky: There are two paths to Pair List interpretations. The first relies on covert phrasal movement. As this movement is subject to superiority, it is possible when the in-situ phrase has not been crossed overtly, (29a–c), but fails when the in-situ *wh*-phrase has been crossed overtly, (29d–f). Feature movement is not subject to superiority but it is subject to intervention. This explains why a pair-list reading is blocked in (29f), where both superiority and intervention come together.

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, we can ask whether the capacity of an in situ *wh*-phrases to license ACD is clause bounded. Indeed, Baltin 1987, p. 583 showed that it is. He gives the (30) and claims that it can only be interpreted as (30a) but not as (30b). Baltin interprets these data as a problem for the idea that ACD is licensed under LF movement on the assumption that *wh*-phrases may or must move to their

scope position at LF. We agree. The example suggests that covert movement of the overtly in-situ *wh*-phrase is clause-bounded.

(30) Who thought that Fred read how many of the books that Bill did?
   a. Who thought that Fed read how many of the books that Bill read?
   b. Who thought that Fred read how many of the books that Bill thought that he had read?

The judgment on (30) is confirmed in Culicover and Rochemont 1990, p. 44 ex. 53. Elliott 2015 independently reaches the same conclusion.

K. Syrett (p.c.) suggests that a clearer test than Baltin's might be based on unambiguous examples:

(31) 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=surprised that Mary likes t). The speakers we have asked find the version with *is* ungrammatical. This is in line with Baltin's, Culicover &Rochemont's, and Elliott's judgments. The data are very suggestive of the conclusion that covert phrasal *wh*-movement is clause bounded.[16]

[16]An anonymous reviewer points out an interesting predicted interaction between the account of Nishigauchi's counterexample, (10), in terms of Barros and Frank 2017a; Grano and Lasnik 2018 from footnote 7 and the ACD case discussed here.

If the clause-boundedness of covert *wh*-movement can be overcome by the presence of a bound pronoun in the subject position of the embedded clause, as suggested by the account sketched in footnote 7, then we should see the following pattern (predicted ideal judgments):

(i) a. ACD with quantifier
   1) John claims that Sue is working on every project that Bill {*does <claim that Sue is working on> | is <working on>}.
   2) John_j claims that he_j is working on every project that Bill_b {does <claim that $\text{he}_{\{b \mid *j\}}$ is working on> | is <working on>}.
   b. ACD with *wh*-in-situ
   1) Which of these boys claims that Sue is working on which project that Mr Finn (also) {*does <claim that Sue is working on> | is <working on>}?
   2) Which of these boys_b claims that he_b is working on which project that Mr Finn_f (also) {does <claim that $\text{he}_{\{f \mid *b\}}$ is working on> | is <working on>}?

Consultation with a number of native speaker colleagues suggest that there are contrasts going in the right direction, but the baseline is somewhat fuzzy, since the amelioration in (ia-2) does not reach full acceptability. Carefully controlled work (see Syrett 2015; Syrett and Lidz 2009) would be necessary to shine a clearer light on these facts and, in particular, on the question of whether

A second argument for clause boundedness of 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 (32).

(32) 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 Ken a car, and Charles gave Ken 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 (33), 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.

(33) [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. Of the three answers listed, only answer (34a) is available.

(34) 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 and below for further discussion).

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there is a parallel interaction between the bound construal of the embedded subject in the ellipsis site and the availability of long ACD in both the quantifier and the *wh*-conditions. The outcome of such an experiment would allow evaluating the proposal from footnote 7 more clearly.

Finally we return, with some hesitation, to intervention effects. Kotek 2014, 2015; Kotek and Erlewine 2016 observe that it follows from Pesetsky's logic 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 phrasal *wh*-movement. Recall that Pesetsky claims that covert phrasal *wh*-movement is not subject to intervention. Kotek 2015 deploys this diagnostic to demonstrate the island sensitivity of covert phrasal *wh*-movement by contrasting high and low negation in structures schematically like (35). This confirms Pesetsky's (1987) conjecture mentioned in the introduction. The logic is the following. If covert *wh*-movement is island sensitive, then negation outside of the island should block a pair list interpretation even in superiority obeying structures while negation inside of the island should not have this effect. The data in Kotek 2015 suggest that covert *wh*-movement is indeed island sensitive.

(35) a. [Wh_1 [Wh_2 [...[Wh_1 ...[...[$_{\text{island}}$ Wh_2 [...$\text{negation}_{\text{low}}$ [...Wh_2 ...]]]]]]]]

*long covert *wh*-movement

b. [Wh_1 [Wh_2 [...[Wh_1 ...[$\text{negation}_{\text{high}}$ ...[$_{\text{island}}$ Wh_2 [...Wh_2 ...]]]]]]]

*long covert *wh*-movement

With the same logic one can also evaluate whether covert phrasal *wh*-movement is clause bounded: We simply replace the island boundary in (35) with a CP in a bridge context. If covert phrasal *wh*-movement is clause bounded, then high (non clausemate) negation and other interveners will suppress pair list readings but low (clausemate) negation will not. The closest Kotek comes to this structure is example (36). The example features a weak island created by the manner of speaking verb. The asterisk indicates the lack of a pair list reading.

(36) 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.

(37) 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.

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. Clause boundedness and superiority sensitivity of covert movement were crucial in our account of the clause-mate condition on multiple sluicing. The assumptions find independent support in the interpretive asymmetries discussed throughout this section.

5 Single-pair Readings via Choice Functions

We now turn to the semantic implications of what we have discovered about multiple sluicing. To recap, the basic generalizations are the following. Multiple sluicing is possible in *wh* in-situ, single *wh* fronting as well as multiple *wh* fronting languages. Multiple sluicing is not possible across clauses or in superiority violating simple clauses. On the view that sluicing involves ellipsis of material below $C_{[+WH]}$, the conclusion we draw from this set of generalizations is that (a) sluicing requires overt or covert *wh* movement to a position above $C_{[+WH]}$, (b) covert movement is not only island-sensitive but also clause-bounded and (c) superiority violating structures leave at least one *wh* in a position below $C_{[+WH]}$, the site of the ellipsis.

Licit multiple sluicing structures, that is structures that involve overt or covert *wh* movement, do not pose any particular semantic challenge as long as some theory of single-pair and pair-list answers compatible with *wh* movement is adopted. It is the illicit sluicing structures that have interesting implications for the semantics of questions because their non-elliptical versions establish the availability of single-pair and pair-list readings, even without all *wh* expressions moving to the same C.

In the rest of this section we do three things. We introduce three basic scope taking mechanisms used in much of the current literature to interpret multiple *wh* questions. We show how single-pair readings can be derived without movement. We discuss an existing proposal for interpreting pair-list answers without movement and show that it cannot be adopted for single-pair readings relevant to multiple sluicing.

5.1 Mechanisms for Scope Taking

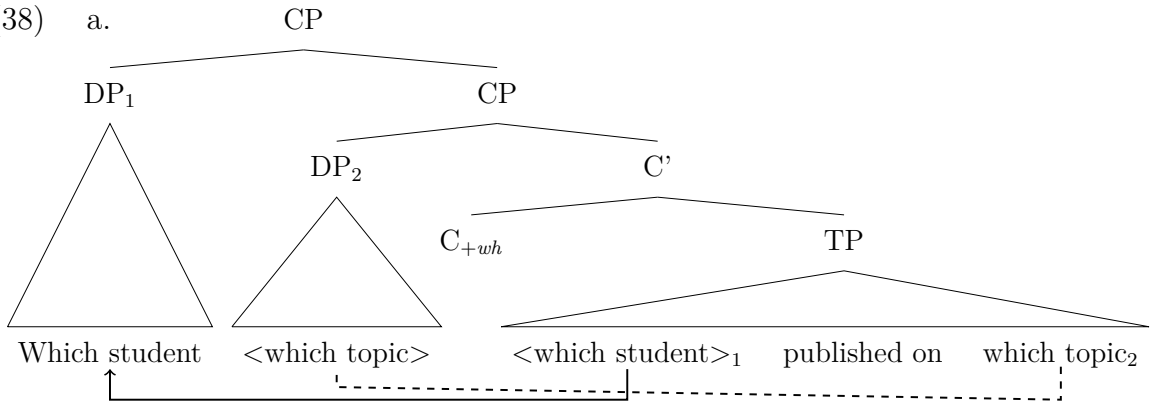
There exist at present at least three distinct semantic mechanisms for *wh* scope-taking: *wh*-phrases as inherently focused expressions (Hamblin 1973), *wh*-phrases as existential generalized quantifiers (Karttunen 1977), and *wh*-phrases as existentially bound choice functional expressions (Reinhart 1997, 1998).[17]

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 intepretation 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 (38a) 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 overt 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. An important point to note is that material below $C_{[+WH]}$ forms the question nucleus (see Dayal 2016 and references cited there for details):

[17] 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 (Ciardelli, Roelofsen, and Theiler 2017; Groenendijk and Roelofsen 2009).

(38) 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 (38b) as the logical representation. If *which topic* is left in situ and interpreted as a choice function variable, existentially bound from outside C_{+wh}, we get (38c), where CF(f) indicates that f is a choice function from sets of individuals to individuals «e,t>,e>. If *wh*-expressions are treated as foci, we get (38d). The final denotation is the same in each case: in contexts where there are two students and two topics, this will be a set of four propositions such as the one in (39a):

(39) 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 (39a) (w@) = ^Sue has published on NPI.

Applying the answerhood operator from Dayal 1996a (Ans-D), we get the single-pair reading straightforwardly. It picks out the unique proposition in the set which is true at the world of evaluation w@, and is undefined if there is no true proposition or if there is 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 (40a) we have an antecedent that forces the multiple sluice in (40c) and its pre-sluice in (40d) to have the single-pair reading. In (40b) the antecedent

sets up a distributive context and forces the identical sluice in (40c) and its pre-sluice in (40d) to have a pair-list reading (see discussion below example (9b) above):[18] [19,20]

(40) a. Some student has published on some topic, but I couldn't tell you
b. Every student has published on some topic, but I couldn't tell you
c. …which student on which topic.
d. … which student has published on which topic.
e. …[$_{CP}$ which student$_1$ [$_{CP}$ on which topic$_2$ ~~[$_{TP}$ t_1 has published t_2]~~]]

In a theoretical setting like the one assumed here, in which ellipsis can make covert movement overt, the example in (40) 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 (41), 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:[21]

(41) a. [$_{TP}$ some student$_1$ [$_{TP}$ some topic$_2$ [$_{TP}$ t_1 has published on t_2]]]
b. [$_{TP}$ every student$_1$ [$_{TP}$ some topic$_2$ [$_{TP}$ t_1 has published on t_2]]]

We also adopt the standard view that a structure where the indefinite has scope over the universal, (42), is compatible only with an interpretation of the indefinite as a unique individual, which then allows only single sluicing, (42a). The reading we get is the individual reading of the pre-sluice where every student is working on the same

[18]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 (39b), 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.

[19]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 (40d), where the second *wh*-phrase is inside a PP but not if it is just a 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 (40d) as representative of multiple sluicing patterns more generally.

[20]While in the previous sections movement structures were notated with copies, to save space and for readability, we switch to a notation with traces here. Struck out text represents ellipsis whereas angled brackets, <>, or traces represent movement relations.

[21]While the LF representations in (41) are compatible with a strict syntactic identity condition on ellipsis resolution, recall from above that we are not endorsing such a view.

topic. Although such cases will not concern us for the moment, they will become relevant in section **??** :

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

We now return to multiple sluicing. The rest of Section **??** is devoted to single-pair readings, leaving pair-list readings for sections **??** 6, 7 8. We first present our choice-function based account of single-pair readings in section 5.2, before discussing a focus-based account of the same facts and our reservations about it in section 5.3

5.2 A Choice Functional Account of Single-Pair Readings

As we have seen, local multiple *wh*-questions and multiple sluices demonstrate 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:[22]

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

The unacceptability of (43a) rules out the possibility of an LF like (43c) in which both *wh*-expressions are at the left periphery of the matrix CP. That is, (43a) tells us that covert *wh*-movement across islands is not possible. The grammaticality of (43b) tells us that there must exist in natural language another scope mechanism that is not subject to the same constraints as covert movement.

One such mechanism is the choice functional account of indefinites and *wh*-phrases, proposed by Reinhart 1997, 1998 (see also Winter 1997), which we adopt

[22]Recall 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}*.

here. Taking the antecedent clause first, we see in (44a) that the indefinite inside the island can be interpreted with a choice function variable, existentially bound from the matrix. The single pair reading in (43b) must derive from an LF like (44b) where the choice function variable over the *wh*-in-situ is bound from the matrix C_{+wh} by a null ∃ operator:[23]

(44) a. [∃**f₂** [$_{TP}$ Some linguist$_1$ [$_{TP}$ t_1 was upset [$_{ISLAND}$ because [$_{TP}$ Harry spoke to **f_2 (philosopher)**]]]]

b. [$_{CP}$ which linguist$_1$ [$_{CP}$ ∃**f₂** [$_{TP}$ t_1 was upset [$_{ISLAND}$ because [$_{TP}$ Harry spoke to **f_2 (philosopher)**]]]]

⇒ λp ∃x [CF(f) ∧ linguist(x) ∧ p = x was upset because Harry spoke to f(philosopher)]

Treating *wh*-expressions as choice functional expressions derives single-pair answers when Ans-D, given in (39b), is applied to the set of propositions in (44b), and the ungrammaticality of the sluice. When the TP is elided there is only one *wh*-remnant at the left edge - the null ∃ that binds the choide 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*.[24]

[23]We adopt 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.

[24]One might be tempted to argue that the sluice in (43a) 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):

(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 (43a) plausible: clause-bounded QR and strict syntactic parallelism (see Abels 2019a for relevant discussion in the context of Griffiths and Lipták's (2014) parallelism based account of the island sensitivity of contrast sluicing).

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

(45) 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 have been presented (Dayal 1996a; Hagstrom 1998; Nishigauchi 1990; Pesetsky 1987), 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.[25] The following paradigm (made famous by Baker 1970) is illustrative of the type of structure in question:

(46) 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 (46b) and (46c) but the single-pair answer in (46d) is also possible. It needs special prosody and context, as single-pair readings often do. The context sentence in (45) provides an antecedent with the right properties to bring out the single-pair reading.

Single pair readings across islands, then, turn out to be revealing at two levels. One the one hand, we can use their impossibility under multiple sluicing to reinforce our argument from section 3 above that covert *wh*-movement is island sensitive and remains so under sluicing. The multiple sluicing facts thus provide a novel argument against the view that overt and covert *wh*-movement differ with respect to island sensitivity and argue against Huang 1982 and much subsequent work. The clausemate condition goes even further: Not only is covert *wh*-movement not less restricted than overt movement, it is more restricted than overt movement (Dayal 1996a) in that it is clause-bounded. At the second, more general level, the acceptability of

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.

[25]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 in non-elliptical structures provides evidence that natural language has a further scope taking mechanism for *wh*-in-situ. We assume 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 ∃-operator. This conclusion is in keeping with the claim in Pesetsky (1987) that only non movement-based scope taking alternatives can be impervious to constraints relevant to syntactic islands.[26] Dayal (2002) modifies her earlier claim of only local scope-taking for *wh*-in-situ to admit long-distance single-pair readings but this generalization will have to be modified when we turn to multiple pair readings in section **??**

5.3 A Focus-based Account of Single-pair Readings

In section 5.1 we discussed the focus-based account of *wh* expressions, which is also suited to interpreting *wh* expressions in-situ. Here we briefly its applicability to the phenomenon of multiple sluicing. In what follows we present some of our reservations in adopting this approach, but we should state at the outset that we do not intend to argue against the focus-based approach per se. As should become clear in the course of the discussion, we do not see a simple way of using the most prominent accounts based on focus semantics to address the issues raised by multiple sluicing, though a more nimble theoretician might be able to overcome the difficulties we see. In this section our primary attention is on single-pair readings, We will address the applicability of focus semantics to pair-list readings i section **??** leaving discussion of focus semantics and pair-list readings to section **??**.

As we discussed, it is possible for pre-sluice structures in which one *wh*-phrase is in the matrix clause and another is in the an embedded clause to have single-pair readings:

(47) a. Some student knows what Mary said to some professor but…
b. I can't remember which student knows what Mary said to *which professor*.
c. *I can't remember which student to which professor.

The question we are interested in probing is whether the italicized *wh*-phrase in (47b) can be interpreted in situ via focus semantics. Kratzer and Shimoyama (2002) and Shimoyama 2001, 2006 predict that a single-pair reading of the Japanese counterpart should not be possible. This is because the scope of indeterminate

[26]Pesetsky (1987) took the relevant mechanism to be unselective binding of an individual variable, which we do not adopt, for the reasons given in Reinhart (1997, 1998).

Japanese phrases is restricted by the closest c-commanding operator. The following example from Nishigauchi 1990 illustrates:

(48) 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?

Kratzer and Shimoyama capture this fact by allowing the alternatives created by an inherently focused indeterminate phrase to expand across clauses but require it to be caught by the first relevant operator, where the squiggly line represents the expansion of alternatives:

(49) * [… [… *wh*-indefinite …ka/mo…] -ka/mo

It is not true, however, that Japanese indeterminate pronouns are always constrained in this way. The following, from Dayal 1996b, shows that long-distance pair list readings are available for the Japanese counterpart of the Baker example, which turn out also to allow single-pair readings, analogously to English.

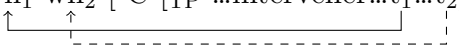
(50) dare-ga [Mary-ga doko-de nani-o kat-ta ka] sitte-imasu ka
who Mary where what bought Q know Q
Who knows where Mary bought what?

Deferring discussion of pair-list readings for now, we note the fact that (48) and (50) pose a problem for Kratzer and Shimoyama's position on the scope properties of *wh*-expressions because they pull in opposite directions.[27]

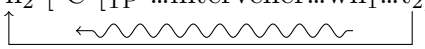
We can also demonstrate the problems with the focus-based approach on the basis of English. Kotek (2014) discusses intervention effects in superiority obeying vs. superiority violating multiple *wh*-questions. She follows Pesetsky (2000) in taking the *wh*-in-situ to have the option of moving to C, as long as it results in a superiorty compliant structure, or to be interpreted in situ. Taking the in-situ option to use focus semantics and adopting the analysis of Beck (2006) for intervention, she derives the pattern of judgments shown in the LFs she posits. Solid lines indicate overt movement and dashed lines indicate covert movement. As above, the squiggly arrows indicate the the *wh*-expressions does not move to C for scope assignment but rather derives its meaning via focus semantics:

[27] We have confirmed that a single-pair reading is possible for (50) when prosody and context are controlled for.

(51) a. English superiority-obeying questions: no intervention effects
√ [$_{CP}$ wh_1 wh_2 [C [$_{TP}$ …intervener…t_1…t_2]]]



b. English superiority-violating questions: intervention effects
* [$_{CP}$ wh_2 [C [$_{TP}$ …intervener…wh_1…t_2]]]



Recall, however, that intervention effects relate to the loss of pair-list readings, not to ungrammaticality per se (cf. the paradigm from Pesetsky (2000) given in (29)). Kotek's account does not allow for the available single-pair reading of structures like (51b). The account of intervention she relies on, namely Beck (2006), is silent on the single-pair vs. pair-list distinction but the ingredients of that analysis should apply equally to both readings. Kotek addresses this problem by denying the legitimacy of single-pair readings in superiority violating questions generally.[28] Appealing to scope-economy Fox, 2000, she argues that multiple-pair readings of superiority-violating questions are licensed because they lead to distinct answers from those to superiority-obeying ones. Single-pair answers, since they are not affected by the order of *wh* expressions, disfavour superiority-violations. She cites David Pesetksy (p.c.) in a footnote for a possible counterexample, however:

(52) Context: To foster an atmosphere in our Linguistics unit, every day one syntactician and one phonologist go out to lunch together, at the department's expense. You know who went out to lunch together this week, so tell me:
   a. Which syntactician took which phonologist to lunch today?
   b. Which phonologist did which syntactician take out to lunch today?

Kotek's suggestion is that this is an "accidental" single-pair reading, not a "true" single-pair reading but the distinction seems to us somewhat strained. We have proposed instead that single-pair readings are genuine and can be derived by interpreting the *wh* in situ through choice functions, which are impervious to locality considerations as well as to intervention effects.

To sum up, our position is that the ungrammaticality of multiple sluicing can provide evidence that covert *wh* movement is blocked in specific cases. The single-pair reading of the grammatical pre-sluices in such cases calls for a scope mechanism

[28]Beck's account of intervention has been challenged in a number of studies, both empirically and theoretically. At present there are a number of alternatives on the market that present viable alternative accounts of the phenomenon (Grohmann 2006; Mayr 2014; Tomioka 2007).

that does not rely on movement. We take this scope mechanism to involve binding of choice function variables, a mechanism that is known to be non local, non island-sensitive, and not subject to intervention. We do not see a clear way of tapping into the focus-based approach to derive the same effects, at least not in the versions of focus semantics for questions currently on the market.

6 Pair-list readings via Skolem Functions

Our arguments against the focus-based approach to single-pair readings across clauses and in superiority violating structures do not transfer over to a focus-based account of their pair-list readings. One might argue, for example, that natural language grammar includes all (three) types of scope taking mechanisms and that the choice functional account survives when movement is blocked (as evidenced by the ungrammaticality of multiple sluicing) and when focus percolation hits a roadblock of some kind (let us say in the presence of interveners). That is, accounts such as Kotek (2014) may not be helpful for single-pair readings but may well be what is needed for pair-list readings. In this section we argue against this possibility and propose an alternative approach to pair-list readings, based on functional dependencies. In sections 7 and **??**8 we apply the function-based approach to structures where multiple sluicing rules out the possibility of covert movement.

6.1 The Focus-based account of Pair-list Readings

Let us consider the focus-based account of pair list readings in Kotek (2014), who follows the lead of Hagstrom (1998) and Fox (2012) in the account of pair-list readings for superiority compliant structures (see also Nicolae 2013):

superiority violating simple clauses, where multiple sluicing rules out the possibility of movement to C, in keeping with Pesetsky, 2000. Kotek (2014) follows the lead of Hagstrom (1998) and Fox (2012) in the account of pair-list readings for superiority compliant structures (see also Nicolae 2013):

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

b. $\lambda Q\ \exists y$ [student(y) $\wedge$ Q = $\lambda p\ \exists x$ [topic(x) $\wedge$ p = ^y 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* $\mathbb{Q}$: *what did John publish on? what did Sue publish on?*

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

Among the crucial aspects of this account is a split $C_{[+WH]}$ structure, where the lower C results in a set of propositions and the higher C in a set of questions. The final result delivers the two properties identified in Dayal (1996a) as being critical to pair-list readings. Every member of the set denoted by the fronted *wh* expression is paired with exactly one member of the set denoted by the *wh* in situ, domain cover and point-wise uniqueness. The answer to the question is the intersection of the answers to the sub-questions (cf. (39b)): *what did John publish? what did Sue publish?* derived by applying the answerhood operator from Dayal (1996b), given in (39b). It picks out the unique true proposition in the set that entails any other true proposition. In the case of singular terms, this ensures that only one proposition will be true. That is, the question will be defined only if each individual has published on exactly one topic.

We present the relevant pairing in the diagram below, highlighting two terms that occur regularly in current semantic discussions of pair-list readings and which will be crucially used in the analysis we develop in the next section:

(54) DRAW PICTURE AT SOME POINT

Domain cover: all members of the set denoted by the fronted *wh*, the *domain set* are paried but not all members of the set dnoted by the in-situ *wh*, the *range set*, need to be.

Point-wise Uniqueness:each member of the domain set is paired with only one member of the range set, when the *wh* phrase that sets the range set is singular, i.e., *which N.SG*, reflects the uniqueness that such phrases display when they occur in single *wh* questions *which topic did John publish on?*

Let us return now to Kotek's account of pair-list readings. She accounts for them in superiority violating questions in the following way:

(55) a. [Which topic$_i$ [$C_{[+WH]}$ [$C_{[+WH]}$ [which student published on t_i]]]]

b. {John published on x, Sue published on x}

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

In this derivation, *which student* does not undergo covert movement but is interpreted via focus semantics resulting in a set of propositions at the lower C, as shown in (55b), tantamount to *who has published on x?* When the free variable cor-

responding to the trace is existentially bound from the higher CP, we get a reading where the fronted *wh*, this time the object *wh which topic*, is exhaustively paired with exactly one member of the subject term. This is the desired outcome, capturing the empirical generalization that in superiority violating questions, it is the object *wh* which sets the domain and the subject *wh* which functions as the range:

(56) DRAW PICTURE AT SOME POINT

As mentioned earlier, Kotek's account of superiority violating questions draws on intervention effects as support for focus semantics à la Beck (2006). We noted above there have been several empirical as well as theoretical challenges to Beck's account of intervention effects and there are plausible alternative explanations that have been proposed. When combined with our own argument from the survival of single-pair readings, we are not persuaded that Kotek's account should be adopted on the basis of intervention effects. We also have a general discomfort with the fact that superiority violations are known to be sensitive to discourse and yet discourse factors play no role in the explanation. To be fair, this disconnect between observations about D-linking and the actual nature of the proffered explanation also holds of other accounts of superiority violations. It would be desirable if D-linking played the same role in the explanation as it does at the observational level. For these reasons, we believe an alternative approach to pair-list readings, one that connects to discourse factors, is worth exploring. We present such an alternative in what follows.

6.2 Skolem Fucntions in Question Semantics

Our approach builds on the account of pair-list readings in Dayal (2016, in preparation), which in turn draws on the view that *wh* epxressions can denote not just sets of individuals but also sets of functions of type <e,e>, that is, sets of functions from individuals to individuals (Chierchia (1993), Engdahl (1980, 1986), and Groenendijk and Stokhof (1983)). The initial justification comes from functional answers to questions with quantifiers:

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

Although the functional account of such questions is well-established at this point, let us take a moment to understand what is at issue in order to make our discussion in this paper self-contained. Let us go back to the diagram in (54), which describes the relation between individuals and topics. However, the information can also be

packaged in terms of a description of the relation between individuals topics, that is, *his/her dissertation topic, his/her qualifying paper topic* etc.[29]

The two readings in (57b) and (57c) are captured on this account by extending the ontology to allow *wh* quantifiers to range over skolem functions. We present the individual reading in (58) and the functional reading in (59).

(58) $[_{CP}$ which topic$_2$ $[_{C'}$ C_{+wh} $[_{TP}$ every student$_1$ $[_{TP}$ t_1 published on t_2]]]]
$\lambda p\ \exists x\ [\text{topic}(x) \wedge p = \hat{}\ \forall y\ [\text{student}(y) \rightarrow y \text{ published-on } x]]$
$\{\hat{}\ \forall y\ [\text{student}(y) \rightarrow y \text{ published-on NPI}],$
$\hat{}\ \forall y\ [\text{student}(y) \rightarrow y \text{ published-on FCI}]\}$

As is standard, the fronted *wh* in (58) quantifies over individual topics and the universal quantifier raises TP-internally and is interpreted as part of the question nucleus. The same assumptions carry over to the functional reading, adjusting for quantification over <e,e> type functions. Here we use captial F in order to flag the distinction between Engdahl-style skolem functions from individuals to individuals and Reinhart-style choice functions from sets of individuals to individuals discussed earlier. We see a minimal variant of (58) below where *which topic* is interpreted as an existential quantifier over skolem functions. That is, instead of *topic* restricting individuals as in (58), it restricts the range of functions in (59):

(59) $[_{CP}$ which topic$_2$ $[_{C'}$ C_{+wh} $[_{TP}$ every student$_1$ $[_{TP}$ t_1 published on t_2^1]]]]
$\lambda p\ \exists F\ [\forall x(\text{topic}(F(x)) \wedge p = \hat{}\ \forall y\ [\text{student}(y) \rightarrow y \text{ published-on } F(y)]]$
$\{\hat{}\ \forall y\ [\text{student}(y) \rightarrow y \text{ published-on y's dissertation topic}],$
$\hat{}\ \forall y\ [\text{student}(y) \rightarrow y \text{ published-on y's qualifying paper topic}]\}$

Ans-D, when applied to (58) and (59), yields the two types of answers we are interested in, the individual and the functional answer respectively.

One other crucial aspect of the functional approach involves structural sensitivity. We adopt the syntactic proposal from Chierchia 1993, where functional *wh* expressions leave behind functional traces. In (59), 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 (60a):

[29]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.

(60) 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 published on t_2]]]]

For Chierchia, the a-index is a pronominal element and subject to the same constraints as regular pronouns. (60c) is ruled out because the binding required for the functional reading involves QR over the a-index of the functional trace, resulting in a 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:[30]

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

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

We will return to pair-list readings of questions with quantifiers in section **??**. For now, we turn to pair-list readings of multiple *wh* questions and show how skolem functions can be used to model the relevant dependency.

6.3 Deriving pair-list readings through Skolem Functions

Chierchia's account has been adopted for multiple *wh*-questions by Comorovski 1996; Dayal 1996a, 2002; Hornstein 1995, among others, to explain the observation that the fronted *wh*-expression behaves like a universal (É. Kiss 1993). The paradigm in (63) is illustrative, assuming a domain with two students and two topics:

(63) 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.

We follow Dayal 1996a in taking pair-list readings to draw on functional relations displaying domain cover and point-wise uniqueness, as explicated in section **??**6.1 and illustrated above in (63).

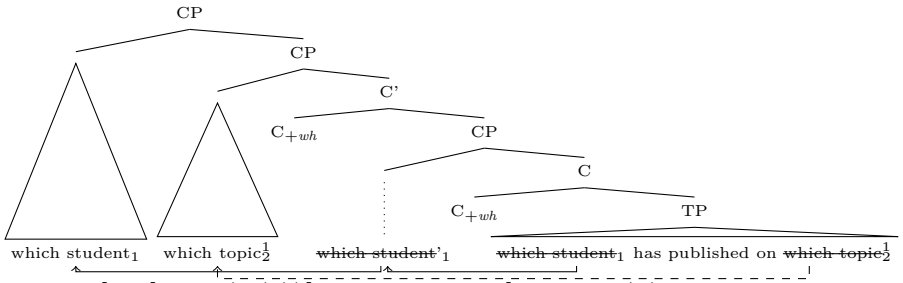
[30] See section **??** for more on questions with quantifiers.

Let us illustrate the workings of the functional account in a basic superiority obeying multiple *wh* structure.

account-discussionshows that pair-list answers draw on functional relations, in the sense that they display domain cover and uniqueness. An answer like (63b), specifying for each member of the subject term the topic they have published on while leaving out a member of the object term, is fine. The opposite, however, is not acceptable (63c). That is, multiple *wh*-questions replay the subject-object asymmetry observed in (61)–(62). 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. 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.

We illustrate the working of the functional account for a basic superiority obeying multiple *wh* structure.

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

b. 

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

Focusing on the LF in (64b), 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. In section 6.1, we saw the split C structure used for pair-list readings by Fox 2012; Kotek 2014; Nicolae 2013. The split C structure was also proposed in Dayal 1996b for echo questions and wh-islands. However, the current account differs in detail from all of these earlier accounts.

We start with the assumption that a split C structure is always available in the syntax as long as a *wh*-phrase moves to the specifier. Note how the overtly moving *wh*-phrase moves through the specifier position of both CP layers activating both.

We take the fronted wh-phrase in (64b) to move through the lower $C_{[+wh]}$, to the Spec of the higher CP. The functional *wh*-in-situ is tucked in at LF. The order of the fronted *wh* and the *wh* in situ follows Richards 1997, which takes its inspiration from multiple fronting languages.

In terms of interpretation, we take the fronted *wh* to be interpreted at the lower C. This results in the set of propositions in (65a):

(65) a. $\lambda p\ \exists x_1$ [student(x_1) $\wedge$ p = $\hat{}x_1$ has published on F_2 (x_1)]
b. {John has published on F_2 (John), Sue has published on F_2 (Sue)}

To understand the way the higher CP affects the interpretation let us make the functional domain concrete. Assuming a domain with two students, John and Sue, and two topics NPI and FCI, as we have been assuming, there are four possible functions of type <e,e>, as shown in (66):

(66)

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

We interpret the functional *wh* at the higher C level using Engdahl's semantics for functional *wh*-phrases as existential quantifiers over skolem functions, as shown in (67a). This provides a fully compositional route to (64c). The derivation of the final answer is illustrated below:

(67) a. $[\![\text{which}_{\text{FUNC}}]\!] = \lambda Q\ \lambda\mathfrak{F}\ \exists F\ [\ \forall z[Q(F(z))] \wedge \mathfrak{F}(F)]$
b. $\lambda Q\ \exists F_2\ [\ \forall z\ [\text{topic}(F_2\ (z))] \wedge Q = \lambda p\ \exists x_1$ [student($x_1 \wedge$ p = $\hat{}\ x_1$ has published on F_2 (x_1)]]

(68)
$$\left\{\begin{array}{l}\{\text{john has published on } F_1(\text{john}), \text{Sue has published on } F_1(\text{sue})\},\\ \{\text{john has published on } F_2(\text{john}), \text{Sue has published on } F_2(\text{sue})\},\\ \{\text{john has published on } F_3(\text{john}), \text{Sue has published on } F_3(\text{sue})\},\\ \{\text{john has published on } F_4(\text{john}), \text{Sue has published on } F_4(\text{sue})\}\end{array}\right\}\ \left\{\begin{array}{l}F_1\text{: j→NPI, s→FCI}\\ F_2\text{: j→NPI, s→NPI}\\ F_3\text{: j→FCI, s→NPI}\\ F_4\text{: j→FCI, s→FCI}\end{array}\right.$$

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

(70) $\hat{}$John has published on NPI and Sue has published on FCI.

A generalization of the answerhood operator is given in (69). 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 1996a and illustrated in (63): 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 1996a, 2002. Fundamental to all these accounts, however, is the fact that once the ontology is extended to include skolem functions as possible meanings for *wh* expressions, the idea of an existential quantifier over them follows as a natural consequence.[31]

We would like to end this section by making a couple of points about the mapping from syntax to semantics that we are assuming for multiple *wh* questions on their pair-list readings. The crucial difference between this account and the one proposes by Hagstrom-Fox has to do with the role of the functional *wh* in giving bite to splitting the C. We postulate that the pair-list readings of functional *wh* expressions, with two indices in them, can only be realized if mapped onto a split C structure, with the lower $C_{[+wh\,]}$ interpreting the variable associated with the domain setting expression and the higher $C_{[+wh\,]}$ interpreting the skolem function variable associated with the dependent term, the range-setting expression.[32,33,34]

7 D-Linking and the Skolem Functional Account of Pair-List Readings without Movement

In this section we extend the functional account of pair-list readings to two cases where the facts from multiple sluicing force a non-movement scope-taking option for

[31] As noted in Dayal 1996a, 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.

[32] The semantic type of the final denotation is the same as in the Hagstrom-Fox approach, namely sets of sets of propositions: «<s,t>, t> ,t>, but there is a difference. The set of propositions at the lower CP node in our account does not correspond to natural questions. As such, the answerhood operator is defined differently. While the details are non-trivial they are orthogonal to our concerns here (see Dayal 2016 for details).

[33] We are less committed to moving the *wh* expressions in exactly the manner given in (64b) for the case at hand. The same results, with minor tweaks, could be obtained on an LF where the overtly fronted *wh* moves to the higher CP directly and the functional, in situ*wh* moves covertly through the lower CP before tucking in below the *wh* phrase in the higher CP. Our choice here is motivated by the fact that it represents the most general case, as we will see, when we turn our attention to cases which do not support multiple sluicing, namely those in which only one member of the dependency is above the ellipsis site.

[34] Note that the functional account places the burden of explanation for the subject-object asymmetry on the TP-internal structurek, where questions with quantifiers and multiple *wh* questions can be similar. Other accounts, such as the Scope Principle of May 1985, locates the explanation in the final scope position, where the two part company.

one of the two *wh*-phrases. The first involves *wh*-'wh dependencies in superiority-violating configurations. The second involves a *wh* dependency with a universal quantifier. The explanation for both leverages the significance of D-linking in making these readings available.

7.1 Pair-list Readings of Superiority Violating Questions

As we noted earlier, there exists at present a disconnect between observations regarding the crucial role of D-linking in ameliorating superiority violations and the explanations given for them. In extending the functional account of pair-list readings, we try to close the gap by allowing a syntactically lower *wh* expression to scramble over a higher *wh* expression if its discourse status is more prominent. This crucially reverses the dependency relationship; a scrambled object for example can thus become the domain term and the subject the functional *wh* term, in keeping with their prominence relation in discourse. In a *wh*-fronting language, this then leads the object term to move to the C domain as an instance of Attract Closest:[35]

(71) a. Which topic did which student publish on?
b. [CP which topic$_2$ [C$_{[+WH]}$ [t$_2$ [C$_{[+WH]}$ [TP t$_2$ which student$^2_1$ publish on t$_2$]]]]]

We follow syntactic accounts, such as Pesetsky (2000), in disallowing LF movement of the subject term once it has been crossed.[36] We elaborate on this below.

Let us make a general point first. We have admitted choice functions into our interpretive toolkit and modeled them as functions of type «e, t> e>, functions from sets of individuals to an arbitrarily chosen member of that set, an individual. We have also admitted into our system, in addition to individuals, abstract entities of type <e,e>, namely skolem functions. We propose a simple generalization of the choice functional binding option available to the domain of individuals to the domain of skolem functions of type «<e, e>, t>, <e, e». That is, if a choice function is applied to a set, be it a set of individuals or a set of skolem functions, it will pick out an arbitrarily chosen member of that set, a particular individual in the first case, a particular skolem function in the second. In (72a) we flesh out the LF in (71b)

[35]In *wh* in situ languages like Japanese or Hindi, the scrambling would be overt, followed by covert *wh* movement to C.
EXPAND THIS FOOTNOTE WITH REMARKS ON A-SCRAMBLING, CROSSOVER, LOCALITY INTERACTIONS.

[36]Note that the formulation of the relevant superiority condition in section 3 was framed generally in terms of A'-movement rather than in terms of *wh*-movement. It should now be clear why.

by activating the null ∃ at the higher C level to bind the choice function variable over the *wh* in situ: *which student*. Recall that we are drawing a crucial connection between a split C structure and a skolem functional dependency in the nucleus.

(72) a. $[_{CP}\ \exists_1\ C_{[+WH]}\ [_{CP}$ which $topic_2\ C_{[+WH]}\ [_{TP}\ t_2$ which $student^2_1$ publish on $t_2\ ]]]]]$

b. $\lambda Q\ \exists f_1\ [CF(f_1) \wedge Q = \lambda p\ \exists x\ [topic(x) \wedge p = \hat{}[f_1\ (\lambda F\ [\ \forall z[student(F(z))]])(x)$ published-on $x]]]$

c. $\lambda F\ [\ \forall z[student(F(z)]] = \{F_1, F_2, F_3, F_4\}$, each F a function from topics to students:

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

The choice-functional interpretation of the in-situ functional *wh*, as we see, mirrors the account for in-situ individual denoting *wh* discussed in relation to single-pair readings of cross-clausal presluices but unacceptable sluices discussed in section 5.2:

(73) a. $\left\{ \begin{array}{l} \{F_1(NPI) \text{ published on NPI}, F_1(FCI) \text{ published on FCI}\} \\ \{F_2(NPI) \text{ published on NPI}, F_2(FCI) \text{ published on FCI}\} \\ \{F_3(NPI) \text{ published on NPI}, F_3 \text{ (FCI) published on FCI}\} \\ \{F_4(NPI) \text{ published on NPI}, F_4(FCI) \text{ published on FCI}\} \end{array} \right\}$

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

c. Ans-D(73b) = John published on NPI and Sue published on FCI.

In a particular case, we might get the answer in (73c) but it is also possible to get answers that link a single individual to both topics. This is the reversal of the dependency seen in superiority compliant structures and matches what has been claimed for superiority violations (Kotek 2014).

To sum up, the functional approach to pair-list readings accounts for superiority violations by scrambling a syntactically lower but discourse-prominent *wh* expression to a position that c-commands the other *wh*-phrase. From this position, the scrambled *wh* can function as the domain term and bind the argument-index on the other *wh* term, which is blocked from moving to the left periphy. The functional *wh* in situ is then interpreted using a choice-function variable over skolem functions, an option correlated with a split C structure. In section 7.2 we return to questions with

quantifiers and provide some further support for this approach to pair-list answers in superiority violating structures.

7.2 Pair-list Readings of Questions with Quantifiers

It is well-known that all quantifiers lend themselves to functional readings, but only a subset of them allow pair-list readings. We can take *each N*|*every N* as canonical examples of quantifiers that allow pair-list readings and *no one* as a canonical example of a quantifier that does not. In (74) we give four LFs that correspond to current approaches to these readings. One approach, due to Engdahl (1986), is that the pair-list is simply a pragmatic spell-out of the functional reading (74a). The second approach, due to Chierchia (1993), pulls the quantifier out of the question nucleus and uses its witness set to create the relevant pairings (74b). A third approach, due to Nicolae (2013), extends the Fox-Hagstrom account of pair-list readings to include quantifiers (74c). A fourth approach, due to Krifka (2001), treats them as quantifying into the speech act of questioning (74d):

(74) a. [$_{CP}$ Which book$^1_2$ [$_{C'}$ did [$_{TP}$ every student$_1$ read t$^1_2$]]]
b. [$_{CP}$ Which book$^1_2$ [$_{C'}$ did every student$_1$ [$_{TP}$ t$_1$ read t$^1_2$]]
c. [$_{CP}$ Every student$_1$ [$_{CP}$ Which book$_2$ [$_{C'}$ did [$_{TP}$ t$_1$ read t$_2$]]]]
d. [$_{SAP}$ Every student$_1$ [$_{SAP}$ Which book$_2$ [$_{C'}$ did [$_{TP}$ t$_1$ read t$_2$]]]]

Of the options above, only (74a) straightforwardly predicts the fact that questions with quantifiers allow pair-list readings but not multiple sluicing:

(75) a. I know that every student is working on a different topic but I couldn't tell you which topic every student is working on.
b. *on which topic
c. *on which topic every student
d. *every student on which topic
e. [$_{TP}$ some topic$^1_2$ [$_{TP}$ every student$_1$ [$_{TP}$ t$_1$ is working on t$^1_2$]]] but I couldn't tell you
[$_{CP}$ which topic$_2$ ~~[$_{TP}$ every student$_1$ [$_{TP}$ t$_1$ is working on t$_2$]]~~]

While it is quite possible that there is no logically independent LF for the pair-list reading, we follow the current view that they are bona fide readings and provide an explanation in terms of the functional approach we have outlined. There are only two additional assumptions we need to make in order to account for the facts, both of which have substantive independent motivation. One, it is possible to extract a unique witness set from universal quantifiers, the common noun set that generates

the quantifier. Two, a universal quantifier cannot be a functionally dependent term, unlike indefinites and *wh*-phrases which have that option. This means that when universal quantifiers participate in pair-list readings, they can only do so as domain terms.

We discuss the LFs for two core cases, with the universal interpreted inside the nucleus. The first has the universal in subject position:

(76) a. Which topic is {every|each} student working on?
[$_{CP}$ which topic$^1_2$ [$_{CP}$ $\exists_1$ [$_{TP}$ {every|each student}$_1$ is working on t$^1_2$]]]

b. $\lambda Q\ \exists F_2\ [\ \forall z(\text{topic}(F_2\ (z)) \wedge Q = \lambda p\ \exists f_1\ [CF(f_1) \wedge p = \hat{}f_1\ (W\{\text{every|each}\}\ \text{student}))\ \text{is working on}\ F_2\ (f_1\ (W(\text{every/each student})))]]$

The binding of the a-index of the *wh*-phrase in (76a) is straightforward. The fronted *wh*-phrase triggers the split C structure and the lower C existentially binds the TP internal universal, via a choice function over the witness set of students. The rest follows along expected lines.

The binding of the a-index of the *wh*-phrase by the universal in object position in (77a) requires an additional step. The universal must scramble above the subject but this option is only available to the inherently D-linked *each N*, not to *every N*[37] But other than scrambling, the path to a pair list reading calls for nothing further.

(77) a. Which student is working on {each |*every} topic?
[$_{CP}$ which student$^2_1$ [$_{CP}$ $\exists_2$ [$_{TP}$ {each|*every} topic$_2$ [$_{TP}$ t$^2_1$ is working on t $_2$]]]

b. $\lambda Q\ \exists F_1\ [\forall z(\text{student}(F_1\ (z)) \wedge Q = \lambda p\ \exists f_2\ [CF(f_2) \wedge p = \hat{}F_1\ (f_2\ (W(\text{each topic}))\ \text{is working}\ f_2\ (W(\text{each topic})))]]$

A few points are worth emphasizing before we transition to pair-list readings across clauses. One, the unacceptability of (77a) with *every N* crucially relies on the assumption that a quantifier cannot be the dependent element in a *wh*-QP chain. Two, dependency-reversals are intrinsically tied to discourse status. Three, fronting of *wh*-expressions in a single fronting language is governed by principles independent of the functional status of the *wh*-expression – Attract Closest targets the domain

[37]The D-linked nature of *each N* has been discussed in the literature. For example, the question *who does ∀ man love?* can have a generic reading with *every* but not with *each* (see Dayal 2016 for further details).

setting *wh*-phrase in a *wh*-*wh* dependency but the range-setting *wh*-term in a *wh*-QP dependency. The confluence of these factors allows us to provide a principled explanation for the availability of pair-list readings in cases where evidence from multiple sluicing converges with independently motivated prohibitions against moving a *wh*-phrase or a quantifier to the C-domain. So although questions with quantifiers have not been considered part of the empirical domain in the sluicing literature, we believe they add an interesting dimension to the discussion.

8 Long-distance Pair-lists without Movement

We now extend the function-based account of *wh* dependencies to cross-clausal contexts. The fundamental question driving work in this domain has traditionally involved a choice between the expression(s) inside the embedded clause taking matrix scope vs. the embedded *wh* (s) taking scope locally, with the embedded clause interacting scopally at the matrix level. The ungrammaticality of multiple sluicing rules out covert movement for the embedded *wh* expression, while the availability of a pair-list reading for the pre-sluice suggests that a functional dependency across clauses can nevertheless be established. We lay out the implications of various options that the theory developed so far makes available. We balance this against empirical considerations, partly drawing on the literature and partly from our own fieldwork. Our discussion relies on separating out 2-member lists where a long-distance non-movement scopal account of individual *wh* expressions seems warranted from 3-member lists which have been noted to manifest trapping of *wh* scope.

8.1 Long-distance lists with two members

A cross-clausal pair-list reading, on our account, involves a split C structure at the matrix level. In single fronting languages like English there should be a *wh* expression at the matrix left periphery and a second expression that it can form a functional dependency with. At least one of these two expressions must originate inside the embedded clause for the structure to count as cross-clausal. In this section we consider the possibility that a null existential operator in the matrix split C at the left periphery can bind a choice functional variable over the set denoted by the *wh* in situ, whether that *wh* sets the domain or the range of the function.

In order to test these possibilities, we created contexts that favored exhaustive pairings on one of two *wh* expressions separated by a clause boundary either at the base or at the surface – that is, we used the context to fix which *wh* expression would set the domain of the function. We asked 8 native speakers of English to rate the

acceptability of questions embedded within such contexts on a 5 point Likert scale. We present our findings first with our interpretation of the results and then draw some conclusions based on what we found. To make our discussion accessible we single underline the domain term and double underline the range term (as a nod to the double indexing on the dependent term) and a very schematic partial LF representation. The interested reader is referred to the appendix for full LFs and their semantic translations.

The first context is one in which the matrix subject sets the domain of the function:

(78) There are crazy rumors going around among the security guards claiming that Mary stole a precious painting from the museum. The rumor exists in many different versions. To get an idea of how it might have spread, I would like a complete list of

a. <u>which guard</u> thinks (that) Mary stole <u>which painting</u> 8✓

b. [∃F2 which guard$_1$ [$_{CP_1}$ ~~which guard$_1$~~ [$_{CP_2}$ which painting$^1_2$]]]

In (78a) the a-index of the functional *wh* is c-commanded by the fronted domain setting *wh*. Its acceptability shows that a-binding of the functional *wh* can take place long-distance. It also shows that long distance-binding of the i-index of the functional *wh* by the null ∃is acceptable.

We next consider a context in which the domain is set by the embedded *wh* in situ, which is fronted over the matrix *wh*, violating superiority:

(79) Three precious paintings went missing from different rooms of the museum. The museum is divided into overlapping security zones. Each guard is in charge of their own zone. Mary is a suspect, because some of the guards believe that she stole a painting from their zone. To investigate this systematically, painting by painting, I need a complete list of

a. which painting which guard thinks Mary stole 5✓, 3 *

b. [∃F1 which painting$_2$ [$_{CP_1}$ ~~which painting$_2$~~ …which guard$^2_1$ …[$_{CP_2}$ …~~which painting$_2$~~]]]

The acceptability of (79a) is straightforwardly explained. The functional dependency is set locally, the subject *wh* moves successive cyclically to the matrix C domain, the split C structure has long-distance binding of the i-index of the functional *wh* by ∃.

Finally, we consider a superiority violation in the embedded clause:

(80) Last night, four valuable paintings were stolen from the museum. Mary has a detailed theory according to which a number of security guards committed independent thefts. To investigate Mary's theory properly, I would like a complete list of

a. which painting Mary thinks (that) which security guard stole. 5✓, 3*/?

b. [∃F1 which painting$_2$ [$_{CP_1}$ …[$_{CP_2}$ ~~which painting$_2$~~ …which guard$^2_1$ …~~which painting$_2$~~]]]

We analyze this structure as involving local scrambling of the object term, following our account of superiority violations in simple cases. The discomfort that some speakers have, we have to conclude, is with long distance movement following scrambling since individual piece of the scope taking mechanism seems be acceptable, on the basis of judgments about the other cases. What this data set suggests is that superiorty violating structures are significantly degraded when clausal boundaries are implicated. Other than that, the results are as we would expect, given our proposal that the non-movement scope mechanism uses choice functions and choice functions are insensitive to clausal boundaries.

In addition to the above, we balanced the multiple *wh* questions in each context with one with a universal quantifier. We did this on the view that universal quantifiers can only ever be domain-setting terms, not the dependent functional element and could thus provide additional insight into findings regarding *wh* expressions. We make two assumptions about universal quantifiers that inform our discussion. One, quantifiers can only be domain setters. Two, quantifiers take only local scope.

From the results of our survey, consultants seem to be comfortable adjusting the context to fit the grammatical need of quantifiers to be domain terms in *wh*-QP dependencies. We therefore represent the four cases accordingly. We give the results below each of them and spell out some of the key conclusions that we can draw from those results:

(81) a. [which guard$^2_1$ [~~which guard$^2_1$~~ thinks [each painting$_2$ [Mary stole ~~each painting$_2$~~]]]] 2✓6*

b. [which painting$^1_2$ [each guard$_1$ [~~each guard$_1$~~ thinks [Mary stole ~~which painting$^1_2$~~]]]] 7✓, 1?

c. [which guard$^2_1$ [Mary thinks [each painting$_2$ [~~which guard$^2_1$~~ stole ~~each painting$_2$~~]]]] 3✓; 3*

d. [which painting$^{1}_{2}$ [Mary thinks [each guard$_1$ [~~each guard$_1$~~ stole ~~which painting$^{1}_{2}$~~]]]] 8✓

The first striking contrast we want to draw attention to is between (81a) and (81b). On the functional account we are proposing (81a) is predicted to be unacceptable because local QR of the universal does not get it to a position from where it can bind the a-index of the *wh* term. In (81b), on the other hand, the requisite c-command relation is established at the base.

Let us now consider the contrast between (81a) and (81d). In both cases QR is restricted to the embedded clause, but in (81a) it is not enough to bind the a-index of the *wh* term and establish dependency while in (81d) it is. This provides, we claim, striking corroboration of our general approach to modeling pair-list answers via skolem functions. As far as we can tell, this contrast cannot readily be explained on theories where the crucial factor involves getting the universal to a position at the leftmost C domain (cf. (74)). There is no reason why whatever principle applies to give the universal extra-wide scope in (81d) should not also apply in (81b).[38]

We conclude this section by highlighting two points. One, pair-list readings do not obey a clause-mate condition per se, only those that are based on movement to the C domain, diagnosable via multiple sluicing, do. Two, the approach to pair-list readings that is best able to capture the complex empirical terrain must rely on skolem functions and the restrictions that go into establishing dependencies via a-binding of the dependent term by the domain setting term. We now turn to list readings involving more than two members, where the clause-mate condition re-emerges in an unexpected way.

8.2 Long-distance lists with three members

A crucial change in the empirical landscape of long-distance lists with multiple wh is due to Cheng and Demirdache (2010) who, building on Raţiu (2011) (IS THAT THE RIGHT REFERENCE? YOU HAD GIVEN 2007) and () (WHAT REFERENCE IS THAT? IT WAS EMPTY), establish the existence of trapping in long distance contexts. We repeat the paradigm in (34) below to illustrate:

[38] We note that **??** does not violate any principle but was not accepted unanimously. We believe this is similar to the resistance we found to the combination of superiority violation and long-distance movement that we saw in multiple *wh* questions in contexts 2 and 4 above. WHAT EXAMPLE NUMBERS ARE THOSE?

(82) a. [Which guest promised [that he would give which toy to which child]]?

b. Bill — the plane to Sybren / the train to Amina — and

c. #Bill / Mary — the plane to Amina / the train to Amina — and

d. #Bill / Mary — the plane to Sybren / the plane to Amina — and

We propose that trapping can be explained by positing a constraint on the mechanism of binding choice functional variables by a null ∃ operator in the left periphery of a clause. We have argued that choice functions are cross-categorial: they take a set and delivers an arbitrary member of that set. In our earlier illustrations we have applied choice functions to sets of entities (type <e,t>) as well as to sets of skolem functions (type «e,e>,t>). In fact, they can apply to any type <α, t> including sets of propositions or sets of sets of propositions, and pick out something of type α. We would like to posit a homogeneity constraint on the null ∃ in the C domain that binds choice functions. We suggest that when a moved *wh* expression activates the cross categorical null ∃, it can only activate binding over a single type of argument, be it type <e,t>, type «e,e>,t> but not both. The same applies to any other type of argument. Let us evaluate the paradigm in (82) in light of this restriction.

On the approach to multiple *wh* questions developed here, a fronted *wh*, *which guest* in this case, need not trigger a split C structure. If it does not, we get simple long-distance binding of two choice functional variables over type <e,t> arguments denoted by *which toy* and *which child*, leading to sets of the kind shown in (82b). Ans-D applies to it and picks out the unique proposition that is true at the world of evaluation, yielding a single triple answer:

(83) a. [$\exists f_2\ \exists f_3$ which guest$_1$ [~~which guest$_1$~~ promised […which toy$_2$ …which child$_3$]]]

$\Rightarrow$ $\lambda p\ \exists f_2\ \exists f_3\ \exists x_1$ [guest(x_1) $\wedge$ CF(f_2) $\wedge$ CF(f_3) $\wedge$
$p = x_1$ promised he$_1$ would give f_2 (toy) to f_3 (child)]

b. {Bill promised that he would give the train to Amina, Bill promised that he would give the plane to Amina…}

The homogeneity restriction comes into play when a *wh* expression triggers a split C structure, calling for a functional dependency. The answer in (82b) is an instance

of a functional dependency inside the embedded clause but not in the matrix.[39] In other words, the embedded clause has a split C, denoting a set of sets of propositions, but not the matrix clause. To fully interpret this question, the LF needs to include a choice functional variable over the embedded clause. This variable is then bound from the matrix C:

(84) a. [Which guest$_1$ $\exists$**f$_4$** [~~which guest$_1$~~ promised [$_{CP_4}$ $\exists$**F$_3$** [**which toy$_2$** [he$_1$ would give ~~**which toy$_2$**~~ to **which child$^2_3$**]]]]]
⇒ λp $\exists x_1$ $\exists f_4$ [guest(x_1) CF(f_4) $\wedge$ p = x_1 promised $\cap$ f_4 ([[CP_4]])]
where [[CP4]] =λQ $\exists F_3$ [$\forall$z[child(F_3 (z))] $\wedge$ Q = λp' $\exists x_2$ [toy(x_2) λp' = x_1 would give x_2 to F_3 (x_2)]]

It may be helpful to show explicitly what sort of sets the embedded clause denotes. Each cell in (85) gives the propositions based on one possible function from toys to children:

(85) .
[[CP_4]] = {x_1 will give the train to Amina, x_1 will give the plane to Sybren}
{x_1 will give the plane to Amina, x_1 will give the train to Sybren}

The choice function variable f4 applies to this set and arbitrarily picks out one cell from this set. Depending on which individual guest and which individual cell in [[CP $_4$]] is chosen, we get a standard question denotation with four propositions:

(86) {Bill promised he will give the train to Amina and the plane to Sybren, Bill promised he will give the plane to Amina and the train to Sybren, Mike promised he will give the train to Amina and the plane to Sybren, Mike promised he will give the plane to Amina and the train to Sybren}

Once Ans-D applies to (86), whichever proposition happens to be the unique true one will be a trapped pair-list answer such as **??**.

Now we turn to the unacceptable answers in **??** and **??**, illustrating how the homogeneity constraint rules them out. Consider a potential LF for **??**:

(87) a. *[$\exists f_3$ $\exists F_2$ which guest$_1$ [which guest$_1$ promised […which toy$^1_2$ …which child $_3$]]]

[39] We will assume that one or both *wh* expressions in the embedded clause have been covertly fronted (see Ratiu 2007, Raţiu (2011), Cheng and Demirdache (2010), Kotek and Erlewine (2016)).

b. $\lambda Q\ \exists f_2\ \exists f_3\ [CF(f_3) \wedge CF(f_4) \wedge Q = \lambda p'\ \exists x_1\ [guest(x_1) \wedge$ $p' = x_1$ promised that x_1 will give f_2 $(\lambda F_2\ [\forall z(toy(F_2\ (z)))])$ (x_1) to f_3 (child)]

(87a) posits a functional dependency between the matrix *wh* (*which guest*) and one of the embedded *wh* 's (*which toy*) to the exclusion of the other (*which child*). Note that the functional dependency between the matrix *wh* and the embedded *wh* is exactly what we saw in **??** and the long-distance binding of *which child* what we saw in **??** and other cases in sections 5, 6 and 7. The problem, therefore, must be with combining two distinct types of long-distance binding. In (87b) we have a functional *wh* in situ: *which toy* denotes a set of toy-valued functions («e,e>,t>), over which we have a choice function variable bound by the matrix ∃. We also have an ordinary *wh* interpreted in situ, *which child*, with a choice function over a set of individuals (<e,t>). The matrix C domain incurs a violation of the constraint we have proposed.

For completeness, let us also consider the option of interpreting *which child* in the embedded clause itself, as in (88):

(88) a. *[$\exists F_2$ Which guest$_1$ [~~which guest$_1$~~ promised [CP_4 which child$_3$ [he would give which toy$^1_2$ to ~~which child$_3$~~]]]]]

⇒ $\lambda Q\ \exists f_2\ \exists f_4\ [CF(f_3) \wedge CF(f_4) \wedge Q = \lambda p'\ \exists x_1\ [guest(x_1) \wedge p' = x_1$ promised f_4 $([\![CP_4]\!])]$ where $[\![CP_4]\!] = \lambda p\ \exists x_3\ [child(x_3) \wedge p = x_1$ will give f_2 $(\lambda F_2\ [\forall z(toy(F_2\ (z)))])$ (x_1) to x_3]

Unpacking (88), we interpret *which child* in the embedded clause, which then denotes a set of propositions. Since promise takes a proposition level complement, individual propositions need to be pulled out of that set. That is, we need a choice function that applies to something of type «s,t>,t>. In addition, we interpret the functional *wh which toy* in-situ, as in (87), and need a choice function over the set of skolem functions: «e,e>,t>. So once again we end up with a violation of the homogeneity constraint. This explains the core paradigm illustrating the phenomenon of trapping. We now turn to cases where trapping seems not to be in evidence.

8.3 The Wh-island Wrinkle

The approach to list answers developed here provides a simple solution to a problem for Cheng and Demirdache (2010). They note that trapping is not observed in the well-known Baker examples, where a list answer can pair the matrix *wh* with the embedded *wh* in situ and leaving the other embedded *wh* untouched. Cheng and

Demirdache appeal to one fell-swoop movement of the *wh* in situ from embedded clause to matrix Spec to account for such answers.

As pointed out in Dayal (2016), this leads to an internal inconsistency in their account. For if such movement is possible out of wh islands, why not also from those clauses that they claim show trapping.

On our account, the crucial difference between (88) and (87) is that the matrix predicates *promise* and *know* differ in the types of complement they can take. This means that an embedded clause with a *wh* interpreted internally does not need the mediation of a choice functional variable in the case of *know*, as opposed to what we saw in connection with *promise*:

(89) a. Which student knows where Mary bought which book?
b. [$\exists F_2$ which student$_1$ [~~which student$_1$~~ knows [where$_3$ [Mary bought which book$^1_2$ where$_3$]]]]
c. $\Rightarrow$ $\lambda Q\ \exists f_2\ [CF(f_2) \wedge Q = \lambda p'\ \exists x_1\ [student(x_1) \wedge p' = x_1$ knows ($[\![CP_4]\!]$)] where $[\![CP_4]\!] = \lambda p\ \exists x_3\ [place(x_3) \wedge p =$ Mary bought f_2 ($\lambda F_2\ [\forall z(book(F_2\ (z)))]$) ($x_1$) at x_3]

The acceptability of list answers linking *which student* and *which book* is predicted since there is no violation of the homogeneity constraint.

The proposal we have made predicts that trapping effects will show up even in Baker examples if the embedded clause has three *wh* expressions:

(90) a. Which student knows who gave what to whom?
b. John knows who gave what to Mary.
c. John knows who gave the book to Mary and the pen to Sue.
d. #John knows who gave the book to Mary and Sue knows who gave the pen to Mary.

Briefly, the answer in (90b) interprets two *wh* 's in the embedded clause. The remaining embedded *wh* is interpreted via a choice function over individuals from the matrix, yielding in effect, a single pair answer. The answer in (90b) is a trapped pair-list reading, an analog of what we saw in **??**. Answer (90d) shows the same kind of trapping violation that we saw in (90c)-(90d), and would be blocked along similar lines by the proposed homogeneity constraint.

While the solution proffered above works well enough, we will end this discussion by noting a wrinkle for all accounts that give wide scope to the embedded *wh* in situ, be it through covert movement or through choice functional binding. Such accounts treat the fronted *wh* as the domain setting term and the embedded *wh* as

functional but it seems, based on the discussion in the literature, that the facts go in the opposite direction. The most prominent *wh* expression seems to be the *wh* in situ, not the fronted matrix *wh* (Dayal 1996a, 2002, 2016, among others). There is an approach to long-distance list answers that addresses this problem, under the moniker of the *wh* triangle. We list its three key components here. One, all *wh* expressions would be interpreted locally, not just those that take scope via movement. Two, the clause itself has to be interpreted at a higher type than usual. Three, a functional dependency is established between the clause as the domain term, treating the clause as a de facto quantifier, and the fronted *wh* as the range term. This is the account of what has been dubbed the *wh* triangle. We would like to point out one further difference in predictions that the two approaches make. The approach to cross-clausal dependencies that we have advanced suggests that it should not matter how deeply embedded the *wh* in situ is. The approach in terms of the *wh* triangle, however, requires the *wh* in situ to be in the complement clause of the matrix predicate since the clause itself undergoes a sort of QR to a position from where it can c-command the a-index of the matrix *wh*. We leave this alternative approach at this suggestive stage since amplifying and adjusting our proposal to accommodate these features would take us too far afield. It is clear to us that further data would be useful in settling some of the empirical issues that would help us choose between the two alternatives. While we are not in a position to do so at this time, our discussion was aimed at making it clear what aspects of the theory are responsible for what effects. We hope this will make it easier to modify the theory to accommodate any new findings that may emerge. We direct the interested reader to Dayal (in preparation) for more on the *wh* triangle.

9 Conclusions

Let us conclude by highlighting the lessons about *wh* scope taking that we have learnt on the basis of our investigation into multiple *wh* sluicing.

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