

# 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. We suggest that this observation can be understood on the assumption that covert phrasal *wh*-movement is clause bound and subject to superiority. Both assumptions have substantial independent empirical support. 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 for 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 account with cross-linguistic validity. Our approach to the generalization 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 and subject to superiority, there must be one or more additional mechanisms to interpret *wh*-phrases that cannot reach their scope position at LF. 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). Crucially, we 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 account builds on earlier proposals but differs in substantive ways both in conception and in execution. It differs from Dayal 1996 in recognizing the possibility of long-distance scope for *wh* in situ, and from Dayal 2002 in allowing a long-distance functional dependency for pair-list as well as single-pair answers. It differs from Pesetsky 1987, 2000 in requiring movement-based covert scope-taking to be local, not just island sensitive. Additionally, our account of pair-list readings differs from other accounts, including those based on skolem functions, in several respects. Most notably, it accords formal status to D-linking in superiority violating questions, bridging a gap in earlier accounts where empirical recognition of D-linking as an ameliorating factor did not lead to a role for it in the explanation.

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 6 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 in superiority violating multiple *wh*



(1b). When discussing theories of sluicing that assume the presence of unpronounced syntactic structure at the ellipsis site, we will use the term “pre-sluice” from Dayal and 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; Alshaalan and Abels 2020 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. The observation 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 without syntactic structure at the E-site face the problem of explaining the case matching facts. The difficulties for both sides are compounded further by the observation that island insensitivity 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 *asyn*detically coordinated single sluices is blocked in (6) and (9a); the singular morphology in the *which*-phrases and the uniqueness presuppo-

sition 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. We have already seen that 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.), Kîtharaka (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 clause-mate condition fails to hold for just those of his informants for whom it also fails to hold under regular multiple *wh*-fronting. These speakers' judgments suggest that overt multiple *wh*-movement can overcome the restriction, which we trace to covert 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, Buciuileac 2019 reports the 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.<sup>2</sup> This line of reason-

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<sup>2</sup>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

ing 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 that this is true.<sup>3</sup> 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.

More troublingly, 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<sub>k</sub> claimed that they<sub>k</sub> 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.

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proper analysis of the example might therefore involve asyndetic coordination of two sluices rather than multiple sluicing. See comments just below (9b).

<sup>3</sup>We should point out that the other multiple *wh*-fronting languages that we have looked at require overtly moved multiple *wh*-phrases to be clause mates and thus do not allow us to further test the conjecture that overt violations of the clause-mate condition license violations under ellipsis. A subset of these languages do not allow long-distance multiple *wh*-movement at all even when the *wh*-phrases are clause mates. The first set allows long-distance multiple fronting of clausemate *wh* phrases and includes Lithuanian (Adliene 2014, p. 29 ex. 138) and Bulgarian (C. Rudin 1988b, p. 452 fn. 7, C. Rudin 1988a, p. 8 for the facts regarding non-elliptical questions pace Richards 1997). The second more restrictive set includes Slovenian (Marušič and Žaucer 2013, p. 419, 421), Russian, which doesn't even allow single long-distance *wh*-movement (Müller and Sternefeld 1993; Stepanov 1998), and Polish, where the situation is similar to Russian (Toman 1982, p. 296–7, D. Grabska, p.c.). Czech also requires multiple *wh*-phrases to be clause mates, though it is not clear whether (multiple) *wh*-movement can go long distance (Meyer 2003, J. Kaspar, p.c. vs. Toman 1982).

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.

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

The clause-mate condition cannot 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.<sup>4</sup> Island violations can then be evaded by choosing an appropriate paraphrase as the pre-slucice at the E-site. Thus, the pre-slucice for (4a) is not the ungrammatical (4b) but rather one of the following:<sup>5</sup>

- (12) Possible pre-slucices 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-slucice 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-slucice. 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 non-identical 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-slucice. 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.)

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<sup>4</sup>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).

<sup>5</sup>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.

- (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 which girl.
  - b. I wish I could remember which boy Fred thinks talked to which girl.

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.<sup>6</sup>

A final type of case for which we invoke non-identical 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-slucice along the lines of (16b) instead of the fully isomorphic pre-slucice (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.<sup>7</sup>

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<sup>6</sup>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.

<sup>7</sup>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 [<sub>CP</sub> 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. Under our approach, the additional *wh*-phrases in multiple sluicing reach their landing site by clause bounded covert phrasal *wh*-movement. If, as suggested by Barros and Frank, clause boundedness can be modulated for covert phrasal *wh*-movement in the same way that it can be modulated for quantifier raising and other movement operations, this

- (16) a. Everybody<sub>k</sub> claimed that they<sub>k</sub> 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  
 c. ...but I can't remember who<sub>k</sub> claimed that they<sub>k</sub> 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 account of 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.<sup>8</sup> 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*<sub>1</sub> and *wh*<sub>2</sub> originate in the same clause.

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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.

<sup>8</sup>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.

$Wh_1$  has undergone overt *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.

$$(17) \quad [Wh_1 [ Wh_2 [_{E\text{-site}} \dots Wh_1 [ \dots Wh_2 \dots ] ] ] ]$$

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). We will assume that the early minimalist distinction between strong and weak features is representationally realized so that Gärtner’s algorithm simply states: In any chain, pronounce the highest strong position; failing that, pronounce the lowest weak position. 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.<sup>9</sup> 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

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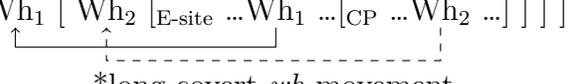
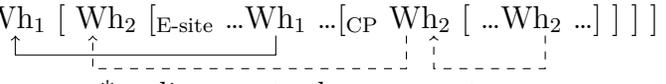
<sup>9</sup>We will continue to refer to the movement of additional *wh*-phrases in multiple sluicing as *covert phrasal wh-movement*, despite the fact that it is exceptionally overt in those cases. Covert movement is movement the head of whose chain is in a weak position.

the moving element alone,<sup>10</sup> 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 licenser and is attracted by it.

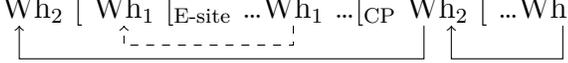
We have no further insight to contribute to the discussion of which covert movements can become overt under ellipsis and which ones cannot and under what further conditions. On our view, movement of the second *wh*-phrase in multiple sluicing is neither PF movement (as proposed for fragments in Weir 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 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 licenser.

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<sub>1</sub> [ Wh<sub>2</sub> [E-site ...Wh<sub>1</sub> ...[CP ...Wh<sub>2</sub> ...] ] ] ]  
  
 \*long covert *wh*-movement
- b. [ Wh<sub>1</sub> [ Wh<sub>2</sub> [E-site ...Wh<sub>1</sub> ...[CP Wh<sub>2</sub> [ ...Wh<sub>2</sub> ...] ] ] ] ]  
  
 \*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<sub>2</sub> [ Wh<sub>1</sub> [E-site ...Wh<sub>1</sub> ...[CP Wh<sub>2</sub> [ ...Wh<sub>2</sub> ...] ] ] ] ]  


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 neces-

<sup>10</sup>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.

sity 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.<sup>11</sup> 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 configuration in which one *wh*-phrase crosses over another one. This configuration is characteristic of superiority violations. We conjecture that it is the crossing configuration which is responsible for the ill-formedness of (19). To rule out

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<sup>11</sup>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.

(19), we then need to impose the following additional constraint (taken directly from Pesetsky 2000):

- (21) The in-situ *wh* phrase in superiority violating questions does not undergo covert phrasal *wh*-movement.

This is a crucial conceptual addition to an account like Lasnik's, Ortega-Santos, Yoshida, and Nakao's, and Park's. (21) regulates the interaction between movements rather than just imposing a locality constraint (clause boundedness, Right Roof Constraint, etc.) on the second movement. A simple locality constraint that fails to target movement interactions is too weak to rule out (19) and thus too weak to capture the clause mate condition.

Given that not all languages obey superiority in equal fashion in non-elliptical multiple questions (see e.g. Featherston 2005a,b on the comparison between German and English), a worry might arise that superiority is not the right constraint to capture the cross-linguistic prevalence of the clause mate condition.

While it is true that there is substantial variation in the acceptability of examples like (22a), where the two *wh* phrases originate in the same clause, the situation is substantially more stable cross-linguistically for *wh*-phrases that do not originate as clause mates, (22b):

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

As noted, there is variation on (22a) with English disallowing it but German, Spanish (Bošković, 1997a, p. 243 ex. 23–24), and Dutch (Bošković, 1997a, p. 247 fn. 28, crediting M. den Dikken) allowing it – though our Dutch informants do report a degradation in examples like (22a). There is much less variation concerning (22b): neither English, nor German (Bošković 1997a; Buring and Hartmann 1994; Grewendorf 2001), nor Spanish (Bošković, 1997a, p. 243 ex. 23–24), nor Dutch (Bošković, 1997a, p. 247 fn. 28, crediting M. den Dikken) allow it. The German pattern is illustrated here:

- (23) Grewendorf 2001, p. 112 ex. 29  
a. \*Wen<sub>i</sub> glaubt wer, dass Hans t<sub>i</sub> 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?

Structure (19), which we intend to target with (21), is the case of superiority among *wh*-phrases that are not clause mates, that is, it corresponds to (22b). A third class of languages might exist that violates superiority freely even in structures like (22b) and in which the cross *wh* phrase is not barred from moving.<sup>12</sup>

To be concrete, we will assume following Pesetsky, 2000 that *wh*-movement is subject to attract closest. As a consequence, the highest *wh*-phrase moves first. Further *wh*-phrases, if they move (covertly in languages like English, overtly in multiple *wh*-fronting languages), tuck in below the first *wh*-phrase. This set of assumptions derives that all *wh*-movement must obey superiority. The D-linking exceptions to superiority are derived by first scrambling the D-linked *wh* phrase past the superior one and then *wh* moving the scrambled phrase in accordance with attract closest. Under the well-founded assumption that so-called A-scrambling is clause bound and feeds *wh* movement while A'-scrambling is not clause-bound and does not feed *wh* movement (see Wiltschko, 1998 for the original proposal and Abels, 2015 for a recent overview and references), we have an immediate explanation for the asymmetry between clause-mate superiority and non-clause mate superiority. Given the discourse driven nature of scrambling, this also allows us to understand why superiority violations require D-linking: only those *wh*-phrases that are D-linked are allowed to scramble (see section 6 for further discussion). In English scrambling is, of course, usually not realized overtly while in German it is.<sup>13</sup> Under the single cycle model of syntax assumed here, this means that the head of a scrambling chain in English is in a weak position while in German it is in a strong position. As a result, the consequence of scrambling becomes visible in English only if scrambling feeds a further movement step whose chain is headed by a strong position. *Wh* movement provides just the right derivational context.

We then need to reformulate (21) as follows:

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<sup>12</sup>Learnability considerations would demand that robust triggering evidence is provided to the learner for this parameter setting. This makes it plausible that the setting is only accessible in languages with multiple *wh* fronting.

Among the multiple *wh* fronting languages that we have looked at, all except for Romanian and Serbo-Croatian obey the clause mate condition in non-elliptical multiple *wh* fronting structures (as well as under sluicing, see footnote 3). These languages are therefore uninformative. Romanian obeys superiority even in the short-distance case, (22a) (C. Rudin, 1988b, p. 474). In Serbo-Croatian superiority violations 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 in the non-clause mate case is strongly adhered to, just as it would have to given our set of hypotheses.

<sup>13</sup>Though see Johnson 2001 for the suggestion that pseudogapping allows scrambling in English to become overt.

- (24) No *wh* phrase that has been crossed by covert<sup>14</sup> scrambling may undergo *wh* movement.

Our derivation of the clause-mate condition on multiple sluicing is now complete.<sup>15</sup>

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 this clause-mate constraint with multiple sluicing. Gapping, pseudogapping, and multiple fragments all have been analyzed as elliptical structures and all are subject to the clause-mate 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 the 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 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 5–8.

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<sup>14</sup>The restriction to covert scrambling, that is scrambling that creates chains headed by a weak position, is imposed to allow for two facts: First, multiple *wh*-fronting languages like Russian that have overt scrambling allow superiority violations under multiple *wh* fronting in non-elliptical clauses and in multiple sluicing (see Barros and Kotek 2018). Single *wh* fronting scrambling languages allow superiority violations under multiple sluicing.

<sup>15</sup>Abels and Dayal 2017, section 2.1 suggest that multiple sluicing must obey superiority even in certain contexts where the pre-sluices may violate superiority. However, the crucial examples Abels and Dayal 2017, ex. 20-21 are not perfect minimal pairs and it is questionable whether the pre-sluices for their example 21 really do allow superiority to be violated.

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 instead 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. If this speculation is on the right track, then the clause-boundedness of various ellipsis phenomena with multiple remnants find a unified explanation in this 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 9.

## 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 phrasal *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 (25a) has not been crossed by overt *wh*-movement and it can license ACD.

- (25) Pesetsky 2000, p. 30
- a. I need to know which girl \_\_\_\_\_ ordered [which boy that Mary (also) did  $\Delta$  ] 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 (26a) by contrast, the in-situ *wh*-phrase has been crossed by overt *wh*-movement; it cannot license ACD, which makes the example overall unacceptable.

- (26) Pesetsky 2000, p. 31
- a. \*I need to know which girl Sue ordered [which boy that Mary (also) did  $\Delta$ ] 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 (25a) but impossible in (26a). 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 for the sensitivity of covert phrasal *wh*-movement to superiority 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 observes that in superiority obeying configurations like those in (27a)–(27c) both a single pair and a pair-list interpretation are accessible. However, in superiority violating configurations like (27d)–(27f), 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: (27f). 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.

- (27) 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 |

As before, this pattern is explained by assuming that 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, (27a–c), but fails when the in-situ *wh*-phrase has been crossed overtly, (27d–f). Feature movement is not subject to superiority but it is subject to intervention. This explains why a pair-list reading is blocked in (27f), 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 covert phrasal movement and that this movement is 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 (28) and claims that it can only be interpreted as (28a) but

not as (28b). 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 phrasal *wh*-movement is clause-bounded.

- (28) Who thought that Fred read how many of the books that Bill did?  
 a. Who thought that Fred 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 (28) 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:

- (29) Which of these boys is surprised that Mary likes which teacher that Sally also {does | is}  $\Delta$ ?

*Does* forces embedded ACD resolution ( $\Delta$ =like t) while *is* forces the long construal ( $\Delta$ =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.<sup>16</sup>

A second argument for clause boundedness of covert *wh*-movement comes from trapped lists (see Cheng and Demirdache 2010; Rațiu 2011). To understand trapped

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<sup>16</sup>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<sub>j</sub> claims that he<sub>j</sub> is working on every project that Bill<sub>b</sub> { does <claim that he<sub>{b | \*j}</sub> 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<sub>b</sub> claims that he<sub>b</sub> is working on which project that Mr Finn<sub>f</sub> (also) { does <claim that he<sub>{f | \*b}</sub> is working on> | is <working on> }?

lists, we need to consider questions with at least three *wh*-phrases. Triple questions can be answered by lists of triples and single triples, but also by partial lists in which a single individual is paired with a list of the other two terms. This last option is illustrated by the three answers in (30).

- (30) 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 Rațiu 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 (31), where only *wh*<sub>2</sub> and *wh*<sub>3</sub> can form a partial list to the exclusion of *wh*<sub>1</sub>. List formation is ‘trapped’ inside of the CP/island.

- (31) [ *wh*<sub>1</sub> ...<sub>{CP|island}</sub> ...*wh*<sub>2</sub> ...*wh*<sub>3</sub> ] ... ]

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 (32a) is available.

- (32) Which guest<sub>1</sub> promised that he would give which toy<sub>2</sub> to which child<sub>3</sub>?
- 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.

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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 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.



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

- (35) a. Which newspaper reported that Obama would only support which candidate?  
b. \*Which newspaper only 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 phrasal *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.

Note that we are not attempting to give a theoretical deduction of the posited constraints of clause-boundedness and superiority sensitivity here. It suffices for our purpose to show that these are operative constraints. In the next section we draw out semantic consequences of these syntactic conclusions.

## 5 Single-pair Readings via Choice Functions

Let us remind ourselves of the basic generalizations. 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 such answers without movement and show that it cannot be adopted for single-pair readings relevant to multiple sluicing. Multiple-pair answers are discussed in subsequent sections.

## 5.1 Mechanisms for Scope Taking

There exist at present at least three distinct semantic mechanisms for *wh* scope-taking: *wh*-phrases as alternative generating expressions (Hamblin 1973), *wh*-phrases as existential generalized quantifiers (Karttunen 1977), and *wh*-phrases as existentially bound choice functional expressions (Reinhart 1997, 1998). Let us illustrate the three mechanisms with an example. The solid line in (36) corresponds to the overtly moved *wh*-phrase, and the dashed line (- - -) to the *wh*-phrase that takes scope covertly. The arrow on the solid line indicates 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 (see Dayal 2016 for further details):<sup>17</sup>

- (36) [ Which student<sub>1</sub> [<which topic><sub>2</sub> [C<sub>+wh</sub> [TP <which student><sub>1</sub> published on which topic<sub>2</sub> ]]] ]
- a.  $\lambda p \exists x \exists y [\text{student}(x) \wedge \text{topic}(y) \wedge p = \wedge x \text{ has published on } y]$
- b.  $\lambda p \exists x \exists f [\text{student}(x) \wedge \text{CF}(f) \wedge p = \wedge x \text{ has published on } f(\text{topic})]$
- c.  $\{\wedge x \text{ has published on } y: x \in \text{student} \wedge y \in \text{topic}\}$

There are three syntactic positions relevant for interpretation: the innermost TP which forms the question nucleus, C<sub>+wh</sub> which is the locus for the shift from declarative to interrogative meaning, and a position to its left for fronted *wh*-phrases. If *which topic* moves covertly, both *wh*-phrases can be interpreted as existential generalized quantifiers, as shown in (36a). If *which topic* is left in situ and interpreted with a choice function variable,  $\exists$ -bound from outside C<sub>+wh</sub>, we get (36b), where CF is the set of choice functions from sets of individuals to individuals  $\langle\langle e,t \rangle, e \rangle$ . If *wh*-expressions are treated as foci, we get (36c).

The final denotation, we can see, is the same in each case: with two students and two topics, we get a set of four propositions, as in (37a):

<sup>17</sup>We set aside here the possibility of interpreting *wh*-expressions as lambda abstracts (George 2011; Groenendijk and Stokhof 1982, 1984) as well as work on *wh* scope-taking in the framework of Inquisitive Semantics (Ciardelli, Roelofsen, and Theiler 2017; Groenendijk and Roelofsen 2009).

- (37) a. {  $\wedge$ John has published on NPI,  $\wedge$ John has published on FCI,  
 $\wedge$ Sue has published on NPI,  $\wedge$ Sue has published on FCI}  
 b.  $\text{Ans-D}(Q)(w) = \iota p [p \in Q \wedge p(w)]$   
 c.  $\text{Ans-D}(37a)(w@) = \wedge$ Sue has published on NPI.

The answerhood operator from Dayal 1996 (Ans-D) 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. The single-pair reading is thus derived straightforwardly.<sup>18</sup>

Of course, multiple *wh*-questions have pair-list readings as well, which we will tackle in the sections to follow. For now, we simply note that sluicing, because it provides an explicit antecedent, disambiguates between the two readings. In (38a) the antecedent forces the multiple sluice in (38c) and its pre-sluice in (38d) to have the single-pair reading. In (38b) the antecedent sets up a distributive context and forces the identical sluice in (38c) and pre-sluice in (38d) to have a pair-list reading (see discussion below example (9b) above):<sup>19,20</sup>

- (38) 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<sub>1</sub>  $[_{CP}$  on which topic<sub>2</sub>  $[_{TP}$   $t_1$  has published  $t_2$   $]]]$

In the next section we present our account of single-pair readings. We then discuss an alternative account of the same facts and our reservations about it.

<sup>18</sup>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 (37b), 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.

<sup>19</sup>English is not the best example of a multiple sluicing language as there is some variation among speakers. Some speakers are willing to accept examples like (38d), 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 multiple sluicing, we abstract away from this non-trivial issue and present examples like (38d) as representative of multiple sluicing patterns generally.

<sup>20</sup>Movement structures were notated with copies so far but to aid readability we switch to a notation with traces. Formally speaking, however, we intend movement chains to involve copies.

## 5.2 A Choice Functional Account of Single-Pair Readings

Local multiple *wh*-questions and multiple sluices establish the existence of covert *wh*-movement, but nothing more. Non-local structures add further issues of interest:<sup>21</sup>

- (39) Some linguist was upset because Harry spoke to some philosopher but Bill doesn't know
- a. \*...which linguist to which philosopher.
  - b. ...which linguist was upset because Harry spoke to which philosopher.
  - c. \* $[_{CP}$  which linguist<sub>1</sub>  $[_{CP}$  which philosopher<sub>2</sub>  $[_{C+wh}$   $[_{TP}$  t<sub>1</sub> was upset  $[_{ISLAND}$  because Harry spoke to t<sub>2</sub>  $]]]]]$

The unacceptability of (39a) rules out the possibility of an LF like (39c) in which both *wh*-expressions are at the left periphery of the matrix CP. That is, (39a) tells us that covert *wh*-movement across islands is not possible. The grammaticality of (39b) tells us that there must exist in natural language another scope mechanism that is not subject to the same constraints as covert movement.

We adopt the choice functional account of indefinites and *wh*-phrases in Reinhart 1997, 1998 (see also Winter 1997) to account for such cases.<sup>22</sup> In (40a), the LF for the antecedent clause, the indefinite inside the island is interpreted with a choice function variable, existentially bound from the matrix. The single pair reading of the pre-sluice in (39b) derives from an LF like (40b) where the choice function variable over the *wh*-phrase is bound from the matrix  $C_{+wh}$  by the null  $\exists$  operator.<sup>23</sup>

Single-pair answers to the pre-sluice are derived when Ans-D, given in (37b), is applied to the set of propositions in (40b). The ungrammaticality of the sluice in (39a) is also derived. The second *wh* phrase cannot reach the matrix CP due to clause-boundedness of covert phrasal *wh*-movement.

- (40) a.  $[_{\exists f_2}$   $[_{TP}$  Some linguist<sub>1</sub>  $[_{TP}$  t<sub>1</sub> was upset  $[_{ISLAND}$  because  $[_{TP}$  Harry spoke to **f<sub>2</sub> (philosopher)**  $]]]]]$

<sup>21</sup>We take coordinate sluices: *but Bill doesn't know which linguist and which philosopher* to derive from a different pre-sluice: *which linguist and which philosopher {it was | they were}*.

<sup>22</sup>Like Reinhart, we treat fronted *wh* phrases as generalized quantifiers. Unlike her, we crucially allow *wh* in-situ to have both interpretive options, as generalized quantifiers or as choice functional. Using choice functions to interpret fronted *wh* would not make any difference for single-pair readings but it would go against the uniformity constraint we posit in section 8.2 for multiple-pair readings.

<sup>23</sup>Whether the choice functional variable should remain free remains an open question, as is the status of wide scope indefinites as quantifiers with singleton domains. These issues do not seem to us to bear on the points under discussion here (see Heusinger 2011 for an overview).

- b. [CP which linguist<sub>1</sub> [CP ∃f<sub>2</sub> [TP t<sub>1</sub> was upset [ISLAND because [TP Harry spoke to f<sub>2</sub> (**philosopher**)]]]]]  
 ⇒ λp ∃x ∃f [CF(f) ∧ linguist(x) ∧ p = ^ x was upset because Harry spoke to f(philosopher)]

As pointed out by an anonymous reviewer, this leaves the question of why the single sluice does not yield a multiple question interpretation. We conjecture that we are dealing with a residue of syntactic identity. The indefinite *some philosopher* in the antecedent would have to be able to correspond to *which philosopher* in the ellipsis site. Recall that above we drew on D. Rudin’s idea that the eventive core of the ellipsis site is subject to syntactic identity. Under this view, the unmoved *wh*-phrase *which philosopher* cannot be matched with *some philosopher*. (Extracted material on the other hand is recoverable and thus exempt from the identity condition.) Thus, the single sluicing version of (39a) can only be interpreted as a single question: *...but Bill doesn’t know which linguist was upset because Harry spoke to a philosopher.*<sup>24</sup>

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

- (41) 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.

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<sup>24</sup>One might be tempted to argue that the sluice in (39a) 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*<sub>2</sub> 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<sub>1</sub> [TP t<sub>1</sub> was upset [ISLAND because [TP some philosopher<sub>2</sub> [TP Harry spoke to t<sub>2</sub> ]]]]]  
 b. [CP which linguist<sub>1</sub> [CP which philosopher<sub>2</sub> [TP t<sub>1</sub> was upset [ISLAND because [TP Harry spoke to t<sub>2</sub> ]]]]]

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 (39a) 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).

Concretely, adopting a choice functional analysis of the indefinite inside the island, as 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.

The point that covert *wh*-movement is island sensitive is worth emphasizing. Although many arguments against the view that covert movement can violate islands have been presented (Dayal 1996; Hagstrom 1998; Nishigauchi 1990; Pesetsky 1987), the idea continues to have currency. For example, Cheng and Demirdache 2010 argue for adjunct islands as traps for *wh*-in-situ but nevertheless resort to island insensitive covert *wh*-movement in the face of pair-list answers across *wh*-islands.<sup>25</sup> The following paradigm, famously due to Baker 1970, illustrates the structure in question:

- (42) 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 (42b) and (42c) but the single-pair answer in (42d) is also possible. It needs special prosody and context, as single-pair answers often do. The context sentence in (41) 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. On 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 clause-mate condition goes even further: Not only is covert *wh*-movement not less restricted than overt movement, it is more restricted than overt movement in being clause-bounded (Dayal 1996).<sup>26</sup> At the second, more general level, the acceptability of 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 argued that it involves binding of choice functional variables by a null  $\exists$ -operator. This conclusion is in

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<sup>25</sup>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.

<sup>26</sup>While the claims in this section are in keeping with Dayal (2002), the discussion in section 8 will diverge in allowing pair-list answers, in addition to single-pair answers, across clauses.

keeping with the claim in Pesetsky (1987) that only non movement-based scope taking alternatives can be impervious to constraints relevant to syntactic islands.<sup>27</sup>

### 5.3 A Focus-based Account of Single-pair Readings

As we saw in section 5.1, it is possible to interpret *wh* in-situ through focus semantics. In this section we consider whether it provides a viable account of multiple sluicing. We have seen that single-pair readings are available for pre-slucice structures with one *wh*-phrase in the matrix clause and another in the embedded clause: *some student knows what Mary said to some professor but I can't remember which student knows what Mary said to which professor*. The question we are interested in probing is whether the in-situ *wh*-phrase can be interpreted 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 because the scope of indeterminate Japanese phrases is restricted by the closest *c*-commanding operator. An example from Nishigauchi 1990 illustrates:

- (43) 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 allow the alternatives created by an indeterminate phrase to expand across clauses but require expansion to stop at the first relevant operator. The squiggly line in (49) represents the expansion of alternatives:

- (44) \* [... [ ... *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 1996, 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:<sup>28</sup>

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

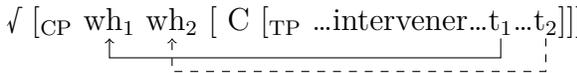
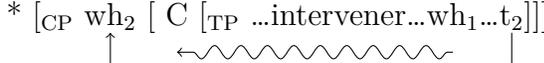
<sup>27</sup>Pesetsky (1987) took the relevant mechanism to be unselective binding of an individual variable, which we do not adopt, for the reasons given in Reinhart (1997, 1998).

<sup>28</sup>We have confirmed that a single-pair reading is possible for (45) when prosody and context are controlled for.

Who knows where Mary bought what?

Deferring discussion of pair-list readings for now, we note that (43) and (45) pose a problem for Kratzer and Shimoyama’s position on the scope properties of *wh*-expressions because they pull in opposite directions.

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 superiority 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, dashed lines indicate covert movement, and as above, squiggly arrows indicate that the *wh*-expression is interpreted without movement via focus semantics:

- (46) a. English superiority-obeying questions: no intervention effects  
 $\sqrt{[_{CP} \text{wh}_1 \text{wh}_2 [_{C} [_{TP} \dots \text{intervener} \dots t_1 \dots t_2]]]}$   

- b. English superiority-violating questions: intervention effects  
 $* [_{CP} \text{wh}_2 [_{C} [_{TP} \dots \text{intervener} \dots \text{wh}_1 \dots t_2]]]$   


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 (27)). Kotek’s account does not allow for the available single-pair reading of structures like (46b). 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.<sup>29</sup> Kotek addresses this problem by denying the legitimacy of single-pair readings in superiority violating questions generally. Appealing to scope-economy Fox (2000), she argues that multiple-pair answers to 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 Pesetsky (p.c.) in a footnote for a possible counterexample, however:

<sup>29</sup>Beck’s account of intervention has been challenged in a number of studies, on empirical as well as theoretical grounds. As such, there are several viable alternative accounts of the phenomenon currently on the market (Grohmann 2006; Mayr 2014; Tomioka 2007, among others).

- (47) 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 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 would like to emphasize that we are not arguing against the focus-based approach *per se*. It is just that we do not see a clear way of tapping into the focus-based approach to address the issues raised by multiple sluicing, at least not in the versions of focus semantics for questions currently on the market. It is possible, of course, that a more nimble theoretician might be able to overcome the difficulties we see.

## 6 Pair-list readings via Skolem Functions

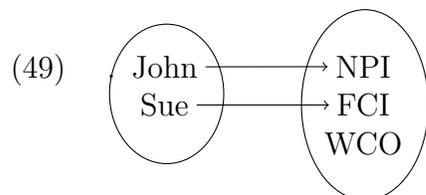
Our arguments against the focus-based approach to single-pair readings across clauses and in superiority violating structures do not transfer over to a focus-based account of their pair-list readings. One might argue, for example, that natural language includes all (three) types of scope taking mechanisms 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 correct for pair-list readings. We argue against this and propose an alternative approach, based on functional dependencies. We show its applicability to multiple sluicing in superiority compliant structures here, leaving superiority violating structures to section 7.

## 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):

- (48) a.  $[_{CP} \text{ which student}_i [C_{+wh} [_{CP} \text{ which topic}_k [C_{+wh} [t_i \text{ published on } t_k ]]]]]$   
 b.  $\lambda Q \exists y [\text{student}(y) \wedge Q = \lambda p \exists x [\text{topic}(x) \wedge p = \wedge y \text{ published on } x]]$   
 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.  $\text{Ans}(\mathbb{Q})(w) = \cap \{p: \exists Q \in \mathbb{Q} [p = \text{Ans-D}(Q)(w)]\}$   
 e. John published on NPI and Sue published on FCI.

One crucial aspect 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 (1996) as 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, derived by applying the answerhood operator  $\text{Ans-D}$  given earlier in (37b): *what did John publish? what did Sue publish?*:



Domain cover: all members of the set denoted by the fronted  $wh$ , the *domain set* are paired, but not necessarily all members of the set denoted by the in-situ  $wh$ , the *range set*.

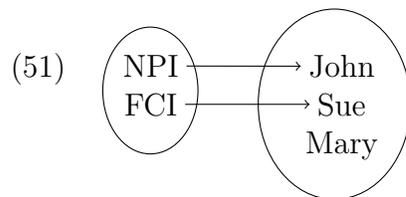
Point-wise Uniqueness: each member of the domain set is paired with only one member of the range set, when a singular  $wh$  phrase sets the range set.

Let us return now to Kotek's account, focusing on pair-list readings of superiority violating questions:

- (50) a.  $[\text{Which topic}_i [C_{[+WH]} [C_{[+WH]} [\text{which student published on } t_i ]]]]$   
 b.  $\{\text{John published on } x, \text{ Sue published on } x\}$

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

The in-situ *which student* does not move covertly but is interpreted via focus semantics, yielding a set of propositions at the lower C ((50b)). This is tantamount to the question: *who has published on x?* When the free variable corresponding to the trace is existentially bound from the higher CP, the fronted object *wh which topic*, is exhaustively paired with exactly one member of the subject term. This is the desired outcome, capturing the observation that in superiority violating questions, it is the object *wh* which sets the domain and the subject *wh* which sets the range:



Kotek’s account of superiority violating questions draws on intervention effects as support for focus semantics à la Beck (2006) but there are independent reasons to doubt its validity (see footnote 29). When combined with our own argument from the survival of single-pair readings, we are not persuaded that the focus-based 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 applies to 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 below.

## 6.2 Skolem Functions in Question Semantics

We build on the account of pair-list readings in Dayal (2016, in preparation), which in turn draws on the view that *wh* expressions can denote at the level of individuals as well as at the level of Skolem functions, 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:

- (52) 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 review what is at issue in order to make our discussion in this paper self-contained. The diagram in (49) describes the relation between individuals and topics but the information can also be packaged in terms of the relation between individuals and topics: *his/her dissertation topic, his/her qualifying paper topic* etc.<sup>30</sup>

The two readings in (52b) and (52c) are captured on this account by extending the ontology to allow *wh* quantifiers to range over skolem functions. We present the individual reading in (53) and the functional reading in (54).

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

The fronted *wh* in (53) quantifies over 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  $\langle e, e \rangle$  type functions. We use capital F to flag the distinction between Engdahl-style skolem functions from individuals to individuals and Reinhart-style choice functions from sets of individuals to individuals. We have a minimal variant of (53) below where *which topic* is interpreted as an existential quantifier over skolem functions: instead of *topic* restricting individuals as in (53), it restricts the range of functions in (54):

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

Ans-D, when applied to (53) and (54), 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 (54), for example, the TP that forms

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<sup>30</sup>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.

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 (55a):

- (55) a. Which student has published on every topic?  
 b. \*Its chief proponent.  
 c.  $[_{CP} \text{ which student}_{t_1} [_{C'} C_{+wh} [_{TP} \text{ every topic}_{t_2} [_{TP} t_1^2 \text{ published on } t_2 ]]]]$

For Chierchia, the *a*-index is a pronominal element, subject to the same constraints as regular pronouns. (55c) 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 but to anticipate, our own account of structural sensitivity will tap into a different aspect of meaning. What is relevant for us to note at this point 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:

- (56) a. Which topic has every student published on?  
 b. John has published on NPI and Sue has published on FCI.  
 (57) a. Which student has published on every topic?  
 b. \*John has published on NPI and Sue has published on FCI.

With this background in place, 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 1996, 2002; Hornstein 1995, among others, to explain the observation that the fronted *wh*-expression behaves like a universal (É. Kiss 1993). The paradigm in (58) is illustrative, assuming a domain with two students and two topics:

- (58) 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 start with the assumption that a split C structure is always available in the syntax as long as a *wh*-phrase moves to the C domain. The overtly moved *wh*-phrase passes through the specifier positions of the two CP layers, activating both. The fronted *wh*-phrase in (59b) moves through the lower C<sub>[+wh]</sub>, to the Spec of the higher CP. The functional *wh*-in-situ tucks under it at LF. The order of *wh*-phrases follows Richards 1997, which takes its inspiration from multiple fronting languages.<sup>32</sup>

In terms of interpretation, we take the fronted *wh* to be interpreted at the lower C. This results in the set of propositions in (60a):

- (60) a.  $\lambda p \exists x_1 [\text{student}(x_1) \wedge p = \wedge x_1 \text{ has published on } F_2(x_1)]$   
 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. In a domain with two students and two topics, there are four possible functions of type  $\langle e, e \rangle$ , as shown in (61):

- (61) 
$$\begin{array}{ccccccc} F_1 & \text{John} \rightarrow \text{NPI} & F_2 & \text{John} \rightarrow \text{NPI} & F_3 & \text{John} & \text{NPI} & F_4 & \text{John} & \text{NPI} \\ & & & \nearrow & & \times & & & \searrow & \\ & \text{Sue} \rightarrow \text{FCI} & & \text{Sue} & \text{FCI} & & \text{Sue} & \text{FCI} & & \text{Sue} \rightarrow \text{FCI} \end{array}$$

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 (62a). This provides a fully compositional route to (59c), as illustrated below:

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

- (63) 
$$\left( \begin{array}{l} \{\text{john has published on } F_1(\text{john}), \text{ Sue has published on } F_1(\text{sue})\}, \\ \{\text{john has published on } F_2(\text{john}), \text{ Sue has published on } F_2(\text{sue})\}, \\ \{\text{john has published on } F_3(\text{john}), \text{ Sue has published on } F_3(\text{sue})\}, \\ \{\text{john has published on } F_4(\text{john}), \text{ Sue has published on } F_4(\text{sue})\} \end{array} \right) \begin{array}{l} F_1: j \rightarrow \text{NPI}, s \rightarrow \text{FCI} \\ F_2: j \rightarrow \text{NPI}, s \rightarrow \text{NPI} \\ F_3: j \rightarrow \text{FCI}, s \rightarrow \text{NPI} \\ F_4: j \rightarrow \text{FCI}, s \rightarrow \text{FCI} \end{array}$$

<sup>32</sup>We are not committed to moving the *wh* expressions exactly as in (59b) for this case. The same results, with minor tweaks, could obtain with 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 is motivated by the fact that it represents the most general case, as we will see, when we turn to cases which do not support multiple sluicing in section 7, namely those in which one member of the dependency remains below the ellipsis site.

A generalization of the answerhood operator is given in (64). 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 of pair-list answers: domain cover and point-wise uniqueness.<sup>33</sup>

$$(64) \quad \text{Ans-D } (\mathbb{Q})(w) = \bigcap (\iota Q \in \mathbb{Q} [\forall q \in \mathbb{Q} q(w)])$$

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

Though built up differently, the end result is the same as in Dayal 1996, 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.

A crucial difference between our account and the one in Fox (2012) 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 on 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 phrase and the higher  $C_{[+wh]}$  interpreting the skolem function variable associated with the range-setting phrase.<sup>34</sup>

To return to multiple sluicing, the LF we have posited predicts that ellipsis of the structure below  $C_{[+wh]}$  will lead to a grammatical sluice. To complete the picture, we note that an analysis of the antecedent clause involving skolem functions has been independently argued for. Hintikka 1986 pointed out that it is possible for an indefinite that QRs above a universal to covary if interpreted as functionally dependent on the universal:<sup>35</sup>

$$(66) \quad [\text{TP some topic}_2 [\text{TP every student}_1 [\text{TP } t_1 \text{ has published on } t_2^1 ]]]$$

To conclude, the skolem functional account of pair-list readings developed here is based on structures that allow for multiple sluicing, structures where both *wh*-phrases move above C. We now turn to pair-list readings in structures where the unacceptability of multiple sluicing calls for an in-situ scope mechanism.

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<sup>33</sup>As noted in Dayal 1996, other functional accounts of pair-list readings such as Chierchia 1993 or Comorovski 1996 do not derive the relevant results as their question denotations involve simple atomic propositions that do not reflect functional dependencies.

<sup>34</sup>Note that the semantic type of the final denotation is the same in both accounts: sets of sets of propositions ( $\langle \langle \langle s, t \rangle, t \rangle, t \rangle$ ) but there is a difference. The set of propositions at the lower CP in our account does not correspond to natural questions, so the answerhood operator is defined differently. While non-trivial, this difference is orthogonal to our concerns here (see Dayal 2016).

<sup>35</sup>An anonymous reviewer points out that there may be reasons (see e.g. Fox 2000) to think that this particular LF might not be derivable because of scope economy.

## 7 D-Linking and Pair-Lists without Movement

In this section we consider pair-list readings in two cases where the facts from multiple sluicing force a non-movement scope-taking option for one member of a dependency. The first involves *wh-wh* dependencies in superiority-violating configurations, the second a dependency with a quantifier in it. Our extension of the functional account leverages the significance of D-linking in making these readings available.

### 7.1 Pair-list Readings of Superiority Violating Questions

As noted earlier, there is at present a disconnect between observations about the crucial role of D-linking in ameliorating superiority violations and the explanations given for them. We close this gap by allowing a syntactically lower *wh* expression to scramble over a higher *wh* expression if its discourse status is more prominent, crucially reversing 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:<sup>36</sup>

- (67) a. Which topic did which student publish on?  
b. [CP *wh* topic<sub>2</sub> [C<sub>[+WH]</sub> [ t<sub>2</sub> [C<sub>[+WH]</sub> [TP t<sub>2</sub> *wh* student<sub>1</sub><sup>2</sup> publish on t<sub>2</sub> ]]]]

We follow syntactic accounts, such as Pesetsky (2000), in disallowing LF movement of the subject term once it has been crossed.<sup>37</sup> 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  $\langle\langle e, t \rangle e\rangle$ , 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  $\langle e, e \rangle$ , 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  $\langle\langle\langle e, e \rangle, t \rangle, \langle e, e \rangle\rangle$ . 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

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<sup>36</sup>In *wh* in situ languages like Japanese or Hindi, the scrambling would be overt, followed by covert *wh* movement to C. Dayal 1996 notes for Japanese that scrambling leads to a reversal in the functional dependency. An anonymous reviewer points out that the same has been noted for Russian in Grebenyova 2009.

Recall the discussion from section 3 on the interactions between A-scrambling and *wh* movement.

<sup>37</sup>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.

particular skolem function in the second. In (68a) we flesh out the LF in (67b) by activating the null  $\exists$  at the higher C level to bind the choice function variable over *which student*, the *wh* in situ that sets the range:

- (68) a.  $[_{CP} \exists_1 C_{[+WH]} [_{CP} wh \text{ topic}_2 C_{[+WH]} [_{TP} t_2 wh \text{ student}_1^2 \text{ publish on } t_2 ]]]]$   
 b.  $\lambda Q \exists f_1 [CF(f_1) \wedge Q = \lambda p \exists x [\text{topic}(x) \wedge p = \wedge [f_1 (\lambda F [\forall z[\text{student}(F(z))]])](x) \text{ published-on } x]]]$   
 c.  $\lambda F [\forall z[\text{student}(F(z))]] = \{F_1, F_2, F_3, F_4\}$ , each F a function from topics to students:
- |       |                                      |       |                                      |       |                                |       |                                     |
|-------|--------------------------------------|-------|--------------------------------------|-------|--------------------------------|-------|-------------------------------------|
| $F_1$ | $\text{NPI} \rightarrow \text{John}$ | $F_2$ | $\text{NPI} \rightarrow \text{John}$ | $F_3$ | $\text{NPI} \quad \text{John}$ | $F_4$ | $\text{NPI} \quad \text{John}$      |
|       |                                      |       | $\nearrow$                           |       | $\times$                       |       | $\searrow$                          |
|       | $\text{FCI} \rightarrow \text{Sue}$  |       | $\text{FCI} \quad \text{Sue}$        |       | $\text{FCI} \quad \text{Sue}$  |       | $\text{FCI} \rightarrow \text{Sue}$ |

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 pre-slucies but unacceptable slucies discussed in section 5.2:

- (69) a.  $\left\{ \begin{array}{l} \{F_1(\text{NPI}) \text{ published on NPI}, F_1(\text{FCI}) \text{ published on FCI}\} \\ \{F_2(\text{NPI}) \text{ published on NPI}, F_2(\text{FCI}) \text{ published on FCI}\} \\ \{F_3(\text{NPI}) \text{ published on NPI}, F_3(\text{FCI}) \text{ published on FCI}\} \\ \{F_4(\text{NPI}) \text{ published on NPI}, F_4(\text{FCI}) \text{ published on FCI}\} \end{array} \right\}$   
 b.  $\left\{ \begin{array}{l} \{\text{John published on NPI}, \text{Sue published on FCI}\} \\ \{\text{John published on NPI}, \text{John published on FCI}\} \\ \{\text{Sue published on NPI}, \text{John published on FCI}\} \\ \{\text{Sue published on NPI}, \text{Sue published on FCI}\} \end{array} \right\}$   
 c.  $\text{Ans-D}(69b) = \text{John published on NPI and Sue published on FCI}.$

In a particular case, we might get the answer in (69c) but it is also possible for answers to 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 Japanese scrambled questions (Dayal 1996) and English 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 periphery. The functional *wh* in situ is then interpreted using a choice-function variable over skolem functions. Note that this extension of our account maintains the crucial connection between a split C structure and a skolem functional dependency in the nucleus. We now 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 (70) 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 (70a). 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 (70b). A third approach, due to Nicolae (2013), extends the Fox-Hagstrom account of pair-list readings to include quantifiers (70c). A fourth approach, due to Krifka (2001), treats them as quantifying into the speech act of questioning (70d):

- (70) a.  $[_{CP} \text{ Which book}_2 [_{C'} \text{ did } [_{TP} \text{ every student}_1 \text{ read } t_2^1 ]]]]$   
 b.  $[_{CP} \text{ Which book}_2 [_{C'} \text{ did every student}_1 [_{TP} t_1 \text{ read } t_2^1 ]]]]$   
 c.  $[_{CP} \text{ Every student}_1 [_{CP} \text{ Which book}_2 [_{C'} \text{ did } [_{TP} t_1 \text{ read } t_2 ]]]]]]$   
 d.  $[_{SAP} \text{ Every student}_1 [_{SAP} \text{ Which book}_2 [_{C'} \text{ did } [_{TP} t_1 \text{ read } t_2 ]]]]]]$

Of the options above, only (70a) straightforwardly predicts the fact that questions with quantifiers allow pair-list readings but not multiple sluicing:

- (71) 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.  $[_{TP} \text{ some topic}_2^1 [_{TP} \text{ every student}_1 [_{TP} t_1 \text{ is working on } t_2^1 ]]]]$  but I couldn't tell you  
 $[_{CP} \text{ which topic}_2 [_{TP} \text{ every student}_1 [_{TP} t_1 \text{ is working on } t_2 ]]]]$

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 within the functional approach we have outlined. There are only two additional assumptions we need in order to account for the facts, both of which

have substantive independent motivation.<sup>38</sup> 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 do so only 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:

- (72) a. Which topic is {every|each} student working on?  
 $[_{CP} \text{ which topic}_2 [_{CP} \exists_1 [_{TP} \{\text{every|each student}\}_1 \text{ is working on } t_2^1 ]]]$
- b.  $\lambda Q \exists F_2 [ \forall z(\text{topic}(F_2(z))) \wedge Q = \lambda p \exists f_1 [CF(f_1) \wedge p = \wedge f_1 (W(\{\text{every|each}\} \text{ student})) \text{ is working on } F_2 (f_1 (W(\text{every/each student})))]]]$

The binding of the a-index of the *wh*-phrase in (72a) 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.<sup>39</sup> The rest follows along expected lines.

The binding of the a-index of the *wh*-phrase by the universal in object position in (73a) 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*<sup>40</sup> But other than scrambling, the path to a pair list reading calls for nothing further:

- (73) a. Which student is working on {each |\*every} topic?  
 $[_{CP} \text{ wh student}_1 [_{CP} \exists_2 [_{TP} \{\text{each|*every}\} \text{ topic}_2 [_{TP} t_1^2 \text{ is working on } t_2 ]]]]$
- b.  $\lambda Q \exists F_1 [ \forall z(\text{student}(F_1(z))) \wedge Q = \lambda p \exists f_2 [CF(f_2) \wedge p = \wedge F_1 (f_2 (W(\text{each topic})) \text{ is working } f_2 (W(\text{each topic})))]]]$

A few points are worth emphasizing before we transition to pair-list readings across clauses. One, the unacceptability of (73a) with *every N* crucially relies on the

<sup>38</sup>On the role of witness sets in questions with quantifiers, see Dayal (2016, pp. 106–108) and references cited there; on the ability of *wh* phrases and indefinites to have skolem functional denotations see Engdahl 1980, 1986 and Hintikka 1986, respectively.

<sup>39</sup>An anonymous reviewer asks what prevents "*every N P*" from being interpreted as "*some N P*", using the same mechanism. On our view, the universal itself cannot introduce the binder for the choice function variable, a *wh* phrase is needed to activate the null  $\exists$ .

<sup>40</sup>The D-linked nature of *each N* is well-established. For example, the question *who does  $\forall$  man love?* can have a generic reading with *every* but not with *each* (see Dayal 2016 for further details).

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 setting *wh*-phrase in a *wh-wh* dependency but the range-setting *wh*-term in a *wh*-QP dependency. The confluence of these factors provides 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* phrase 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 schematic partial LF representation.

In the first context the matrix subject sets the domain of the function:

- (74) 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. which guard thinks (that) Mary stole which painting 8✓
- b.  $[\exists F2 \text{ which guard}_1 [_{CP_1} t_1 \xrightarrow{\hspace{1.5cm}} \dots [_{CP_2} \dots \text{which painting}_2^1 ] ] ]$

In (74a) the functional *wh* is c-commanded by the trace of the fronted domain setting *wh*. The judgments show that long distance binding of the a-index of the functional *wh* is grammatical, as is long distance binding of its the i-index by the null  $\exists$ .

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

- (75) 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.  $[\exists F1 \text{ which painting}_2 [_{CP_1} t_2 \xrightarrow{\hspace{1.5cm}} \dots \text{which guard}_1^2 \dots [_{CP_2} \dots t_2 ] ] ]$

Here long-distance scrambling is needed in to bind the a-index of the functional term and we ascribe the discomfort that some speakers had with (77a) to this. We do not see any other problem with this derivation.

The next two contexts also vary the domain along the subject vs the object *wh* but this time both *wh* terms originate in the embedded clause. The context in (76) has the domain set by the subject:

- (76) Last night, a number of precious paintings were stolen from the museum. Mary has an elaborate theory according to which a number of security guards stole the paintings by individually smuggling them out of the building. To investigate Mary's theory properly, I would like a complete list of
- a. which security guard Mary thinks stole which painting. 7✓, 1 ?
  - b.  $[\exists F2 \text{ which guard}_1 [_{CP_1} \dots [_{CP_2} t_1 \dots \text{which} \xrightarrow{\quad} \text{painting}_1^1 ] ] ]$

The acceptability of (76a) is straightforwardly explained. The functional dependency is set locally, the subject *wh* moves successive cyclically to matrix C, splitting the C domain, and enabling  $\exists$  to long-distance bind the i-index of the functional *wh*.

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

- (77) 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.  $[\exists F1 \text{ which painting}_2 [_{CP_1} \dots [_{CP_2} t_2 \dots \text{which} \xrightarrow{\quad} \text{guard}_1^2 \dots t_2 ] ] ]$

We deem each individual piece of the scope taking mechanism in (77b) legitimate on the basis of judgments about cases discussed earlier. We are forced to conclude that the discomfort that some speakers feel must be with long distance movement coming after scrambling.

What this data set suggests is that superiority 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 our survey, we also balanced the multiple *wh* questions in each context with one with a universal term. We did this on the view that universal quantifiers, because of their distinct properties, could provide additional insight into our findings about *wh* phrases. Two assumptions about universal quantifiers inform our discussion. One, quantifiers can only be domain setters, unlike *wh* expressions which can be domain or range terms. Two, quantifiers take only local scope.

The results of our survey suggest that consultants adjust 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 next to each of them and spell out some of the key conclusions that we can draw from them:

- |      |    |                                                                                                                            |        |
|------|----|----------------------------------------------------------------------------------------------------------------------------|--------|
| (78) | a. | [which guard <sub>1</sub> [t <sub>1</sub> <sup>2</sup> thinks [each painting <sub>2</sub> [Mary stole t <sub>2</sub> ]]]]  | 2✓6*   |
|      | b. | [which painting <sub>2</sub> [each guard <sub>1</sub> [t <sub>1</sub> thinks [Mary stole t <sub>2</sub> <sup>1</sup> ]]]]] | 7✓, 1? |
|      | c. | [which guard <sub>1</sub> [Mary thinks [each painting <sub>2</sub> [t <sub>1</sub> <sup>2</sup> stole t <sub>2</sub> ]]]]] | 3✓; 3* |
|      | d. | [which painting <sub>2</sub> [Mary thinks [each guard <sub>1</sub> [t <sub>1</sub> stole t <sub>2</sub> <sup>1</sup> ]]]]] | 8✓     |

The first striking contrast we note is between (78a) and (78b). (78a) is predicted to be ungrammatical since local QR of the universal does not get it to a position from where it can bind the a-index of the *wh*. The grammaticality of (78b) is also predicted since the quantifier c-commands the *wh* trace in the base structure itself.

The second striking contrast is between (78a) and (78d). In both cases QR is restricted to the embedded clause, but in (78a) it is not enough to bind the a-index of the *wh* trace while in (78d) QR is not needed for c-command. This provides, we claim, strong corroboration of our general approach to modeling pair-list answers via skolem functions. As far as we can tell, this contrast cannot be explained on theories where the crucial factor involves getting the universal to the matrix C domain (cf. (70)). There is no reason why whatever principle would apply to give the universal matrix scope in (78d) would not also apply in (78a).

We note that (78c) does not violate any principle but was not accepted unanimously. We believe this is similar to the resistance to the combination of superiority violation and long-distance movement that we saw in multiple *wh* questions in contexts (75) and (77).

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.

## 8.2 Long-distance lists with three members

Turning to list readings with more than two members, we find the clause-mate condition re-emerge in an unexpected way. The empirical landscape of long-distance lists was crucially changed by Cheng and Demirdache (2010) who built on Rațiu (2007, 2011) to establish the existence of trapping. The paradigm in (32) is repeated here:

- (79) a. [Which guest promised [that he would give which toy to which child]]?
- b. Bill the plane to Sybren and  
the train to Amina
- c. #Bill the plane to Amina and  
Mary the train to Amina
- d. #Bill the plane to Sybren and  
Mary the plane to Amina

We posit a constraint on the binding of choice functional variables by the null  $\exists$  in C to explain trapping. We have argued that choice functions are cross-categorial: they take a set and deliver an arbitrary member of that set, and applied it to sets of entities (type  $\langle e, t \rangle$ ) as well as to sets of skolem functions (type  $\langle \langle e, e \rangle, t \rangle$ ). In fact, they can apply to any type  $\langle \alpha, t \rangle$ , including sets of propositions or sets of sets of propositions, and denote something of type  $\alpha$ . We posit a uniformity constraint on the binding of choice functions by null  $\exists$ : when a moved *wh* expression activates the cross categorial null  $\exists$ , it can only activate binding over a single type of argument, be it type  $\langle e, t \rangle$  or type  $\langle \langle e, e \rangle, t \rangle$ , but not both. The same applies to any other type of argument. Let us evaluate the paradigm in (79) in light of this restriction.

On our approach to multiple *wh* questions, the fronted *which guest* may or may not trigger a split C structure. If it does not, we get simple long-distance binding of two choice functional variables over type  $\langle e, t \rangle$  arguments, denoted by *which toy* and *which child*, leading to sets like (80b). Ans-D applies to it and picks out the unique true proposition at the world of evaluation, yielding a single triple answer:

- (80) a.  $[\exists f_2 \exists f_3 \text{ which guest}_1 [t_1 \text{ promised } [\dots \text{which toy}_2 \dots \text{which child}_3]]]$
- $\Rightarrow \lambda p \exists f_2 \exists f_3 \exists x_1 [\text{guest}(x_1) \wedge \text{CF}(f_2) \wedge \text{CF}(f_3) \wedge p = x_1 \text{ promised he}_1 \text{ would give } f_2 \text{ (toy) to } f_3 \text{ (child)}]$
- b. {Bill promised that he would give the train to Amina,  
Bill promised that he would give the plane to Amina...}

The uniformity restriction comes into play when a *wh* expression triggers a split C structure, calling for a functional dependency. The answer in (79b) instantiates a functional dependency inside the embedded clause but not in the matrix.<sup>41</sup> That is,

<sup>41</sup>We will assume that one or both *wh* expressions in the embedded clause have been covertly fronted (see Ratiu 2007, Rațiu (2011), Cheng and Demirdache (2010), Kotek and Erlewine (2016)).

the embedded clause has a split C, denoting a set of sets of propositions, but not the matrix clause. To interpret this question, the LF has to include a choice functional variable over the embedded clause, which is then bound from the matrix C:

$$(81) \quad \text{a. } [\text{Wh guest}_1 \exists \mathbf{f}_4 [\text{t}_1 \text{ promise } [\text{CP}_4 \text{ wh child}_3 [\text{wh toy}_2 [\text{he}_1 \text{ give } \text{t}_2 \text{ to } \text{t}_3^2 ]]]]] \\ \Rightarrow \quad \lambda p \exists x_1 \exists f_4 [\text{guest}(x_1) \quad \text{CF}(f_4) \wedge p = x_1 \text{ promised} \cap f_4 (\llbracket \text{CP}_4 \rrbracket)] \\ \text{where } \llbracket \text{CP}_4 \rrbracket = \lambda Q \exists F_3 [\forall z(\text{child}(F_3(z))) \wedge Q = \lambda p' \exists x_2 [\text{toy}(x_2) \\ \wedge \lambda p' = x_1 \text{ would give } x_2 \text{ to } F_3(x_2)]]]$$

It may be helpful to see what kind of sets the embedded clause denotes. Each cell in (82) gives the propositions based on one possible function from toys to children:

$$(82) \quad \llbracket \text{CP}_4 \rrbracket = \left\{ \begin{array}{l} \{x_1 \text{ will give the train to Amina, } x_1 \text{ will give the plane to Sybren}\} \\ \{x_1 \text{ will give the plane to Amina, } x_1 \text{ will give the train to Sybren}\} \end{array} \right\}$$

The choice function variable  $f_4$  applies to this set and arbitrarily picks out one cell from it. Depending on which individual guest and which individual cell in  $\llbracket \text{CP}_4 \rrbracket$  is chosen, we get a standard question denotation with four propositions:

$$(83) \quad \left\{ \begin{array}{l} \text{Bill promised he will give the train to Amina and the plane to Sybren,} \\ \text{Bill promised he will give the plane to Amina and the train to Sybren,} \\ \text{Mike promised he will give the train to Amina and the plane to Sybren,} \\ \text{Mike promised he will give the plane to Amina and the train to Sybren} \end{array} \right\}$$

Once Ans-D applies to (83), whichever proposition happens to be the unique true one will be a trapped pair-list answer such as (79b).

Now we turn to the unacceptable answers in (79c) and (79d), illustrating how the uniformity constraint rules them out. Consider a potential LF for (79c):

$$(84) \quad \text{a. } *[\exists f_3 \exists F_2 \text{ which guest}_1 [\text{t}_1 \text{ promised } [\dots \text{which toy}_2^1 \dots \text{which child}_3 ]]] \\ \text{b. } \lambda Q \exists f_2 \exists f_3 [\text{CF}(f_3) \wedge \text{CF}(f_4) \wedge Q = \lambda p' \exists x_1 [\text{guest}(x_1) \wedge \\ p' = x_1 \text{ promised that } x_1 \text{ will give } f_2 (\lambda F_2 [\forall z(\text{toy}(F_2(z))))] (x_1) \text{ to } f_3 \\ (\text{child})]]]$$

(84a) posits a functional dependency between the matrix *wh* (*which guest*) and one embedded *wh* (*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 (74) and the long-distance binding of *which child* what we saw in (80b) and other cases in sections 5, 6 and 7. The problem, therefore, must be with combining two distinct types of long-distance binding. In (84b) we have a functional *wh* in situ: *which toy* denotes a set of toy-valued functions ( $\langle \langle e, e \rangle, t \rangle$ ), over which

we have a choice function variable bound by the matrix  $\exists$ . We also have an ordinary *wh* interpreted in situ, *which child*, with a choice function over a set of individuals ( $\langle e, t \rangle$ ). The matrix *C* domain incurs a violation of the proposed constraint.

For completeness, let us also consider the option of interpreting *which child* in the embedded clause itself, as in (85):

$$(85) \quad *[\exists F_2 \text{ Wh guest}_1 [t_1 \text{ promised } [CP_4 \text{ wh child}_3 [\text{he would give wh toy}_2^1 \text{ to } t_3 ]]]] \\ \Rightarrow \quad \lambda Q \exists f_2 \exists f_4 [CF(f_3) \wedge CF(f_4) \wedge Q = \lambda p' \exists x_1 [\text{guest}(x_1) \wedge \\ p' = x_1 \text{ promised } f_4 ([CP_4 ])] \\ \text{where } [CP_4 ] = \lambda p \exists x_3 [\text{child}(x_3) \wedge \\ p = x_1 \text{ will give } f_2 (\lambda F_2 [\forall z(\text{toy}(F_2(z))))] (x_1) \text{ to } x_3 ]]$$

Unpacking (85), 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  $\langle \langle s, t \rangle, t \rangle$ . In addition, we interpret the functional *which toy* in-situ, as in (84), and need a choice function over the set of skolem functions:  $\langle \langle e, e \rangle, t \rangle$ . So once again we end up with a violation of the uniformity constraint. This explains the core paradigm illustrating the phenomenon of trapping.

### 8.3 The Wh-island Wrinkle

Our approach to list answers provides a simple solution to a problem for Cheng and Demirdache (2010)'s claim of trapping. They note that trapping is not observed in the well-known Baker examples, where the matrix *wh* can be paired with the embedded *wh* in situ, 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 Dayal (2016) points out, 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?

The crucial difference between (85) and (84), we suggest, is in the types of complements that the matrix predicates 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*:

$$(86) \quad \text{a. Which student knows where Mary bought which book?} \\ \text{b. } [ \exists F_2 \text{ wh student}_1 [t_1 \text{ knows } [\text{where}_3 [\text{Mary bought wh book}_2^1 \text{ } t_3 ]]]] \\ \text{c. } \Rightarrow \quad \lambda Q \exists f_2 [CF(f_2) \wedge Q = \lambda p' \exists x_1 [\text{student}(x_1) \wedge \\ p' = x_1 \text{ knows } ([CP_4 ])]]$$

where  $\llbracket \text{CP}_4 \rrbracket = \lambda p \exists x_3 [\text{place}(x_3) \wedge$   
 $p = \text{Mary bought } f_2 (\lambda F_2 [\forall z(\text{book}(F_2(z))))] (x_1) \text{ at } x_3 ]$

An answer linking *which student* and *which book* does not incur a violation of the uniformity constraint, since (86b) effectively represents a 2-member dependency.

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

- (87) a. Which student knows who gave which present to which teacher?  
 b. John knows who gave which present 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.

Ans (87b) interprets two *wh* 's within the embedded clause and one from the matrix via choice functions over individuals. Ans (87c) interprets one embedded *wh* in the embedded clause while allowing the other two to form an internal dependency. They get wide scope via choice functional binding over skolem functions. The answer is a single-pair answer on *which student* and a function from presents to teachers - a trapped pair-list answer, analogous to (79b). Ans (87d) is a trapping violation similar to (87c)-(87d), and is similarly blocked by the proposed uniformity constraint.

While this solution works well enough, there is in fact 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. They predict that the fronted *wh* will be exhaustively paired, but it is the *wh* in-situ that is so interpreted (Dayal, 1996).

There is already an approach to long distance lists that addresses this problem. The solution to the *wh* triangle, developed in Dayal 1996 and subsequent work, has three key components: (i) all *wh* expressions are interpreted locally, not just those that take scope via movement, (ii) the complement is interpreted at a higher type than usual, (iii) the complement functions as the domain term, becoming a de facto quantifier, and the fronted *wh* becomes the dependent expression.

We now have two distinct approaches, both of which capture the kind of trapping discussed in section 8.2. Apart from domain-cover, there is one further difference that separates the two approaches. In the long-distance binding of the *wh* in-situ, the depth of embedding should not matter, while the *wh* triangle approach requires the *wh* in situ to be in the complement clause of the matrix predicate. This is because the complement undergoes a sort of QR to a position from where it can c-command the a-index of the matrix *wh*, enforcing strict locality.

To calibrate our account for long-distance lists in terms of the *wh* triangle would take us too far afield and may well be premature, specially given the facts in section 8.1. Our goal here was to make explicit which aspects of the theory are responsible for which effects. This should make it relatively easy to see how the theory would have to be modified to accommodate any new findings that future empirical explorations of long-distance list answers may reveal.

## 9 Conclusions

Sluicing is clearly an interface phenomenon and yet the many studies that have focused on it have not tapped its full potential. In our account of multiple sluicing, we have probed both aspects of its grammar and drawn some substantive conclusions about *wh* scope taking. These conclusions were based on close comparisons between licit and illicit multiple sluicing structures and between illicit multiple sluicing structures and the interpretive options available to their pre-sluices. Based on these comparisons, we have argued for the following:

- Sluicing can make (certain) otherwise covert phrasal movement operations overt. Specifically, sluicing can make covert phrasal *wh*-movement overt.
- Covert phrasal *wh*-movement is clause bounded. While clause-boundedness is somewhat non-specific and would have been compatible also with other movement operations such as extraposition (see Lasnik 2014) or quantifier raising. We have argued that multiple sluicing is not fed by quantifier raising, because quantifiers are not possible multiple sluicing remnants. We have argued that extraposition does not in general feed multiple sluicing, because cross-linguistically the two do not pattern together.
- Covert phrasal *wh*-movement is subject to superiority. The necessity not only of imposing locality constraints on the movement of the second ellipsis remnant but of imposing superiority as a condition on the interaction of the two movements (see section 3), strongly suggests that the second remnant reaches its position through *wh*-movement specifically.
- A single language can employ more than one *wh* scope taking mechanism, a movement-based mechanism that obeys strict locality as well as an island insensitive long-distance choice-functional mechanism.
- Skolem functions as well as a Split C structure are needed to model pair-list readings. The lower C interprets the domain term and denotes a set of

propositions. The higher C interprets the functional term and yields a set of sets of propositions. The answer to the question is the intersection of the unique cell with only true propositions in it.

- The domain term in a *wh* dependency must syntactically c-command the dependent term. In superiority violating structures and in questions with D-linked universal quantifiers, this can be established by scrambling a discourse prominent but syntactically lower expression over the structurally higher expression.
- Neither single-pair nor pair-list answers are constrained by the clause-mate condition per se but embedded *wh* expressions reveal a clause-mate dependence, where clause-mates cannot separately enter into dependency relations outside the clause.
- Choice functions can be cross-categorical but any given existential quantifier can only bind one type of choice function. This can explain the trapping of embedded clause-mates in their own clause.

It would be foolish of us to believe that this paper is the last word on any of these issues. Even if its conclusions and generalizations are accepted, there clearly are many open questions that need to be pursued further. A number of empirical issues have been flagged in the text of the paper.

On the theoretical side, the following two issues seem most pressing. On the syntactic side one would need to develop an understanding of what the exact mechanisms are which guarantee that covert phrasal movement is clause bounded and subject to superiority. On the semantic side, a full theory of *wh*-scope taking needs to account for intervention effects. We have motivated our choice not to adopt the focus based account of intervention, because it does not address the crucial distinction between single pair and pair list readings. We believe that an account along the lines of Mayr 2014 holds promise and is compatible with our own proposals but we leave the details of this to be worked out.

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