Scope Theory Revisited:
Lessons from pied-piping in *wh*-questions

by

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Abstract

It is widely assumed that both the movement-based theory of scope and the scope-based theory of intensionality fall short in the face of empirical challenges like 'exceptional' scope out of extraction islands and the possibility of transparent/*de re* construals for DPs inside extraction islands. The standard response to these challenges consists in assuming that grammar makes available *in-situ* methods of scope-taking — in addition to movement— (e.g. pointwise composition (Hamblin, 1973; Kratzer and Shimoyama, 2002; Cable, 2010), choice functions (Reinhart, 1997, 1998)) and adopting a richer representation of intensionality (e.g. *in-situ* binding of world/situation-denoting pronouns (Percus, 2000)).

This thesis argues that a closer study of pied-piping in *wh*-questions reveals the true power of already-existing tools in grammar. Building on the important insight that more complex scope-takers can be recursively built (Dayal, 1994; Charlow, 2019), I advance the idea that grammar makes crucial use of pied-piping to generate meanings that would otherwise be unavailable. I argue that with pied-piping in its toolbox, grammar may not need in-situ methods of scope-taking and in-situ methods of assigning DPs a transparent/*de re* construal.

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Contents

Chapter 1

Introduction

In an influential paper, von Stechow (1996) argued that interpreting pied-piping in *wh*-questions makes incorrect predictions on what *wh*-questions mean, for example, predicting (1a) would be equivalent to (1b). Therefore, he argued that pied-piping has to be *undone* for interpretation, as in (1c).

(1)   a.   I wonder **which girl's cat** Alex fed.
       b.   I wonder **which cat** Alex fed.
       c.   LF≈ I wonder **which girl** λ Alex fed **t**'s cat

von Stechow's criticism was directed at a particular proposal by Nishigauchi (1990) and made certain assumptions on the compositional semantics of *wh*-questions and the representation of intensionality in grammar. These assumptions have since then been modified or replaced by other assumptions. However, what has gone largely unnoticed is that the validity of von Stechow's criticism persists to this day. It turns out that the now-widespread assumptions on how *wh*-questions are composed (Cable, 2010; Kotek, 2016, e.g.) and how intensionality is represented (Percus, 2000; Schwarz, 2012, e.g.) do not address von Stechow's criticism.

In this thesis I study von Stechow's lesson and offer a compositional semantics for pied-piping, building on Charlow (2019). The proposed theory is primarily designed to address von Stechow's criticism without undoing the pied-piping, yet it has far-reaching consequences. I advance the idea that grammar makes crucial use of pied-piping to generate meanings that would otherwise be unavailable. I argue that with pied-piping in its toolbox, grammar may not need *in-situ* methods of scope-taking (Reinhart, 1997; Hagstrom, 1998; Shimoyama, 2006; Cable, 2010; Kotek, 2016) and *in-situ* methods of assigning DPs a transparent/*de re* construal (Percus, 2000).

In Chapter 2, we will study von Stechow's lesson in detail. In what follows, I briefly go over the fundamental issues that motivated in-situ methods of scope-taking and assigning a *de re* construal to DPs. Both sections provide an overview of what this thesis promises to contribute to the debate on the relevant phenomena.

1.1   On the nature of scope-taking

Following May (1977) and much subsequent work (Heim and Kratzer, 1998, e.g.), I assume that scope-taking in natural languages consists in **Quantifier Raising** (QR).[1] QR is a (potentially scope-shifting) movement operation that can be instantiated overtly as illustrated in (2b). Essentially, when a quantifier phrase QP undergoes Quantifier Raising, this movement creates a function (i.e. λ-abstract) which QP takes as its argument, as illustrated in (2c) for (2b).[2]

(2)   Turkish

   a. $[_{QP_1}$ bi çocuk] $[_{QP_2}$ her   elma-yı]   ye-di
          a child   every apple-ACC eat-PST.3SG
          'A child ate every apple.'
          false if every apple was eaten by a different child.

   b. $[_{QP_2}$ **her   elma-yı**] $[_{QP_1}$ bi çocuk] $\mathbf{t}_{QP_2}$ ye-di
          every apple-ACC   a child   eat-PST.3SG
          true if every apple was eaten by a different child.

   c.   ⟦her elmayı λ_1 bi çocuk t_1 yedi⟧ = 1 iff
          ⟦her elmayı⟧(λx. ⟦bi çocuk⟧(⟦yedi⟧(x))) = 1 iff
          $\forall y$ apple$(y) \rightarrow \exists x$ child(x) & ate$(y)(x)$

Since Karttunen (1977), it has been widely assumed that *wh*-phrases are existential quantifiers and the semantics of *wh*-questions involves **scope-taking** (Cresti, 1995; von Stechow, 1996; Dayal, 1996; Heim, 2000; Fox, 2012; Heim, 2012; Dayal, 2016, a.o). From this perspective, *wh*-movement, illustrated in (3a), is QR.[3]

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[1]It should be noted that QR/movement is not the only conceivable scope mechanism. See Heim and Kratzer (1998) for an alternative that involves type-shifting, and Jacobson (2014) for an alternative view of grammar that where λ-abstraction via movement is replaced by Function Composition.

[2]Notice that the scope-shift via QR is contingent on the created λ-abstract being the argument of QP. We will also make crucial use of the possibility of QP being the argument of the created λ-abstract, which achieves *scope reconstruction* semantically.

[3]QR has been traditionally defined as a **covert** scope-shifting movement. From this perspective,

(3)   a.   Sue told me [**which applicant**]$_1$ she hired $\mathbf{t}_1$.

        b.   *Sue told me she hired [**which applicant**].

1.1.1   QR and exceptional scope

Both the idea that QR is the sole mechanism for scope-taking and the idea that *wh*-questions involve scope-taking were empirically challenged in the face of data that concerns exceptional scope-taking ability of existential quantifiers, i.e. indefinites and *wh*-phrases. It was widely observed that indefinites seem to freely take scope out of what Ross (1967) called **islands** (Farkas, 1981; Fodor and Sag, 1982; Heim, 1982; Ludlow and Neale, 1991; Ruys, 1992; Abusch, 1994; Reinhart, 1997; Brasoveanu and Farkas, 2011, a.o).[4] As shown in (4a), an indefinite can scope out of the antecedent of a conditional —an extraction island— whereas a universal quantifier cannot, (4b).

(4)   a.   If **a rich relative of mine** dies, I'll inherit a house.
               $\checkmark \exists x$: x is a rich relative of mine & if x dies, I'll inherit a house.

        b.   If **every rich relative of mine** dies, I'll inherit a house.
               $\times \forall x$: x is rich relative of mine $\rightarrow$ if x dies, I'll inherit a house.

                                    Reinhart (1997); Charlow (2019)

Similarly, it was observed that *wh*-phrases (in particular in-situ *wh*-phrases) exhibit exceptional scope, on a par with indefinites (Huang, 1982; Pesetsky, 1987; Nishigauchi, 1990; Cheng, 1991; Watanabe, 1992; Aoun and Li, 1993; Tsai, 1994; Cole and Hermon, 1994, 1998; Dayal, 1996; Reinhart, 1997, 1998; Hagstrom, 1998; Kratzer and Shimoyama, 2002; Shimoyama, 2006, a.o). This is illustrated by the Turkish data below. A universal quantifier cannot scope out of the antecedent of a conditional as shown in (5a) while a *wh*-phrase can, as shown in (5b).

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neither the scrambling in (2b) and nor the *wh*-movement in (3a) technically would be instances of QR. I assume that scope-shifting overt movement is no different from scope-shifting covert movement and describe both as QR. See also Johnson (2000) who argues that QR is best characterized as scrambling.

    [4]I am not being entirely faithful to the cited works. Not all authors have taken this exceptional behavior of indefinites to involve scope-taking. For example, Fodor and Sag (1982) argue that indefinites have a referential reading where they are scopeless.

(5) Turkish

    a. [$_{island}$ **her soru-yu** çözersem] öğretmen şeker verecek
            every question-ACC solve.COND.1SG teacher candy will.give
        'If I solve every question, the teacher will give me a candy.'

        $\neq$ For every question x, if I solve x, the teacher will give me a candy.

    b. [$_{island}$ **hangi soru-yu** çözersem] öğretmen şeker verecek?
            which question-ACC solve.COND.1SG teacher candy will.give
        Lit: 'If I solve which question, the teacher will give me a candy?'

        = For which question x, if I solve x, the teacher will give me a candy?

A number of explanations have been offered to accommodate the exceptional behavior of *wh*-phrases and indefinites. Some have argued in favor of exempting covert/LF movement from locality restrictions on QR (Huang, 1982; Abusch, 1994; von Stechow, 1996, e.g.) yet this still does not explain the exceptional behavior of *wh*-phrases and indefinites. Prominent syntactic approaches to exceptional scope include the in-situ binding approach (Pesetsky, 1987; Cheng, 1991; Tsai, 1994), inspired by Heim (1982), and the covert island pied-piping approach (Nishigauchi, 1990; Watanabe, 1992; Richards, 2000), where an entire island containing the exceptional scope-taker QRs. Both of these approaches have been shown to make incorrect predictions on the meaning of *wh*-questions (Reinhart, 1992; von Stechow, 1996; Hagstrom, 1998).

The in-situ binding approach to exceptional scope was refined by Reinhart (1997, 1998) who provided a compositional semantics using *choice functions*. Another solution to exceptional scope is an enriched semantics, known as Alternative Semantics/Hamblin semantics that makes use of *pointwise composition* (Hamblin, 1973; Rooth, 1992; Kratzer and Shimoyama, 2002; Shimoyama, 2006). This solution has been particularly popularized in recent work on *wh*-questions (Hagstrom, 1998; Beck, 2006; Cable, 2010; Kotek, 2016). What unifies these two semantic approaches is that they essentially give up on a theory of exceptional scope that exclusively relies on QR. Finally, Schwarzschild (2002) has argued that an indefinite with apparent exceptional scope is to be analyzed as an existential quantifier whose restriction is a singleton set. This essentially makes 'exceptional scope' for indefinites an illusion, for an existential quantifier whose restriction is a singleton set is scopeless. This approach to exceptional scope, however, does not extend to *wh*-phrases, as far as I can see. Recently, Charlow (2019) has advanced the idea that exceptional scope can be given a QR-based treatment that involves cyclic scope-taking via pied-piping in the spirit

of Nishigauchi (1990); Richards (2000).[5] His proposal relies on QRing an exceptional scope-taker to the edge of an island, and subsequently QRing the island. Even though I do not adopt his exact implementation, I will be arguing that grammar generates exceptional scope via pied-piping.

1.1.2 The contribution of the thesis in this domain

This thesis takes von Stechow's (1996) criticism for pied-piping as its starting point and develops **a compositional semantics for pied-piping**, building on Charlow's (2019) insight on deriving exceptional scope via cyclic QR and pied-piping. I name this alternative pied-piping theory **the ∃-theory**, as it involves syntactically turning pied-piped phrases into existential quantifiers. In the way the ∃-theory derives exceptional scope, it is essentially a variant of Charlow's theory. Yet, it provides an additional insight into the contrast we have seen between quantifiers that can take exceptional scope and quantifiers that cannot. Under the ∃-theory, an exceptional scope derivation for a universal quantifier returns **anomalous truth conditions** (i.e. a contradiction). In Charlow's theory of exceptional scope, blocking exceptional scope for a universal quantifier is achieved *lexically* in that exceptional scope takers are not generalized quantifiers and are assumed to compose with functions into sets (they *quantify into sets* in Charlow's terms). Under the ∃-theory, all scope taking DPs are uniformly generalized quantifiers.

An immediate prediction of the proposed exceptional scope mechanism is that in *wh*-fronting languages, an island containing a *wh*-phrase can overtly move. This is borne out in some languages like Finnish (Huhmarniemi, 2012). However, many *wh*-fronting languages including English do not allow overt island pied-piping. As a preliminary account of what restricts overt island pied-piping in *wh*-questions, I characterize extraction islands in terms of their linearization properties (Fox and Pesetsky, 2005) and motivate overt island pied-piping in these terms. While an important restriction on overt island pied-piping will be shown to follow from this characterization, the motivation for covert island pied-piping will remain a mystery. I take this to suggest that while a characterization of extraction islands in terms of linearization seems necessary, it is not sufficient.

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[5]Though Charlow (2019) notes that he is not committed to QR-based theories of scope.

1.2 Intensionality in grammar

I follow the traditional theory of intensionality, in particular the representation of intensionality laid out in von Fintel and Heim (2011) as an extension of the framework in Heim and Kratzer (1998) (see also Russell (1905); Montague (1973)).[6] I will refer to this representation of intensionality as **Scope Theory of Intensionality** (STI), as Keshet (2008, 2011) names it.

Under STI, the interpretation function is relativized to a possible world: $[\![\ ]\!]^w$. This means that $[\![\alpha]\!]^w$ denotes the extension of α at w. Accordingly, *a cat meows* uttered at w is true iff there is a cat in w that meows in w. Some sample lexical items are given in (6). (7) illustrates how interpretation relativized to a possible world works, using a toy example.

(6) a. $[\![\text{cat}]\!]^w = \lambda x.\ x$ is a cat in w
     b. $[\![\text{meows}]\!]^w = \lambda x.\ x$ meows in w
     c. $[\![\text{a cat}]\!]^w = \lambda f_{<e,t>}.\ \exists x\ [\![\text{cat}]\!]^w(x)=1\ \&\ f(x)=1$
     d. $[\![\text{Mary}]\!]^w = \text{Mary}$[7]

(7) *w: There are only two cats, Rory's cat Ragu and Mary's cat Moku.*
     a. $[\![\text{cat}]\!]^w = \{\text{Moku, Ragu}\}$
     b. $[\![\text{Mary's cat}]\!]^w = \iota y$: $y \in \{\text{Moku, Ragu}\}\ \&\ y$ is Mary's in $w = \text{Moku}$

In STI, in addition to Function Application (Heim and Kratzer, 1998), we also need *Intensional Functional Application*, as defined in (8). IFA is required when a node requires the *intension* of its complement, for example, when an intensional operator (e.g. $[\![\text{think}]\!]^w$, $[\![\text{must}]\!]^w$, etc.) combines with its sister, as illustrated in (9).[8]

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[6]Unfortunately, partly due to my insufficient learning, I am putting aside questions on how context, times, situations, events are to be represented, and only refer to possible worlds. I can only hope that the claims made here are compatible with more complete assumptions on meaning that include them. All errors and shortcomings are solely my responsibility.

[7]I take proper names to be rigid designators (Kripke, 1980; Heim and Kratzer, 1998; von Fintel and Heim, 2011). There are problems with this (Quine, 1956; Percus and Sauerland, 2003; Charlow and Sharvit, 2014; Cable, 2018b), which I set aside. See Chapter 7 for a brief note on how fine-grained theories of *de re* can be implemented under STI's assumptions.

[8]In addition, there will be cases where an intensional trace needs to compose with a node that requires the extension of its sister (at the local evaluation world). This will require an additional rule that von Fintel and Heim (2011) call *Extensionalizing Function Application*. I will discuss and use this rule in Chapter 3 and 4. In Chapter 5, I present an alternative.

(8) *Intensional Functional Application* von Fintel and Heim (2011)

If α is a branching node and $\{\beta,\gamma\}$ the set of its daughters, then for any w and g, if $[\![\beta]\!]^{\mathrm{w,g}}$ is a function whose domain contains $\lambda w'.\ [\![\gamma]\!]^{\mathrm{w',g}}$, then $[\![\alpha]\!]^{\mathrm{w,g}} = [\![\beta]\!]^{\mathrm{w,g}}(\lambda w'.\ [\![\gamma]\!]^{\mathrm{w',g}})$

(9) $[\![\text{Mary believes it is raining}]\!]^{\mathrm{w}} = 1$ iff

$[\![\text{believes}]\!]^{\mathrm{w}}(\lambda w'.\ [\![\text{it is raining}]\!]^{\mathrm{w'}})(\text{Mary}) = 1$ iff

$\{w':$ it is raining in $w'\} \subseteq \{w'': w''$ is compatible with Mary's beliefs in $w\}$

A key property of STI is that the syntactic position of an object α at LF also determines the possible world α is evaluated in —if nothing else is said. To illustrate, if the sentence in (10) has the logical form in (10a), it receives the truth conditions in (10b) which require there to be an **actual** congresswoman for New York such that she is likely to fight for universal healthcare. That is, *a congresswoman for New York* receives a *de re*/transparent construal relative to the intensional operator *likely*, by virtue of being above it at LF.

(10) A congresswoman for New York is likely to fight for universal healthcare.

  a. LF: [a congresswoman for NY] λ_1 [likely [t_1 fight for UH]]

  b. $[\![(10a)]\!]^{\mathrm{w}} = 1$ iff

  $[\![\text{A congresswoman for NY}]\!]^{\mathbf{w}}(\lambda x.\ [\![\text{likely}]\!]^{\mathrm{w}}(\lambda w'.[\![\text{fight for UH}]\!]^{\mathrm{w'}}(x))$

Precisely due to this character of STI, it has faced serious empirical challenges. To put it simply, STI appears to undergenerate (Cresswell, 1990; Percus, 2000, a.o.).

1.2.1 How does STI undergenerate?

Under STI, an in-situ DP that is below (i.e. in the scope of) an intensional operator ω at LF cannot be interpreted *de re*/transparent with respect to ω. For it to have a *de re* construal (with respect to ω), it has to move *above* ω. The problem is that there appear to be cases with apparent paradoxical requirements. It seems as though DPs that **scope below** an intensional operator *can* have a *de re* construal with respect to that operator. von Fintel and Heim (2011) state that this is referred to as a *scope paradox* from the perspective of STI, for the 'intensional status' of a DP is determined by its LF-position.[9]

Let us briefly illustrate what scope paradoxes are. As shown below, *every rally*

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[9]Roger Schwarzschild warns me that the label 'scope paradoxes' is misleading and suggests that this is simply a false prediction of STI.

in John's district is able to scope above *some politician* in (11a), but cannot do so in (11b). Hence, it seems that the universal quantifier in (11b) cannot extend its scope beyond a tense clause. Under our assumptions, this means that the universal quantifier cannot QR out of a tensed clause (May, 1977).[10]

(11)   von Fintel and Heim (2011): pg. 113

    a.   **Some politician** will address **every rally in John's district**.
        ✓∀ > ∃

    b.   **Some politician** thinks that he will address **every rally in John's district**. * ∀ > ∃

The assumption that the scope of the universal quantifier is clause-bounded conflicts with the data below. As Keshet (2011) puts it, the sentence in (12a) has a *"reading which asserts that everyone actually in this room is such that Mary thinks that he or she is outside"* (p.253). That is, *everyone in this room* receives a *de re* construal relative to *think*. Accordingly, the sentence needs to be interpreted as in (12b), where *everyone in this room* is evaluated in the utterance world rather than in the belief worlds of Mary. Under STI, the *de re* reading of *everyone in this room* would require it to leave a tensed clause and QR above *think* so that it can "escape" the intensional context created by the verb *think*. But this conflicts with the data in (11b), which suggests that it in fact **cannot** leave a tensed clause.

(12)   a.   Mary thinks that everyone in this room is outside. Keshet (2011): ex. 4

    b. $[\![$Mary thinks$]\!]^{\mathrm{w}}(\lambda w'.$ $[\![$everyone in this room$]\!]^{\mathrm{w}}([\![$outside$]\!]^{w'})$)

I will call this the problem of exceptional *de re*, which is the core paradox of STI.

(13)   **the problem of exceptional *de re***
        a universal quantifier can have a *de re* construal in certain domains (e.g. tensed clauses, if-clauses, etc.) it **cannot** scope out of.

A solution to this paradox, which has become "standard" as von Fintel and Heim (2011) puts it, is quitting STI altogether and handing intensionality via **binding of overt world pronouns** in syntax (Percus, 2000; Keshet, 2008, 2010; Schwarz, 2012).

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[10]Though see Wilder (1997) who argues against this strong statement, showing that QR out of a tensed clause can target the embedding VP. (Thanks to Danny Fox for informing me about this work.) However, the point about "scope paradoxes" is not contingent on the clause-boundedness of QR, for extraction islands (e.g. the antecedent of a conditional) allow us to make the same point. This will be discussed in Chapter 4.

This alternative system, which I will call the **Binding Theory of Intensionality** (BTI) does indeed addresses the paradoxes that arise under STI. For example, in the sentence above, binding the world pronoun of **everybody in this room** by the λ-binder of the higher clause gives it a *de re* construal.

(14) λw_1 Mary thinks(w_1) $[\lambda w_2$ **everybody-in-this-room**(w_1) is-outside$(w_2)]$

While STI appears to undergenerate, BTI, as a more expressive system (Cresswell, 1990), has been shown to overgenerate (Percus, 2000; Keshet, 2008, 2010, 2011; Schwarz, 2012; Percus and Sauerland, 2003; Romoli and Sudo, 2009). Here, I will not go over how BTI works and the assumptions required to address the overgeneration issues that comes with BTI.

Throughout the discussion in Chapter 2 and 3, I simply follow STI, putting aside its undergeneration problems. Hence, I kindly ask the reader to keep in mind that unless explicitly stated, the assumptions on intensionality throughout this dissertation are STI's assumptions, and not BTI's. In Chapter 4, I address the undergeneration issues of STI, presenting a pied-piping theory of exceptional *de re* that is strictly based on the assumptions of STI.

1.2.2   The contribution of the thesis in this domain

This thesis will highlight the fact that von Stechow's criticism of LF-pied-piping in *wh*-questions can be understood as an *overgeneration problem* that relates to how intensionality is represented in grammar. I will show that under the particular theory of pied-piping I will propose, STI is able to block the overgeneration, while BTI still requires further assumptions.

I will argue that pied-piping in fact provides a way to address the core puzzle of STI. I take as my starting point a proposal offered in von Fintel and Heim (2011) that involves *semantic reconstruction* for scope, via higher type traces. This proposal has not been widely adopted, as far as I can see, because it does not by itself eliminate the core paradox of STI given in (13). I will show that when the possibility of semantic reconstruction for scope (von Fintel and Heim, 2011) is combined with the possibility of pied-piping, we have a working account of what I call **exceptional *de re***.

Finally, I will extend the idea of *semantic reconstruction* to another challenging data set for STI, i.e. a DP that is evaluated above an intensional operator can contain a pronoun bound by a quantifier evaluated below that intensional operator.[11]

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[11]Keshet (2011) proposed a theory he calls Split Intensionality which reinterprets STI with fairly

1.3 Roadmap

In Chapter 2, I discuss von Stechow's objection to interpreting pied-piping in *wh*-questions at LF. I (informally) characterize von Stechow's empirical claim as the ban stated in (15), and show that von Stechow's proposal that involves 'undoing the pied-piping at LF' derives this ban under STI's assumptions. I argue that alternative theoretical options for representing intensionality and composing *wh*-questions do not have an additional insight on the problem. Moreover, von Stechow's proposal only derives this ban under the assumptions of a theory of intensionality that undergenerates elsewhere, i.e. STI. Therefore, I argue that the problem von Stechow identified with pied-piping is still a problem.

(15)   <u>von Stechow on DP pied-piping</u>
       A DP containing a *wh*-phrase (or its trace) cannot receive a complete *de re* construal.

In Chapter 3, I propose a theory of pied-piping that I call the ∃-theory, which combines the idea of cyclic scope-taking via pied-piping due to Charlow (2019) and a method of composing proposition sets due to Fox (2012); Heim (2012). I show that under STI's assumptions, this theory of pied-piping is able to derive the right meaning for *wh*-questions that involve pied-piping, without syntactic reconstruction (i.e. without undoing any movement). This is our first step towards deriving (15).

In Chapter 4, I argue that pied-piping as characterized under the ∃-theory provides a QR-based analysis of exceptional scope of indefinites and *wh*-phrases. I show that the proposed theory yields equivalent results to Charlow (2019) but provides additional insight on the question why it is only indefinites and *wh*-phrases that are exceptional scope takers. Furthermore, I show that the proposed theory of pied-piping allows us to address the undergeneration issues of STI, making it possible to give an analysis to exceptional *de re* under STI's assumptions. Finally, I revisit von Stechow's problem and show that (15) is indeed derived.

The remaining three chapters discuss some questions that arise from the proposed theory, and point to some remaining challenges.

In Chapter 5, I discuss in more detail the nature of *semantic reconstruction* that

conservative modifications and promises to address the undergeneration problem of STI. The discussion in Chapter 2-to-4 does not adopt his proposal. In Chapter 5, I show that the way Keshet reinterprets STI gives us a way to deal with another problem for STI (as well as BTI), where a DP that seems to have moved above an intensional operator is interpreted below it. The standard solution for this is undoing the movement. I show that Keshet's version of STI allows for semantic reconstruction, as well.

occurs under the ∃-theory of pied-piping. While undoing movement might be an option available to grammar, at least under the theory of pied-piping that I will spell-out, the reconstruction of the 'pied-pipee' is not due to undoing any movement but happens in semantics thanks to higher type traces. This raises a problem, e.g. when a bound pronoun gets pied-piped above its binder. I propose a syntactisized method of achieving semantic reconstruction for binding (a method inspired by a proposal due to Keshet (2011)). This method also allows us to achieve binding reconstruction for a DP containing a pronoun if it is above its binder at LF to receive a *de re* construal. Finally, I point to the fact that semantic reconstruction still has challenges to overcome (e.g. binding theoretic facts (Romero, 1998; Fox, 1999; Fox and Nissenbaum, 2004; Lechner, 2018, a.o.)) which I unfortunately have to leave to future work.

In Chapter 6, I present a preliminary attempt to address one particularly pressing issue concerning cross-linguistic variation. The proposed theory predicts that if a language is *wh*-fronting, it can pied-pipe islands in *wh*-questions. While this is attested, not every *wh*-fronting language allows overt island pied-piping. Investigating Finnish data more closely, I identify a potential constraint on overt island pied-piping, which seems to be a requirement that movement to the island edge be string-vacuous. I attribute this requirement to the linearization properties of extraction islands (Fox and Pesetsky, 2004) and show that overt island pied-piping is the only way to not incur an island violation in *wh*-fronting languages. Accordingly, it is predicted that only languages that can be shown to provide the base structures that would make string vacuous movement possible will have overt island pied-piping. Finally, I discuss the limitations of this approach to islandhood, pointing to the lack of motivation for covert island pied-piping from a linearization perspective.

Chapter 7 provides preliminary answers to some further questions. These include problems like morphological distinctness of *wh*-phrases and indefinites, nested *wh*-questions (Elliott, 2015; Sudo, 2017, a.o.), *de dicto which*-phrases (Rullmann and Beck, 1998; Sharvit, 2002; Sharvit and Guerzoni, 2003; Heim, 2012, a.o.), functional *which*-phrases (Engdahl, 1986; Heim, 2012), compatibility with more fine-grained theories of *de re* ascription (Percus and Sauerland, 2003; Charlow and Sharvit, 2014, a.o), and intervention effects (Beck, 2006; Cable, 2010; Kotek, 2016; Erlewine and Kotek, 2017).

Chapter 2

Composing *wh*-questions: the problem of pied-piping

Under the Hamblin/Karttunen approach (Hamblin, 1973; Karttunen, 1977) to the semantics of *wh*-questions like in (1), the meaning of a *wh*-question is a set of propositions (i.e. a set of sets of possible worlds). That is, the speaker who utters (1) presents her addressee with a set of alternatives of the form *John left, Mary left*, etc.

(1) $[\![$who left?$]\!]$ = {John left, Mary left, ...}   (*informal representation*)

In the first section of this chapter, I give an overview of two compositional analyses that derive a proposition set as the meaning of a *wh*-question through movement.[1]

The second part of this chapter is about cases where *wh*-words like *who* appear embedded within a DP, as in (2). In *wh*-fronting languages, typically not just the *wh*-word but the DP that contains it is fronted, a phenomenon named *pied-piping* (Ross, 1967; Heck, 2008; Cable, 2010).

(2)   [$_{\text{DP}}$ **Whose** seminar] are you attending this semester?

Simply looking at the syntax of the *wh*-question in (2) which involves visible pied-piping, it might appear that the person asking (2) is asking their addressee to identify the seminar they are attending. However, this question is in fact about *the person* whose seminar the addressee is attending. In his influential paper, von Stechow (1996) showed that this raises a syntax-semantics mapping problem, which I will refer to as **von Stechow's problem**. He argued that this problem could be addressed by

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[1]It is also possible to derive a proposition set *in-situ*, i.e. without movement. See Section 2.3 for a brief discussion of in-situ accounts.

rearranging at LF the output of the syntactic derivation. In particular, he proposed that if there is pied-piping in syntax, the pied-piper (i.e. the wh-phrase) is extracted out of the pied-piped constituent and the remnant reconstructs to its base position at LF. In the instance of overt pied-piping above, this would mean that the ['s seminar] part of the pied-piped phrase reconstructs.

To preview the discussion in the second part of this chapter on how **von Stechow's problem** arises in pied-piping,, let us consider the sentence in (3) that features an embedded *wh*-question with pied-piping. In a context where Sue knows that Chris is attending the seminar on AI Models but has no clue who is teaching that seminar, (3) sounds false. Namely, in this context, it is *not* true that Sue knows which person x is such that Mary is attending the seminar x is teaching. Therefore, an adequate compositional semantics of *wh*-questions needs to capture this judgment by blocking the former meaning for *wh*-questions involving pied-piping. As will be shown, it is not a trivial task to block the logical forms that would make (3) true in the given context.

(3)   Sue knows [**whose** seminar Chris is attending].

In the second part of this chapter, I will give a characterization of **von Stechow's problem** as an overgeneration problem and illustrate how it arises under scopal accounts of *wh*-questions. Finally, I will briefly discuss how von Stechow's problem could arise under alternative compositional analyses of *wh*-questions.

2.1   Compositional analyses of *wh*-questions

Following Hamblin (1973) and much subsequent work, I take the meaning of *wh*-questions to be proposition sets (sometimes called *Hamblin sets*). This is a widely adopted view on what *wh*-questions mean.[2] To illustrate, assuming that the world w we live in has only two cats Ragu and Moku, the *wh*-question in (4a) will have the denotation in (4b), shown in function and set notation, respectively.

(4)   a.   ⟦which cat meowed⟧$^{\text{w}}$
       b. $= \lambda p.\ \exists x$: ⟦cat⟧$^{\text{w}}(x)$ & $p = \lambda w'.$ ⟦meowed⟧$^{\text{w'}}(x)$ (*function notation*)
             $= \{\{w$: Ragu meowed in $w\}, \{w$: Moku meowed in $w\}\}$ (*set notation*)

---

[2]There are two other influential views on how *wh*-questions should be represented: functions/lambda abstracts (Hausser and Zaefferer, 1979; Hausser, 1983; Xiang, 2017) and partitions (Groenendijk and Stokhof, 1982, 1984, 1997), which I set aside in this dissertation.

As is transparent in the function notation above, a non-singleton[3] proposition set can be derived by existentially quantifying into a proposition set. The existential quantification is widely assumed to be contributed by the *wh*-phrase itself (Karttunen, 1977).[4] In what follows, I discuss two compositional analyses which derive the Hamblin-denotation of a *wh*-question under the assumption that *wh*-phrases bring in existential quantification and are scope-taking objects. Following the LF-based approach to the syntax-semantics interface (Heim and Kratzer, 1998; von Fintel and Heim, 2011; von Stechow and Beck, 2015), I assume that scope-taking in achieved via QR. Therefore, the two analyses to be discussed below are both QR-based analyses of *wh*-questions, where the *wh*-phrase is a scope-taker of some sort. The difference between them concerns the way we derive a proposition set, which has consequences for what type of scope-taking objects *wh*-phrases have to be.

2.1.1 Two methods of generating proposition sets

A crucial piece in deriving a proposition set is the interrogative complementizer C_Q which takes a proposition and returns the set that contains it (Karttunen, 1977; von Stechow, 1996). Hence, C_Q forms an identity relation and denotes the propositional variant of the IDENT type-shifter in Partee (1986), as defined in (5).

(5) $[\![C_Q]\!]^w = \lambda p_{<s,t>}.\ \lambda q_{<s,t>}.\ p=q$ *function notation*
        $\lambda p_{<s,t>}.\ \{p\}$ *hybrid function-set notation*

Under STI's assumptions, IFA is crucial in generating a proposition set. For illustration purposes, let us assume that C_Q takes as its sister *Sue left*.

(6) $[\![C_Q\ \text{Sue left}]\!]^w$ by IFA=
        $[\![C_Q]\!]^w(\lambda w'.\ [\![\text{Sue left}]\!]^{w'}) =$
        $\lambda p.\ p = \lambda w'.\ \text{Sue left in } w'$ (*function notation*)
        $\{\lambda w'.\ \text{Sue left in } w'\}$ (*hybrid notation*)

---

[3]That is, we get a non-singleton proposition set if (the extension at the local evaluation world of) the restrictor of the *wh*-phrase is a non-singleton set.

[4]There are also compositional ways to derive a proposition set without assuming that *wh*-phrases bring in existential quantification (Beck, 2006; Caponigro, 2003, a.o).

As shown above, C_Q takes the *intension* of its sister (which is a proposition or a set of worlds) and returns the set that contains this proposition.

There are two methods of deriving a proposition set using C_Q. The first one, given in (7), is simply applying C_Q on a type t, as we did above. Given that C_Q requires the intension of its sister, this gives us a proposition set, i.e. a type $< st, t >$ object. This method is employed in Heim (2000) (also Charlow (2019), as we will discuss in Chapter 3.).

(7) $\lambda p.\ p = \lambda w'.\ [\![\text{Sue left}]\!]^{w'}$

        C_Q $\leftarrow$ IFA

               Sue   left

The second method, illustrated in (8), involves feeding a variable of type $< s, t >$ to C_Q that is abstracted over at the root node. Crucially, this method creates a node of type t, i.e. the sister of $\lambda \mathbf{p}$ in the logical form below. This method appears in Heim (2012); Fox (2012); Dayal (2016).[5]

(8) $\lambda p.\ p = \lambda w'.\ [\![\text{Sue left}]\!]^{w'}$

    $\lambda \mathbf{p}$ $\mathbf{p} = \lambda w'.\ [\![\text{Sue left}]\!]^{w'}$

            $\lambda q_{< s,t >}.\ \mathbf{p} = q$ $\leftarrow$ IFA

               C_Q $\mathbf{p}_{< s,t >}$ Sue   left

Consider the *wh*-question below. What generates a Hamblin set is the existential quantification into a proposition set.

(9) $[\![\text{who left}]\!]^w =$
        $\lambda p.\ \boxed{\exists x\colon [\![\text{human}]\!]^w(x)}\ \&\ p = \lambda w'.\ [\![\text{left}]\!]^{w'}(x)$

It is noticeable that the second method of deriving a proposition set illustrated in (8) gives us a straightforward way to incorporate the semantic contribution of *wh*-phrases, if we assume that a *wh*-phrase like *who* is an existential quantifier, as defined in (10a). This is thanks to the created scope position of type t.

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[5]Fox (2012) attributes this method to earlier class notes of Irene Heim.

(10)　　a.　$[\![\text{who}]\!]^{\text{w}} = [\![\text{someone}]\!]^{\text{w}} = \lambda P.\ \exists x\colon [\![\text{human}]\!]^{\text{w}}(x)\!=\!1\ \&\ P(x)\!=\!1$

In the former method given in (7), this requires a higher type for *wh*-phrases.[6] In what follows, I illustrate compositions based on both of these methods.

2.1.2　Fox (2012); Dayal (2016)

A commonly adopted compositional analysis of *wh*-questions is illustrated in (12) for the *wh*-question in (11). Dayal (2016) presents this analysis as the baseline compositional analysis of *wh*-questions. In this composition, the *wh*-phrase is an existential quantifier of type $< et, t >$ (Karttunen, 1977), which QRs above the interrogative complementizer C_Q and takes scope above it. Notice that in this composition, *wh*-movement targets a type t node. Hence, with the λ-abstraction that the movement yields (Heim and Kratzer, 1998)[7], the sister of the *wh*-phrase ends up denoting a predicate of type $< e, t >$, which the *wh*-phrase can compose with.

(11)　　a.　Who did Sue hug?[8]

　　　　b.　$[\![\text{who Sue hugged}]\!]^{\text{w}} = \lambda p.\ \exists x\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ p\!=\!\lambda w'.\ [\![\text{hugged}]\!]^{\text{w'}}(x)(\text{Sue})$

(12)

$< st, t >$

$\lambda\mathbf{p}\ \ \exists x\colon [\![\text{human}]\!]^{\text{w}}(x)\!=\!1\ \&\ \mathbf{p} = \lambda w'.\ [\![\text{hugged}]\!]^{\text{w'}}(x)(\text{Sue})$

who　$\lambda x.\ \mathbf{p} = \lambda w'.\ [\![\text{hugged}]\!]^{\text{w'}}(x)(\text{Sue})$

λ_1　　　　　t

$\leftarrow$ IFA

C_Q　$\mathbf{p}$　Sue

hugged　t_1
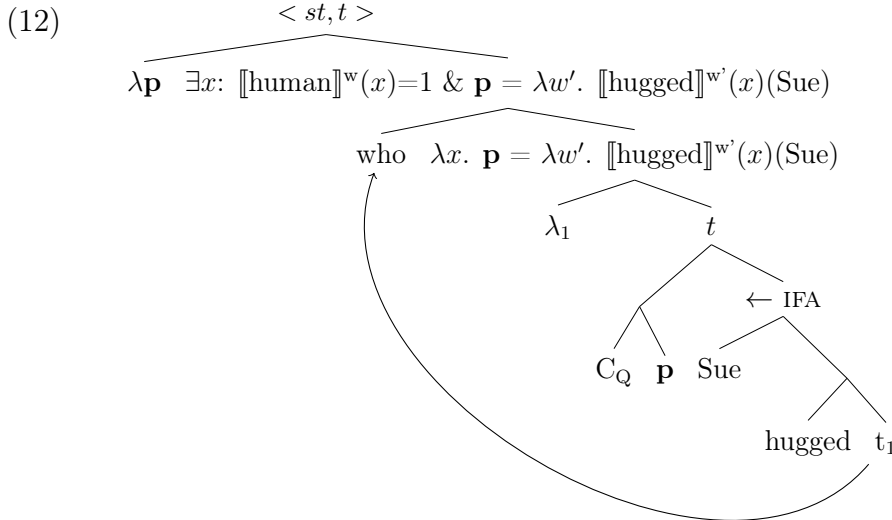
In this system, the interrogative complementizer C_Q forms an identity relation between two propositions, namely the proposition that the question is based on (called *the question nucleus*) and a propositional variable, which is stipulated to be abstracted

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[6]A special composition rule (Karttunen, 1977; Heim, 2010) would yield the same result.

[7]In Heim and Kratzer (1998), λ-abstraction is a syncategorematic rule that makes crucial use of the assignment function g. To simply representations, I suppress the assignment function unless it becomes relevant to the discussion.

[8]As it is irrelevant to the discussion, I never represent the auxiliary fronting in logical forms.

over at the root node.[9] I will make use of this composition of *wh*-questions in the following chapters.

2.1.3 Heim (2000)

As an LF-adaptation of Karttunen (1977), Heim (2000) proposes a compositional analysis where *wh*-words are *not* existential quantifiers of type $< et, t >$ but are existential quantifiers of a higher type, which Heim calls "interrogative generalized quantifiers". An interrogative generalized quantifier, as Heim names it, composes with *a function into sets* and returns a set. As can be seen in its denotation in (13), the *wh*-phrase *who* combines with a function from individuals to proposition sets, and returns a proposition set. Hence, it is of type $<< e, < st, t >>, < st, t >>$.

(13) $[\![\text{who}_{\text{heim}}]\!]^{\text{w}} = \lambda Q_{< e, < st, t >>}.\ \lambda p_{< s, t >}.\ \exists x\colon [\![\text{human}]\!]^{\text{w}}(x){=}1\ \&\ Q(x)(p){=}1$

This high type for *wh*-phrases is a consequence of applying C_{Q} directly to the question nucleus, which does not create a scope site of type t. The logical form in (14b) illustrates Heim's derivation of *wh*-questions.

(14)   a. $[\![\text{who Sue hugged}]\!]^{\text{w}} =$

       b. $\lambda p.\ \exists x\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ p{=}\lambda w'.\ [\![\text{hugged}]\!]^{\text{w'}}(x)(\text{Sue})$

 $<< e, < st, t >>, < st, t >>$ $< e, < st, t >>$

 who λ_1 $\lambda p.\ p = \lambda w'.\ [\![\text{hugged}]\!]^{\text{w'}}(g(1))(\text{Sue})$

 C_{Q} $\leftarrow$ IFA

 Sue

 hugged t_1

---
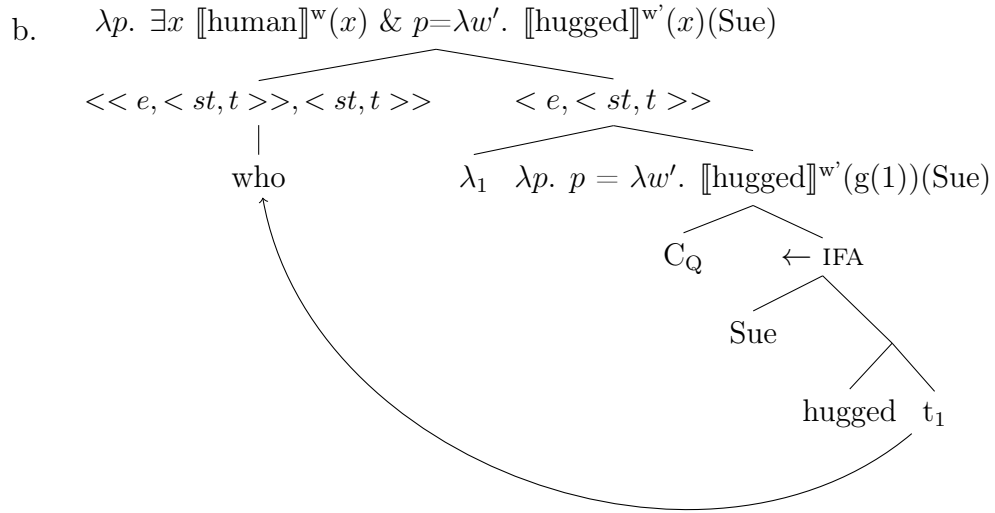
[9]Fox (2012) suggests that abstraction over the propositional variable can be implemented compositionally if we assume that a (possibly semantically vacuous) operator is generated as the sister of C_{Q} and moves up to the root node. We will come back to this point in the next chapter.

2.2 Characterizing von Stechow's problem

In an influential paper, von Stechow (1996) showed that the correct characterization of the meaning of *wh*-questions that involve pied-piping argues against *the existence of pied-piping at LF*. To put it simply, he argued that the logical forms for *wh*-questions that involve pied-piping, e.g. (15), need to be like (15a), rather than (15b). In other words, he characterized the problem as 'the movement of what shouldn't have moved in the first place'. From this perspective, the puzzle may be restated as why English (and many other languages) doesn't pronounce (15) as "**Who** did Sue feed **'s cat**?".

(15)   Whose cat did Sue feed?

      a.   [which human x] [Sue fed x's cat]

      b.   [which human's cat x] [Sue fed x]

This characterization might make it sound like it is a problem specific to the assumption that wh-phrases are scope taking objects and have to move into a scope position in the left periphery of the clause that they take scope in. However, it is in fact a general problem that can surface under completely different assumptions about how questions are composed (e.g. under in-situ compositional analyses that use Pointwise Function Application.[10]).[11] Therefore, we need to characterize this problem as a general problem that does not exclusively arise from 'moving too much'.

Let us see what the issue is with an example. Imagine that the world we live in, w, is as in (16a). In this world, asking the question in (16b) and asking the question in (16c) might *appear* to be equivalent. This is because, the set {Rory's cat in w, Mary's cat in w} and the set {Ragu, Moku} are identical.

(16)   a.   *w: There are only two cats, Rory's cat Ragu and Mary's cat Moku.*

      b.   Whose cat did Sue feed?

      c.   Which cat did Sue feed?

This naive intuition of equivalence disappears when we consider these two questions in an embedded context. Notice that in the utterance world described in (17a), (17b) is judged false whereas (17c) is judged true. This suggests that our semantics never delivers the same proposition set for the questions in (16b) and (16c). Otherwise, (17b) and (17c) would both be true in w.

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[10]This is briefly discussed in section 2.3.

[11]I thank Danny Fox for helping me realize this point, which he attributes to Sudo (2017).

(17) a.   *w: There are only two cats, Rory's cat Ragu and Mary's cat Moku. Sue*
            fed Ragu, Billy knows this. But he thinks Ragu is Mary's cat.
      b.   ⟦Billy knows whose cat Sue fed⟧^{w} = 0
      c.   ⟦Billy knows which cat Sue fed⟧^{w} = 1

To put it simply, von Stechow's claim is that (16b) can **never** be a question that asks its addressee to identify a cat. This might seem like a trivial empirical point but this interpretation is not easily ruled out as a possible meaning for (16b) under common assumptions regarding how *wh*-questions are composed and how intensionality is handled. To be more specific, the two questions need to be represented as follows, which clearly characterize different sets.

(18) a.   ⟦Whose cat did Sue feed⟧^{w} =
      b. $\lambda p. \exists x$ [$x \in$ {Rory, Mary} & $p = \lambda w'$. Sue fed in w' x's cat in w']

(19) a.   ⟦Which cat did Sue feed⟧^{w} =
      b. $\lambda p. \exists x$ [$x \in$ {Ragu, Moku} & $p = \lambda w'$. Sue fed x in w']

In other words, von Stechow's claim is that a logical form for (20) never delivers (21) as its meaning. The proposition set in (21) and the proposition set in (19b) are the same set, because the set {Rory's cat in w, Mary's cat in w} and the set {Ragu, Moku} are identical.

(20) ⟦Whose cat did Sue feed⟧^{w} $\neq$

(21) $\lambda p. \exists x$ [$x \in$ {Rory's cat in w, Mary's cat in w} & $p = \lambda w'$. Sue fed x in w']

As we will discuss in more detail in section 2.2.2, what von Stechow claims to be an unattested meaning for *wh*-questions with pied-piping derives from logical forms where the pied-piped phrase of the form [$_{DP}$ ... [*wh*-phrase] ...] gets a completely *de re* construal. For example, in (21), the existential quantification is over individuals that are human-owned cats in the actual world. This is the result of evaluating the entire pied-piped phrase (including the *wh*-phrase) relative to the utterance world (cf. (18b) where this is *not* the case.). Hence, I informally[12] characterize von Stechow's objection to interpreting pied-piping at LF as a general ban on assigning a *de re* construal to **the entire pied-piped phrase** in *wh*-questions.

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[12]This is an informal characterization in that *de re* is a relative term.

(22)   <u>von Stechow on DP pied-piping</u>
A DP containing a *wh*-phrase (or its trace) cannot receive a complete *de re* construal.

Naturally, this is an empirical claim on what *wh*-questions can mean.[13] To my knowledge, this claim has not been challenged but has not been rigorously tested, either.[14] One potential worry is that the general difficulty in accessing *de re* readings might be a confound (Roger Schwarzschild, p.c.). In the following subsection, I discuss further examples, attempting to eliminate potential confounds. My conclusion will be that (22) seems to be a valid claim, but there is room for further rigorous testing.

2.2.1   Is complete *de re* for pied-piped DPs possible?

As Heim (2010) points out, the intuitions regarding the meaning of *wh*-questions with pied-piping are sharp with examples like (23a), where the inquirer is pointing to a cat and asking their addressee to identify its human/owner. This is not compatible with a complete *de re* construal for *whose cat*. If the complete *de re* reading were accessible, we could in principle understand (23a) as in (23b). Of course, one could argue that the context in which this *wh*-question is uttered would not let us access the complete *de re* reading for *whose cat* even if this reading were in principle available.

(23)   a.   **Whose cat** is this? $\neq$
       b.   **Which cat owned by a human** is this?

Indeed, when there is no obvious pragmatic pressure, the intuitions become weaker. Consider the Turkish *wh*-questions below in the given context. Native speakers I have consulted report that Deniz could respond to both *wh*-questions by pointing to the baklava that he liked. In addition, (24a) accepts a response where Deniz points to Emre or Zeynep. I hypothesize that the possibility of pointing to a baklava in (24a) (rather than pointing to Emre or Zeynep) is allowed because the inquirer can retrieve the answer to the *wh*-question in that the (one-to-one) mapping from a baklava to the person who made it is contextually salient.

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[13]A more formal attempt to characterize von Stechow's claim: *Let Q_1, Q_2 be wh-questions that respectively embed DP_1, DP_2 both containing (the trace of) a wh-phrase such that $\lambda w'.[\![DP_1]\!]^{w'} \neq \lambda w'.[\![DP_2]\!]^{w'}$. Then, for any w, $[\![Q_1]\!]^w$ and $[\![Q_2]\!]^w$ denote distinct sets of propositions whether or not DP_1 and DP_2 have the same extension at w.*

[14]Like von Stechow, I mainly focus on complex DPs (that contain a relative clause) that are independently known to be extraction islands. I set aside the question whether DPs out of which overt *wh*-extraction is possible, are subject to this ban. See also Charlow (2010) and references therein for the debate on whether DPs are scope islands.

(24) *Deniz visits a baklava-tasting event and tries two pieces of baklava: one made by Zeynep, one made by Emre. Zeynep and Emre ask Deniz:*

    a.   [Hangi-miz-in   yap-tığı   baklava-yı]   beğen-di-n?
          which-1PL.POS-GEN make-REL-3SG.POS baklava-ACC like-PST-2SG
          Lit: 'You liked the baklava that which of us made?'

    b.   [Hangi baklava-yı]   beğen-di-n?
          which   baklava-ACC like-PST-2SG
          'Which baklava did you like?'

When *wh*-questions are embedded, however, the intuitions regarding what they mean seem to be more clear (see also Heim (2010)). I have argued that (25a) is false in the given context. This means that Billy's relevant true belief [i.e. that Sue fed Ragu] is not sufficient to make (25a) true (cf. (25b)). For him to know whose cat Sue fed, he has to have a true belief about who owns the cat that Sue fed, which he doesn't in the context.

(25) *There are only two cats, Rory's cat Ragu and Mary's cat Moku. Sue fed Ragu, Billy knows this. But he thinks Ragu is Mary's cat.*

    a.   Billy knows **whose cat** Sue fed.
    b.   Billy knows **which cat** Sue fed.

One potential worry is that the *false belief scenario* makes it impossible to access a *de re* construal. While the false belief scenario admittedly makes accessing *de re* construals harder, it does not entirely block them. To illustrate, in the same context, the sentence in (26) has a (less prominent) true reading where **Rory's cat** is interpreted *de re*. Given that Billy knows that Sue fed **Ragu**, he does know that Sue fed **Rory's cat** because **Rory's cat** *is* Ragu. Then, it seems that Billy's relevant true belief [i.e. him knowing that Sue fed Ragu] is sufficient to make (26) true under a *de re* construal. But this does not seem to be the case in (25a).

(26)   Billy knows that Sue fed **Rory's cat**$_{=\text{RAGU}}$.

Let us still grant that a false belief scenario is not the ideal experimental setup. The following example tries to eliminate this potential confound. Consider the Turkish sentence that embeds an island-violating *wh*-question in (27a). This sentence is fully grammatical yet is felt to be false in the given context. In the control sentence in (27b), however, the DP that translates as *the letter that came to Masha* can have a

de re construal (assuming that it is Masha's letter that is 10 pages long). Therefore, (27b) has a true reading.

(27)   *John has two Russian roommates, Tanya and Masha. He finds two letters, sent to them. Since he doesn't speak a word of Russian, he can't figure out which letter belongs to which of his roommates but notices that the one that came in a purple envelope is 1 page long while the other one is 10 pages long.*

     a.   John [$_{\text{island}}$ **hangi ev**   **arkadaş-ın-a**   gel-en   mektub-un]
          John   which house friend-POS.3SG-DAT come-REL letter-GEN
          10 sayfa ol-duğ-un-u   bil-iyor.
          10 page be-NOMLZ-POS.3SG-ACC know.IMPF
          Lit: 'John knows the letter that came to which of his roommates is 10 pages long.'

     b.   John [**Masha-ya gel-en**   **mektub-un**] 10 sayfa
          John Masha-DAT come-REL letter-GEN   10 page
          ol-duğ-un-u   bil-iyor.
          be-NOMLZ-POS.3SG-ACC know.IMPF
          'John knows the letter that came to Masha is 10 pages long.'

This judgment is explained if the embedded *wh*-question in (27a) does not receive the interpretation in (28a), but is interpreted as in (28b). For John to know the answer to the question in (28b), he needs to know which of his roommates is such that the letter that came to her is 10 pages long. On the other hand, for John to know the answer to the question in (28a), it is sufficient for him to know which of the two letters is 10 pages long. After all, John knows which of the two entities in the set {the letter that came to Masha in w, the letter that came to Tanya in w} is a letter that is 10 pages long (even though he cannot describe those entities as 'the letter that came to Masha', 'the letter that came to Tanya'.).

(28)   a. $\lambda p.\ \exists x\ [x \in$ {the letter that came to Masha in w, the letter that came to Tanya in w} $\land\ p = \lambda w'.\ x$ is 10 pg in w']

       b. $\lambda p.\ \exists x\ [x \in$ {Masha, Tanya} $\land\ p = \lambda w'.$ [the letter that came to x in w'] is 10 pg in w']

However, admittedly, the worry regarding interference from the difficulty of *de re* readings is real. In the same context, it is still fairly difficult to access a *de re* construal for the DP in the control sentence (27b). This is presumably because it is not clear in the context who utters the sentences that we are trying to judge. For us to be able to access a *de re* construal for a DP, we need to know how the speaker would describe the relevant entity that the DP denotes. Usually, truth value judgment tasks require judging the test sentences as if they were uttered by what appears to be an all-knowing speaker. Yet, the presumed speaker's connection to the context is not made clear. In the following example, I attempt to address this confound.

In the context given in (29), it feels very natural for Mary to utter (29a), which contains the definite description *the souvenir that I brought from Norway*. It is clear that the 1-year-old would not describe the relevant entity as *the souvenir that mom brought from Norway*. Then, a *de re* construal for the definite description is the only way for (29a) to be felicitous. Similarly, (29b) that embeds a *wh*-question is felt to be felicitous in the context. Again the restriction of the *wh*-phrase *souvenirs I brought from my trips* is certainly not a possible description that the 1-year old can have in her mind. Hence, (29b) can only be a felicitous utterance in the context under a *de re* construal for the *wh*-phrase.

(29)   Mary speaking: *Last year, I visited Brazil and Norway and brought a souvenir from both countries. My 1-year-old always wants to play with them. I let her play with the one from Brazil. But I paid a fortune for the one from Norway. So whenever she was around that one, I freaked out and started yelling! She finally stopped trying to play with that one. So I think, now,*

   a.   My 1-year-old knows that it is not ok to play with **the souvenir that I brought from Norway.**
   b.   My 1-year-old knows **which of the souvenirs I brought from my trips** it is not ok to play with.

Speakers I have consulted find the Turkish sentence in (30) below odd, in the same context. Notice that in (30), the *wh*-phrase is embedded within an island DP. If the entire DP (including the *wh*-phrase) could be *de re*, the embedded questions in (30) and (29b) would have the same representation, predicting that speakers could access a true reading in both sentences. This does not seem to be possible, which I take to suggest that von Stechow's empirical claim is on the right track.

(30) #1 yaşındaki kız-ım   [DP **hangi ülke-den**   **getir-diğ-im**
      1 year.old daughter-POS.1SG   which country-ABL bring-REL-POS.1SG

      hediyelik eşya-yla] oyna-n-ma-yacağ-ın-ı   bil-iyor.
      souvenir-with   play-PASS-NEG-FUT-POS.3SG-ACC know-IMPF

      Lit: 'My 1-year-old daughter knows the souvenir I brought from which coun-
      try is not to be played with.'

While I will assume that von Stechow's empirical claim is right, I strongly be-
lieve that further rigorous testing is required. Truth value judgment tasks for *de re*
usually make it difficult to see if the obtained judgment reflects how *de re* occurs in
actual language use. Felicity judgment tasks for *de re*, on the other hand, pose other
challenges. One such challenge is discussed below.

It appears that a sentence of the form "x told me Q[15]" can be judged felicitous
even when "x knows Q" seems to be false. In the context below, the sound technician
guy does not know which woman is such that her daughter is the winner. But it feels
natural for Bill to utter (31a), just like (31b). If von Stechow's empirical claim is
right, this judgment is unexpected.

(31)   *Three friends, Susan, Mary, and Bill, are waiting outside a building where
        Susan's daughter and Mary's daughter are performing in front of a jury to
        win a song contest. This is the final round. So one of the two will be the
        winner. Bill has a sound technician friend who is in the room with the jury
        and he receives a text from him. The text says "Hey, I remember you said
        some kids you know are in this song contest. The jury has just selected
        <u>some kid named Ashley Jones</u>. I have no idea who she is but she got some
        talent! You know her?". Bill turns to Susan and Mary and says "Do you
        want to wait for them to come out? or would you want me to share the news
        with you? My sound technician friend has just texted me,...*

        a.   Hangi-niz-in   kız-ın-ın   kazan-dığ-ın-ı
             which-POS.2PL-GEN daughter-POS.2SG-GEN win-NOMLZ-POS.3SG-ACC
             söyle-di bana.
             tell-PST me
             Lit: 'He told me [the daughter of **which of you**] won.'

        b.   Kim-in   kazan-dığ-ın-ı   söyle-di bana.
             who-GEN win-NOMLZ-POS.3SG-ACC tell-PST me
             'He told me who won.'

---

[15]I use Q to refer to an embedded *wh*-question here.

One possible explanation for this judgment is that when we utter "x told me Q", we are not necessarily committed to 'x knows Q' being true, especially if this is irrelevant. Notice that in this context, Bill's utterance is contextually equivalent to 'I have found out the answer to Q', which may allow his addressee to accommodate the fact that 'x knows Q' might actually be false. Needless to say, I offer this merely as a speculation and believe that much more work is needed to determine if von Stechow's claim is the right characterization of the facts. Throughout the discussion that will follow, I assume that the ban on complete *de re* is a valid generalization.

In what follows, I discuss how von Stechow proposed to block complete *de re* readings for pied-piped DPs. His account assumes STI and a scopal account of *wh*-questions. Surely, this problem bears on how *intensionality* is handled as much as how *wh*-questions are composed. In section 2.3, I show that different assumptions on intensionality and compositional derivation of *wh*-questions still require further stipulations to satisfy the ban on complete *de re* readings for pied-piped DPs.

2.2.2 How does the problem arise in scopal accounts?

Having characterized von Stechow's objection to pied-piping as a ban on complete *de re* readings for pied-piped phrases, we are now ready to see why 'LF-pied-piping' as von Stechow calls it fails to satisfy it. The presentation here assumes STI's assumptions on intensionality and a scopal account of *wh*-questions. In particular, I will illustrate the problem roughly within the logical forms von Stechow (1996) assumed (in particular Fox (2012); Dayal (2016)). However, the same problem naturally extends to Heim's logical forms for *wh*-questions.

The discussion that follows benefits from Heim's (2010) discussion of von Stechow (1996).[16] Consider the (still uninterpretable) LF in (32b) for the question in (32a).

---

[16]I assume a naive semantics for the possessive 's: $[\![\text{'s}]\!]^w = \lambda f.\ \lambda x.\ \iota y$: $f(y)$ & $[\![\text{own}]\!]^w(y)(x)$. For more refined analyses of possessives, see e.g. Peters and Westerståhl (2003); Coppock and Beaver (2015). But recall that we have dicussed the same point with examples that do not involve possessives.

(32) a. Whose cat did Sue feed?
      b.

???
  λp   ???
        ???
          whose cat   λx
                   C_Q p Sue
                        fed x
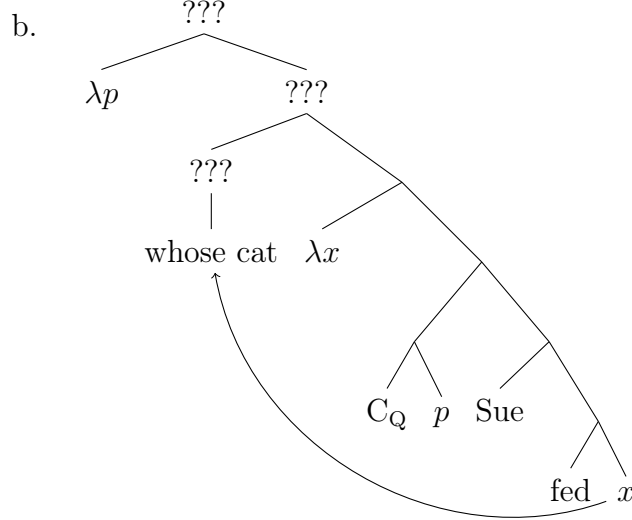
When *whose cat* overtly moves above the C_Q head, it cannot be interpreted as it is, assuming that *who* is a generalized quantifier of type $< et, t >$ but is in a position of type e within the possessive DP. To generate an interpretable LF, we can assume that *who* makes a secondary string-vacuous movement, as shown in the interpretable LF in (33).

(33)

λp
    who
      λ_2
        t_2 's cat λ_1
              C_Q p Sue
                   fed t_1
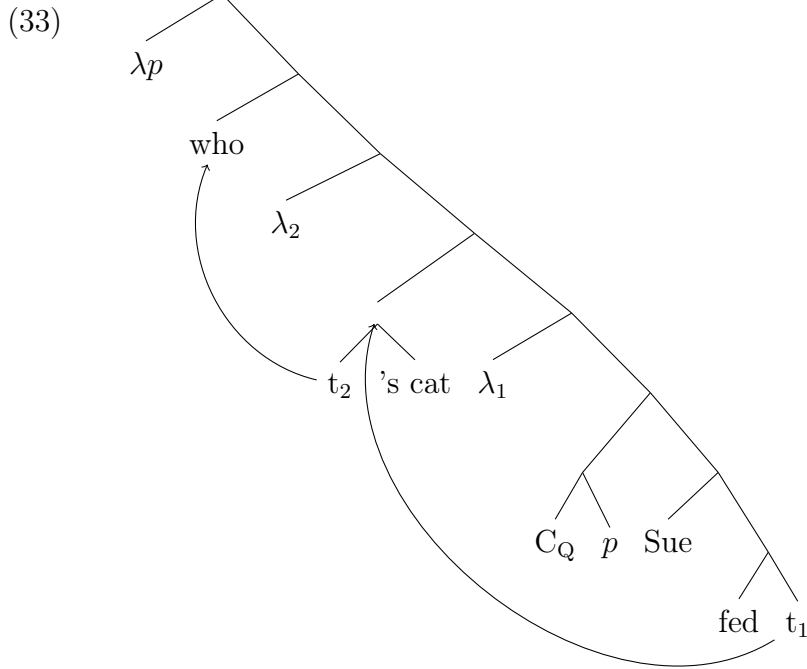
Crucially, the only interpretation this LF has in the evaluation world w is the one in (34). von Stechow (1996) argued that this is exactly the meaning that we want to

block for a sentence like (32a).

(34) $[\![(33)]\!]^{\mathrm{w}} =$
$\lambda p.\ \exists x\ [\![\text{human}]\!]^{\mathrm{w}}(x)\ \&\ p = \lambda w'.\ [\![\text{fed}]\!]^{\mathrm{w'}}(\iota y.[\![\text{cat}]\!]^{\mathrm{w}}(y)\ \&\ [\![\text{own}]\!]^{\mathrm{w}}(y)(x))(\text{Sue})$

Here is why the derived meaning in (34) is wrong for the given question. Let us unpack which set (34) picks out. The object of *feed* is $[\iota y\!:\ [\![\text{cat}]\!]^{\mathrm{w}}(y)\ \&\ [\![\text{own}]\!]^{\mathrm{w}}(y)(x)]$ - the unique cat of x in w, where x is some human in w. If, for example, the utterance world w is (35a), then (35b) picks out the set given in (35c). This is a <u>complete *de re*</u> interpretation for the pied-piped phrase, where the entire DP including the *wh*-phrase is evaluated with respect to the world of utterance.

(35)   a.   *w: There are only two cats, Rory's cat Ragu and Mary's cat Moku.*
       b. $\lambda p.\ \exists x\ [\![\text{human}]\!]^{\mathrm{w}}(x)\ \&\ p = \lambda w'.\ [\![\text{fed}]\!]^{\mathrm{w'}}(\iota y.[\![\text{cat}]\!]^{\mathrm{w}}(y)\ \&\ [\![\text{own}]\!]^{\mathrm{w}}(y)(x))(\text{Sue})$
            $=$
       c.   {{w': Sue fed [**Mary's cat in w**] in w'}
            {w': Sue fed [**Rory's cat in w**] in w'}}
            $=$ {{w': Sue fed **Moku** in w'} {w': Sue fed **Ragu** in w'}}

As we have discussed, von Stechow argues that this is the wrong meaning for the question *whose cat did Sue feed?*. The right meaning for *wh*-questions with pied-piping is derived if nothing but the *wh*-phrase scopes above the interrogative C_Q head. Namely, what is pied-piped along with a *wh*-phrase (i.e. pied-pipee) must in fact be interpreted below the C_Q so that it is evaluated within the intensional complement of the C_Q head, as in (36). In w, (36) picks out the set of propositions in (37a), which is <u>distinct</u> from the set in (35c).

(36) $[\![\text{Whose cat did Sue feed}]\!]^{\mathrm{w}} =$
$\lambda p.\ \exists x\ [\![\text{human}]\!]^{\mathrm{w}}(x)\ \&\ p = \lambda w'.\ [\![\text{fed}]\!]^{\mathrm{w'}}\boxed{(\iota y.[\![\text{cat}]\!]^{\mathrm{w'}}(y)\ \&\ [\![\text{own}]\!]^{\mathrm{w'}}(y)(x))}(\text{Sue})$

(37)   a.   {{w': Sue fed [**Mary's cat in w'**] in w'},
            {w': Sue fed [**Rory's cat in w'**] in w'}} $\neq$
       b.   {{w': Sue fed **Moku** in w'} {w': Sue fed **Ragu** in w'}}

Laying out this problem with pied-piping, von Stechow (1996) goes on to argue that if there is pied-piping in syntax, it must be followed by the subextraction of the *wh*-word out of the pied-piped phrase and the reconstruction of the remnant at LF. This is illustrated in (38).

(38)   a.   ⟦Whose cat did Sue feed⟧^{w} =

   b. $\lambda p. \exists x$ ⟦human⟧$^w(x)$ & $p = \lambda w'$. Sue fed in w' x's cat in w'

```
            λp
           /  \
         who    \
            λ₁  p = λw'. Sue fed in w' t₁'s cat in w'
                 /        \
             C_Q  p  Sue    \
                          fed  t₁'s cat
```
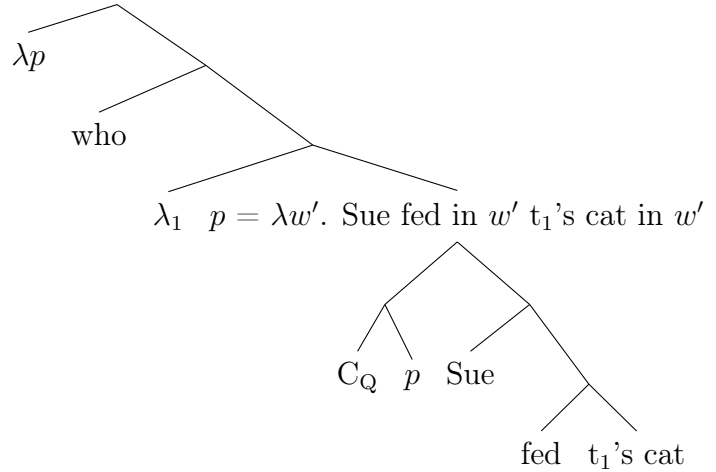
In this logical form, [t_1's cat] is under the interrogative complementizer. Accordingly, it is evaluated within the intensional context introduced by the interrogative complementizer, not relative to the utterance world. Hence, obligatory reconstruction at LF automatically satisfies the ban in (39). This is crucially so **under STI's assumptions**, where a DP within the intensional context created by some intensional OP cannot be *de re* unless it moves above OP.

(39)   <u>von Stechow on DP pied-piping</u>
       A DP containing a *wh*-phrase (or its trace) cannot receive a complete *de re* construal.

However, it is crucial to notice that von Stechow's proposal cannot be considered as a complete solution on the pied-piping problem, simply because STI - as it is - undergenerates elsewhere, as we have discussed briefly in the previous chapter.

In the next subsection, I briefly discuss three reasons why an alternative account that achieves the same result needs to be developed.

2.2.3 Questions on von Stechow's proposal

I have tried to show that von Stechow's criticism of pied-piping is legitimate and show that his solution does indeed address the problem he identified with pied-piping in *wh*-questions. However, there are some important questions on von Stechow's particular proposal.

The first issue is that if von Stechow's empirical claim is right, reconstruction of the pied-pipee at LF needs to be **obligatory**. In other words, LF *has to* rearrange the output of the syntax in the way it is assumed to do. One way to make sure that reconstruction of the pied-pipee takes place is a stipulation on what can be a specifier of the interrogative complementizer. If we assume that only a *wh*-phrase can be in this position, we have a way to force the reconstruction of the pied-pipee. However, this does not really address the motivation problem. Given von Stechow's assumption that reconstruction takes place at LF, we could ask the question "Why should the interpretive component of the grammar care what is in what position?" As long as there is no type-mismatch and the logical form is interpretable, there is no obvious reason why reconstruction should **have to** happen.

While the motivation problem for the obligatoriness of reconstruction has not attracted much attention in the literature, another aspect of von Stechow's proposal has faced criticism, because it assumes (in fact has to assume) that *wh*-movement out of extraction islands is licit at LF (Shimoyama, 2006; Cable, 2010, e.g.). This criticism seems especially relevant in the presence of data from languages like Finnish that exhibit **overt island pied-piping** in *wh*-questions but disallow *wh*-extraction out of same kind of islands. This is illustrated by the data in (40). Notably, for von Stechow (40b) is exactly what the logical form of the given *wh*-question should look like. Hence, a valid question for von Stechow's proposal is why it is only LF that has the privilege to allow *wh*-extraction out of islands.

(40)   **Overt island pied-piping in Finnish**

   a.   [$_{island}$ **kenelle** kirjoitetun   kirjeen]$_1$ Pekka luki **t**$_1$?
              who.ALL written.PTCP letter.ACC Pekka read
         'Who$_1$ is such that Pekka read the letter written to them$_1$?'
         Huhmarniemi (2010:18)

   b.   ***kenelle**$_1$ Pekka luki [$_{island}$ **t**$_1$ kirjoitetun   kirjeen]?
         who.ALL Pekka read   written.PTCP letter.ACC
         Huhmarniemi (2012:329c)

But an even more legitimate question that should be asked in this respect is why it is only *wh*-phrases (or more generally existential quantifiers) that hold this privilege at LF. Proposals that criticize von Stechow's proposal and offer alternative analyses of exceptional scope seem to have only focused on the problem of island-violating QR at LF. As I will discuss in the next section, von Stechow's desideratum, i.e. deriving the right meaning of *wh*-questions, has not actually been addressed in alternative proposals on pied-piping/island-insensitivity.

Finally, as I have mentioned above, von Stechow's proposal cannot be considered a complete proposal because STI undergenerates *de re* readings elsewhere. As a matter of fact, it is possible to illustrate this even in *wh*-questions. Assume for the sake of argument that the reconstruction of the pied-pipee in *wh*-questions is obligatory because the condition stated in (41) holds.

(41)   In a *wh*-question, every constituent but the *wh*-phrase has to be interpreted relative to the intensional context created by the interrogative complementizer.

This condition (whatever it might be) would, of course, make reconstruction of the pied-pipee obligatory. Yet, there is evidence that it is not exactly right when we consider embedded *wh*-questions. For example, in (42), what the speaker refers to as *my daughter's birthday present* can be what was inside the package that got stolen. For Mary to know who stole it, she does not need to know what was in it. In a scenario like this, where Mary does not know what was inside the box but knows who stole it, the speaker can felicitously utter (42). Hence, **my daughter's birthday present** receives a *de re* construal.

(42)   Mary, my neighbor next door, (told me that she) knows [who stole [$_{DP}$ **my daughter's birthday present**]]

This also reinforces the idea that the pied-piping problem in *wh*-questions is actually a problem about pied-piping (or DPs containing a *wh*-phrase, as I formulated it in more neutral terms). However, in von Stechow's particular solution to this problem, the idea appears to be something like (41), which does not make reference to pied-piping at all.

2.3 Are there any working alternatives?

We have illustrated the pied-piping problem under the assumption that the composition of a *wh*-question involves scope taking via movement. Moreover, we adopted Scope Theory of Intensionality (von Fintel and Heim, 2011) to represent intensionality in grammar. A question that naturally arises is whether von Stechow's problem disappears under different assumptions about intensionality and the composition of *wh*-questions.

In what follows, I first recast von Stechow's proposal under BTI's (Binding Theory of Intensionality (Percus, 2000)) assumptions and show that obligatory reconstruction of the pied-pipee does not automatically derive the ban on complete *de re* readings for pied-piping.

Then, I briefly comment on what in-situ approaches to the composition of *wh*-questions have to offer. My conclusion will be that no alternative theoretical option offers any additional insight into the problem and von Stechow's problem remains as a problem.

2.3.1 von Stechow (1996) meets BTI

In this section, I recast von Stechow's proposal under the Binding Theory of Intensionality (Percus, 2000). Under BTI, the interpretation function is not relativized to possible worlds. Instead, **world(-denoting) pronouns** are inserted in certain positions in syntax and logical forms have λ-binders that bind these pronouns.[17] To illustrate, a sentence like *Sue left* will have the logical form in (43). The world pronoun w_1 is sister to *left* which denotes a function whose domain is worlds.[18]

(43) λw_1 Sue left w_1

This logical form delivers a function whose domain is worlds (namely, a proposition). If *Sue left* is uttered in w, we understand the content of this assertion to be the result of applying the function in (43) to w. Given that there are λ-binders for world pronouns, a node that immediately dominates a λw-binder will denote a function whose domain is worlds. Hence, there is no need for IFA in this system. Whenever a node needs to combine with the intension of its sister, a λw-binder can be inserted.

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[17] Situation pronouns in Percus (2000). I gloss over the distinction here. Also, there is an ongoing debate on where world/situation pronouns can be inserted in syntax. Schwarz (2012) argues that world pronouns cannot complement predicates, rather have to complement strong determiners. Hence, under Schwarz's alternative, the intensional flexibility of DPs is mediated by determiners.

[18] $[\![\text{left}]\!] = \lambda w.\, \lambda x.\, x$ left in w.

Let us now consider the logical form in (45) for the *wh*-question below.

(44)   Which cat meowed?

(45)

$$
\begin{array}{l}
< s, < st, t >> \\
\quad \lambda w_0 \qquad < st, t > \\
\qquad\qquad \lambda p \\
\qquad\qquad\quad < et, t > \qquad\qquad < e, t > \\
\qquad\qquad\quad \text{which} \qquad\qquad \lambda_3 \qquad t \\
\qquad\qquad\qquad\quad \text{cat} \;\; w_0 \qquad\qquad C_Q \;\; p \;\; \lambda w_1 \quad < s, t > \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad t_3 \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{meowed} \;\; w_1
\end{array}
$$
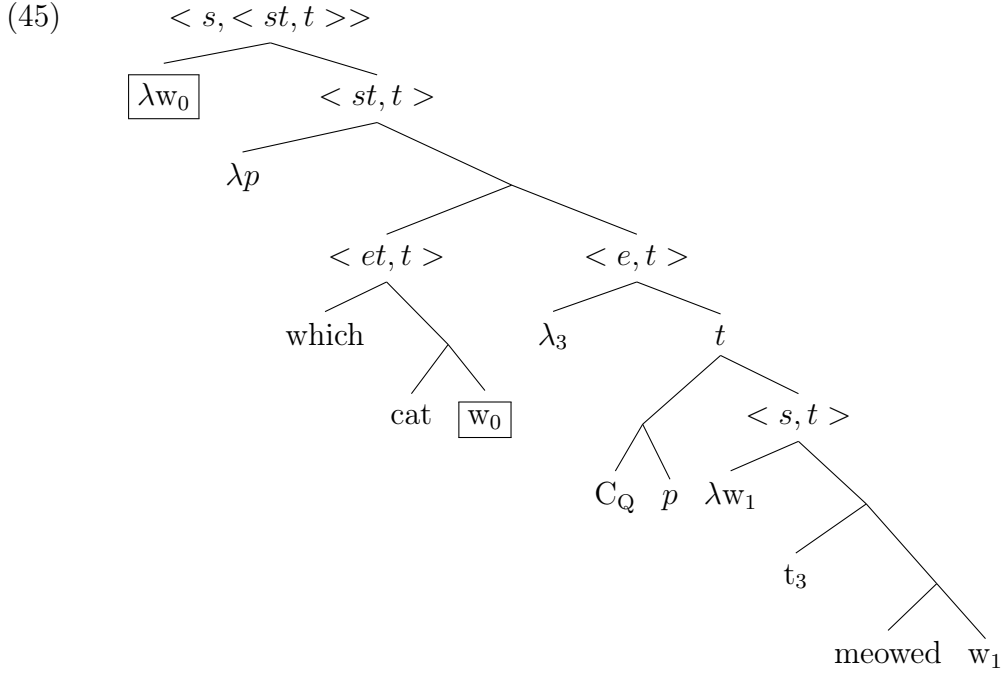
The meaning we derive from this logical form is given below. As in unembedded utterances of the declarative kind, the resulting meaning is a function whose domain is worlds. Given that this function applies to the utterance world, whatever moves above the interrogative complementizer C_Q gets evaluated in the utterance world, just like in STI.

(46) $[\![(45)]\!] = \lambda w_0.\ \lambda p.\ \exists x\!: [\![\text{cat}]\!](w_0)\ \&\ p = \lambda w_1.\ [\![\text{meowed}]\!](w_1)(x)$

Let us now see what the derivation of a *wh*-question that involves pied-piping will look like. I will illustrate this with the Finnish *wh*-question in (47), that involves overt island pied-piping.

(47)   [island **kenelle** kirjoitetun   kirjeen]   Pekka luki?
              who.ALL written.PTCP letter.ACC Pekka read
        'Who$_1$ is such that Pekka read the letter written to them$_1$?'

Crucially, whatever moves above the interrogative complementizer can only be interpreted in the utterance world (just like in STI). Hence, to derive the right meaning of the *wh*-question, von Stechow would argue that the *wh*-phrase *kenelle* 'who' moves out of the island and the remnant of the island reconstructs below the interrogative

complementizer. Hence, the logical form that gets interpreted has to be as in (48), where the world pronoun within the remnant DP is bound by λw_1, not λw_0.

(48)

$$
\lambda w_0 \\
\quad \lambda p \\
\qquad \text{who}(w_0) \\
\qquad\quad \lambda x \\
\qquad\qquad \boxed{C_{\text{Qint}}\ \ p\ \ \lambda w_1} \\
\qquad\qquad\quad \text{Pekka read}(w_1) \\
\qquad\qquad\qquad \text{the} \\
\qquad\qquad\qquad\quad \boxed{{}^{\checkmark}w_1/{}^{\#}w_0}\ \ \text{letter written to } x
$$
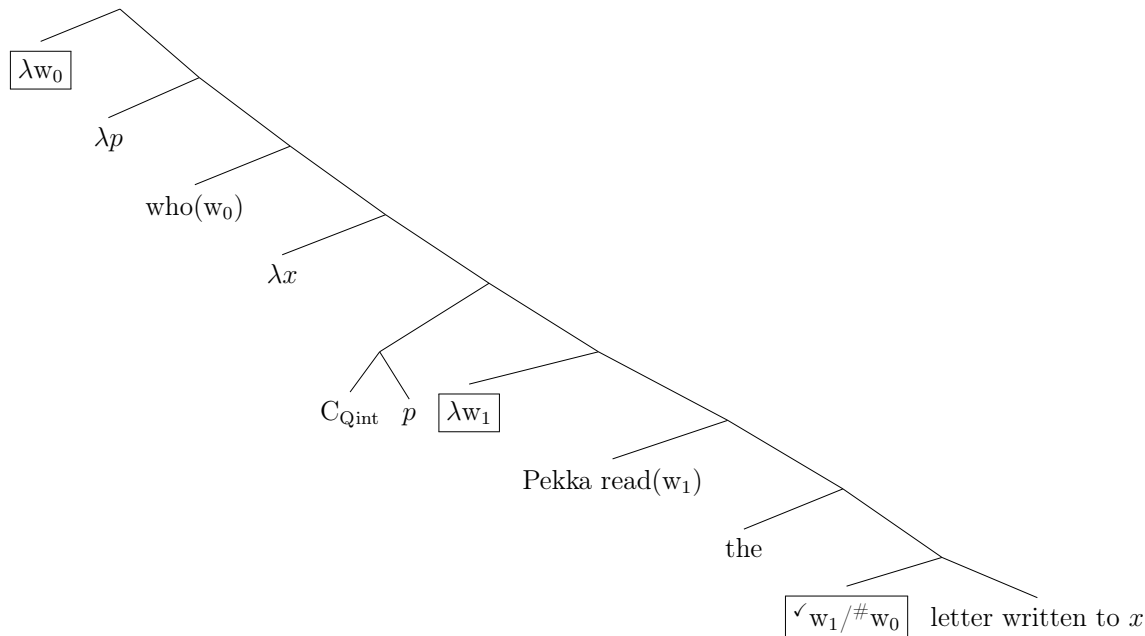
An important difference from STI is that stipulating reconstruction of the remnant in fact **does not guarantee** that the right meaning for the given *wh*-question will be obtained. Given BTI's assumptions, in the logical form above, there is nothing that would disallow w_0 from appearing within the remnant DP. If the world pronoun in the reconstructed DP is w_0, the unattested *de re* construal for the entire pied-piped phrase arises (i.e. the reading that von Stechow objected to). Hence, while under STI, reconstructing the remnant is necessary and sufficient, under BTI reconstructing the remnant is necessary but not sufficient. Under BTI, we also need an additional stipulation that the world pronoun(s) within reconstructed DPs have to be bound by the most local λ-binder.[19] To summarize, BTI does not solve von Stechow's problem. If anything, it requires more stipulations to block the overgeneration due to the flexibility of the system where *de re* via binding is very much possible.[20]

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[19]Even a more restricted version of BTI as in Schwarz (2012), where world/situation pronouns can only complement strong determiners, will need a stipulation that essentially restate von Stechow's problem.

[20]The discussion regarding von Stechow's problem under BTI carries over to the **partially scopal** account of *wh*-questions due to Heim (2012) which builds on Rullmann and Beck (1998) and Fox (1999). Under this account, only the quantificational part of a *wh*-phrase is interpreted above the interrogative complementizer. Given that everything else is in-situ at LF, *de re* readings rely on BTI and again raises the question what blocks its overapplication to pied-pipees.

2.3.2 von Stechow's problem under in-situ accounts

We have illustrated how von Stechow's problem arises under the assumption that the compositional derivation of *wh*-questions involves scope-taking by QR. Under this assumption, *wh*-movement is crucial in creating the meaning of a *wh*-question, i.e. a Hamblin set. There are also approaches to compositional semantics of *wh*-questions which assume that *wh*-phrases are not quantifiers and can be interpreted in-situ.[21] There are two notable in-situ compositional analyses of *wh*-questions, one involving *choice functions* (Reinhart, 1997, 1998; Cable, 2010), one involving pointwise composition (Hamblin, 1973; Beck, 2006; Kotek, 2016).

The choice function analysis

A widely adopted in-situ account of exceptional scope of indefinites and *wh*-phrases due to Reinhart (1997, 1998) makes use of **choice functions**. A choice function is a function that takes a set S and returns a member of S. To illustrate, the function f of type $<< e, t >, e >$ in (49) is an example of a choice function.

(49) f(Mary, John, Susan) = Mary

Let us first go over the example below to see how choice functions yield the desired truth conditions for a sentence with a wide scope indefinite, without positing QR. In (50a), the indefinite **some philosopher** is interpreted as a choice function variable taking $\{x: x$ is a philosopher$\}$ as its complement.[22]

(50)   a.   Max will be offended if we invite **some philosopher**.
         b. $\exists f$: CF(f)[23] & if we invite f(**philosopher**) Max will be offended

                                                                                        Reinhart (1998)

The existential closure over the choice function variable is (syncategorematically) introduced at the root node.[24] This predicts that (50a) will be true iff a function f exists such that if we invite the philosopher f selects, Max will be offended. This gives the indefinite wide scope over the island, without QRing it.

---

[21]There is an alternative view presented in Caponigro (2003) that assumes that *wh*-phrases are not quantifiers but still move for interpretation. He argues that *wh*-phrases provide domain restriction to a property (similar to relative pronouns). Under this view, *wh*-movement is on a par with relativization. The output of *wh*-movement (a λ-abstract) is converted into a proposition set by the interrogative complementizer, which contributes existential quantification.

[22]I ignore intensionality for now.

[23]CF := $\{f : \forall P \in \text{DOM}(f) [f(P) \in P]\}$ Charlow (2015)

[24]$[\![\exists_n\ \alpha]\!]^g = 1$ iff $\exists f$: f is a choice function & $[\![\alpha]\!]^{g[n \to f]}$

Deriving a Hamblin set via choice functions has the same logic. A *wh*-phrase like **which cat** will be interpreted as a choice function variable taking *cat* as its argument. There are two points to pay attention to. First, —assuming the baseline composition in Dayal (2016) but leaving the *wh*-phrase in-situ— the *wh*-phrase will be below the interrogative complementizer but the binder of the choice function variable will be above it. This gives us formulas like below.

(51) $\lambda p.$ $\boxed{\exists f\colon \text{CF}(f)}$ $\&\ p = \ldots$ $\boxed{f}$ $\ldots$

The second point is about intensionality. Under scopal accounts of *wh*-questions, the restrictor of a *wh*-phrase in an matrix *wh*-question is evaluated with respect to the utterance world. Reinhart (1998) acknowledges the necessity of incorporating this into the choice functional analysis of *wh*-questions. She points to the data in (52) and argues that *which millionaire* can have an extensional construal. That is, even though under the choice function analysis, the restrictor noun *millionaire* can remain in-situ (hence, under the intensional verb *want*), the choice function should be able to select from the set of millionaires in the actual world.

(52)   Who wants to marry **which millionaire**?

How do we achieve this under the choice function analysis where a *wh*-phrase is in-situ, i.e. in particular under the interrogative complementizer? First, observe that under BTI's assumptions, this is easy to achieve. Consider (53) for illustration. Even if *cat* remains in-situ below the interrogative complementizer, it can be bound by λw_0, which allows it to be interpreted relative to the utterance world. This is illustrated below, along with the QR analysis to make comparison easier.

(53)   ⟦which cat meowed⟧ $=$

       a.   *under the choice function analysis*
          $\lambda w_0.\ \lambda p.\ \exists f\colon \text{CF}(f)\ \&\ p = \lambda w_1.\ ⟦\text{meowed}⟧(w_1)(f(⟦\text{cat}⟧(w_0)))$

       b.   *under the QR analysis*
          $\lambda w_0.\ \lambda p.\ \exists x\colon ⟦\text{cat}⟧(w_0)\ \&\ p = \lambda w_1.\ ⟦\text{meowed}⟧(w_1)(x)$

Perhaps surprisingly, this can also be achieved under STI's assumptions but *not* under the basic assumption that choice functions are of type $< et, e >$. As proposed in Reinhart (1998), it is possible to relativize choice functions to possible worlds. Accordingly, a choice function G relative to w can take the *intension* of its sister (i.e.

a property P of type $< s, < e, t >>$) and return a member of the extension of P at w (i.e. an individual x such that $x \in P(w)$),[25] as illustrated in (54a). Given the definition of w-relativized choice functions, the end result is equivalent to the formula in (54b) that uses choice functions of type $< et, e >$.

(54)   ⟦which cat meowed⟧^{w} =

      a. $\lambda p.\ \exists G$: G is a choice function <u>relative to w</u> &
           $p = \lambda w'.$ ⟦meowed⟧$^{w'}(G(\lambda w''.\ ⟦cat⟧^{w''}))^{26}$

      b. $\lambda p.\ \exists f$: f is a choice function &
           $p = \lambda w'.$ ⟦meowed⟧$^{w'}(f(\{x$: x is a cat in $\mathbf{w}\}))$

Let us now turn to the pied-piping problem. First, it should be noted that the choice function analysis allows us to dispense with the idea that *wh*-phrases always take scope via QR. This means that two of the assumptions that von Stechow had to make, namely *wh*-extraction out of islands and obligatory reconstruction of the remnant, are no longer needed, given that the choice function analysis allows for in-situ interpretation. This can perhaps be seen as improvement on von Stechow's proposal. However, we have seen that the core of the pied-piping problem concerns assumptions on intensionality.

The choice function analysis of *wh*-questions looks considerably simpler under BTI's assumptions. Yet, when implemented under BTI's assumptions, it faces roughly the same potential overgeneration problem that we discussed in the previous section. Pretending that English is a *wh*-in-situ language for ease of discussion, consider (55). Notice that nothing guarantees that the nucleus of the *wh*-question in (55) will be construed as in (55a), but not as in (55b). If von Stechow's claim is right, we want to be able to block (55b).

---

[25] Given that a relativized choice function variable is now of type $<< s, et >, e >$, it will need to combine with its sister via IFA.

[26] Given that G is relative to $\mathbf{w}$, G chooses form the set $[\lambda w''.\ ⟦cat⟧^{w''}](\mathbf{w})$

(55)   "John trashed the letter from which customer?"

$\lambda w_0. \ \lambda p. \ \exists f: \ \textsc{cf}(f) \ \&$

    a. $p = \lambda w_1. \ \text{J trashed}(w_1) \ \text{the letter}(\underline{w_1}) \ \& \ \text{from}(\underline{w_1})(f(\text{customer}(w_0)))$

    b. $p = \lambda w_1. \ \text{J trashed}(w_1) \ \text{the letter}(\underline{w_0}) \ \& \ \text{from}(\underline{w_0})(f(\text{customer}(w_0)))$

Let us now turn to the alternative under STI's assumptions. As we have discussed above, under STI's assumptions, the simple logic of choice functions needs to be complicated by relativizing choice functions to possible worlds. First let us observe that while the QR theory of *wh*-questions delivers wide scope and *de re* simultaneously, with choice functions, this can only be achieved by an additional complication on the type of choice functions. Without this adjustment, the choice function analysis under STI's assumptions is incapable of assigning a *de re* construal to a *wh*-phrase/wide scope indefinite. While this is certainly not an improvement on the QR-theory of *wh*-questions, this complication is arguably justified given that choice functions do have the advantage of allowing wide scope out of islands without positing QR. When this is granted, it seems to me that von Stechow's particular proposal on the pied-piping problem and the choice function analysis under STI's assumptions are at the same level. (56) gives an illustration of a 'pied-piping' case under STI's assumptions.

(56) $[\![$"John trashed the letter from which customer?"$]\!]^{w} =$

$\lambda p. \ \exists G: \ G$ is a choice function <u>relative to w</u> &

$p = \lambda w'. [\![\text{trashed}]\!]^{w'}(\iota y: [\![\text{letter}]\!]^{w'}(y) \ \& \ [\![\text{from}]\!]^{w'}(G(\lambda w''.[\![\text{customer}]\!]^{w''}))(y))(\text{j})$

Needless to say, just like von Stechow's solution, the choice function alternative preseneted under STI's assumptions, too, cannot be a complete account in that STI undergenerates elsewhere, as we have briefly discussed in section 2.2.3.

The pointwise composition analysis

The classical analysis of *wh*-questions due to Hamblin (1973) assumes a grammar where the basic composition principle is not plain FA but *pointwise functional application* (PFA). PFA operates on sets, and in some sense applies FA within sets (see (58) below). Accordingly, under this grammar, natural language expressions always denote sets (ignoring intensionality for now).

(57)   a. $[\![\text{left}]\!] = \{\lambda x. \ x \ \text{left}\}$

    b. $[\![\text{Sue}]\!] = \{\text{Sue}\}$

(58) a. An FA grammar

⟦Sue left⟧ = ⟦left⟧(⟦Sue⟧) = [λx. left(x)](S)

  b. A PFA grammar

⟦Sue left⟧ = {$f(x)$: $f \in$ ⟦left⟧ & $x \in$ ⟦Sue⟧} =
{$f(x)$: $f \in$ {λx. left(x)} & $x \in$ {Sue}}

Hamblin's original proposal was that *wh*-words simply denote sets. Accordingly, pointwise composition is able to generate a proposition set without QR, as illustrated in (60). A Hamblin-style semantics for *wh*-questions and indefinites is advocated in (Kratzer and Shimoyama, 2002; Shimoyama, 2006).

(59) ⟦who$_{\text{hamblin}}$⟧ = {x: x is human}

(60)
$$\{x \text{ left: human}(x)\}$$
$$|$$
$$\{f(x)\text{: } f \in \{\lambda y.\ \text{left}(y)\} \ \& \ x \in \{x\text{: human}(x)\}\}$$

{x: human(x)} {λy. left(y)}

| |

who   left

On independent grounds, Rooth (1985, 1992) proposed that grammar makes use of pointwise composition in a parallel dimension of meaning composition. Rooth's theory, often called Focus Semantics/Alternative Semantics, was adopted into *wh*-questions by Beck (2006). Beck's theory of *wh*-questions has become influential and been further explored by Cable (2010); Kotek (2014, 2016).

Under Rooth's original proposal, every node is assumed to have an ordinary semantic value ⟦α⟧° and a focus semantic value ⟦α⟧ᶠ. When nothing bears focus marking, the following holds: ⟦α⟧ᶠ = {⟦α⟧°}. Beck (2006) argued that *wh*-words constitute an exception to this and only have a focus semantic value.

(61) a. ⟦who⟧ᶠ = {x: x is human}
  b. ⟦who⟧° = *undefined*

In the focus dimension of meaning, expressions denote sets and composition is pointwise. Therefore, *wh*-phrases, lacking an ordinary semantic value, are forced to compose pointwise. As shown in (62a), we end up with a set of propositions as the focus semantic value of *who left* merely by pointwise composition (just like in Hamblin's original proposal). However, notice that, the ordinary semantic of *who left* is still undefined (62b). To fix this, Beck posits a *focus sensitive operator* that returns

the focus semantic value of its sister as the ordinary semantic value of its mother. Following Kotek (2016), I will call this operator ALTSHIFT, whose effect is illustrated in (63).

(62)   a. $\llbracket \text{who left} \rrbracket^f = \{f(x)\colon x \in \llbracket \text{who} \rrbracket^f \ \& \ f \in \llbracket \text{left} \rrbracket^f\}$
       b. $\llbracket \text{who left} \rrbracket^o = \textit{undefined}$

(63) $\llbracket \text{ALTSHIFT who left} \rrbracket^o = \{f(x)\colon x \in \llbracket \text{who} \rrbracket^f \ \& \ f \in \llbracket \text{left} \rrbracket^f\}$

Notably, this system is able to derive Hamblin sets without any movement. Hence, like choice functions, it has been argued to be a good fit for island-insensitivity of *wh*-phrases. Surely, this is an important feature of this system which has made it attractive as a model of *wh*-in-situ, and exceptional scope in general. However, another crucial aspect of question semantics, namely how intensionality is represented in this system, has not received much attention.

Having introduced the basics of this system that makes use of pointwise composition, let us now turn to questions on intensionality. STI, as I adopted it from von Fintel and Heim (2011), cannot represent intensionality under this system. This is because the interpretation function $\llbracket \ \rrbracket$ that will perform pointwise composition cannot be parameterized to possible worlds (see Rooth (1985) for relevant discussion).[27] Rooth suggests that world-dependence of lexical items can be represented as illustrated below.

(64)   a. $\llbracket \text{left} \rrbracket = \lambda x. \ \lambda w. \ x \text{ left in } w$
       b. $\llbracket \text{saw} \rrbracket = \lambda x. \ \lambda y. \ \lambda w. \ y \text{ saw } x \text{ in } w$

Notice that this representation of intensionality allows us to derive a proposition set under the assumption that a *wh*-phrase denotes a set of individuals.

(65) $\llbracket \text{ALTSHIFT who left} \rrbracket^o = \{f(x)\colon x \in \llbracket \text{who} \rrbracket^f \ \& \ f \in \llbracket \text{left} \rrbracket^f\} =$
       $\{f(x)\colon x \in \{\text{John, Mary}, \ldots\} \ \& \ f \in \{\lambda x. \ \lambda w. \ x \text{ left in } w\}\} =$
       $\{\lambda w. \ \text{John left in } w, \ \lambda w. \ \text{Mary left in } w, \ \ldots\}$

The important question is how does a *wh*-phrase end up denoting a set of individuals. Kotek (2016) assumes that *which* returns the ordinary semantic value of its sister, as in (66). However, if *student*, whose extension varies across worlds, has the

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[27]Just to have an idea on the problem, observe that $\{f(x)\colon x \in \llbracket \text{who} \rrbracket^w \ \& \ f \in \llbracket \text{left} \rrbracket^w\}$ is not a proposition set (but a set of truth-values). Moreover, the relevant proposition set cannot be recovered from it.

denotation in (67), this is still not a set of individuals but a function of type $< e, st >$.

(66) $[\![\text{which student}]\!]^{\text{f}} = [\![\text{student}]\!]^{\text{o}}$

(67) $[\![\text{student}]\!] = \lambda x.\ \lambda w.\ x$ is a student in w

Hence, under this particular assumption on how intensionality is represented, we face a type mismatch issue even in a simple *wh*-question like *which student left.*

Recall that in matrix *wh*-questions, the NP restrictor of a *wh*-phrase is to be evaluated with respect to the utterance world. Therefore, the desired semantics for the *wh*-question *which student left* is (68).

(68) $\{f(x)\colon x \in \{x\colon x$ is a $\underline{\text{student in actual world}}\}\ \&\ f \in \{\lambda x.\ \lambda w.\ x$ left in $w\}\}$

While a *de re* construal for the NP restrictor of *wh*-phrases comes "for free" under the QR theory of *wh*-questions (whether we assume BTI or STI), Reinhart's solution for choice functions involves relativizing choice functions to possible worlds to derive the intended construal under STI. As far as I can see, a solution similar to Reinhart's is impossible under this system.

Then, an obvious alternative is to assume BTI to represent intensionality, as schematized in the LF below. This LF would be able to generate a *de re* construal for the NP restrictor of the *wh*-phrase. However, it suffers from an important problem that is independent of intensionality. The focus semantic value of the sister of ALTSHIFT is supposed to be a set of propositions. To obtain this result, we need to know how λw_1 composes with its sister. If we blindly apply the syncategorematic λ-abstraction rule (Heim and Kratzer, 1998), what we get is a function into sets, not a set of functions. That is, we simply cannot generate a proposition set.

(69)
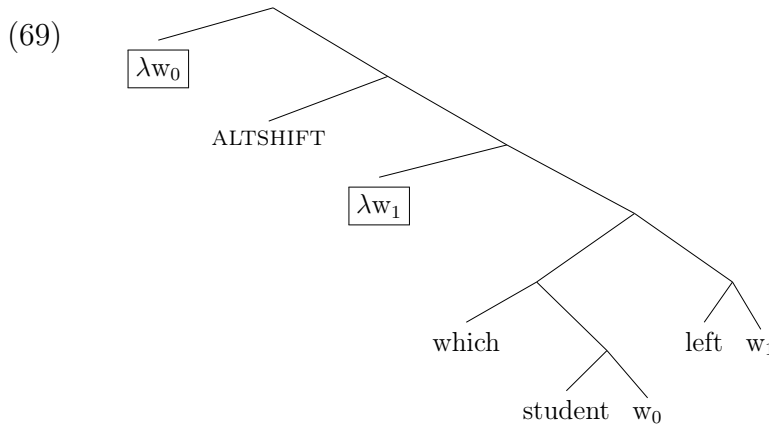
This general problem with binding/λ-abstraction in pointwise composition has

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long been known and various technical solutions have been offered to deal with the problem, which I do not review here.[28] See Shan (2004); Ciardelli et al. (2017); Charlow (2019) for relevant discussion on why λ-abstraction fails under pointwise composition. Assuming that the problem with binding/λ-abstraction can be addressed one way or other, it would be possible to spell-out a semantics that will allow BTI to work with pointwise composition.

Let us briefly discuss what the implication of this discussion for the problem of pied-piping is. In particular, Cable (2010) notes that interpreting pied-piped constituents within Beck's (2006) in-situ semantics is trivial and requires no additional assumptions. That is, he seems to suggest that pied-piping is only a problem under accounts like von Stechow's where *wh*-phrases are scope taking objects and have to move out of whatever they "pied-pipe". Essentially, his point is that pied-piping is semantically unremarkable in that there is no need for *wh*-extraction in the first place. Cable (2010) is right in claiming that his account indeed does not face some of the problems that we have discussed with regard to von Stechow's particular **proposal** for the interpretation of pied-piping (e.g. there does not need to be any island-violating *wh*-movement for a Hamblin set to be derived.) However, Cable (2010) in fact does not discuss von Stechow's **problem** itself. It is important to notice that von Stechow's problem is essentially an overgeneration problem. In particular, it is the problem of how to rule out the logical forms where the entire pied-piped phrase has the *de re* construal. Does Cable address von Stechow's problem? The answer to this question cannot be found in Cable (2010) because Cable's proposal is silent on how *de re* readings are derived in the first place. Recall that Reinhart complicates the choice function analysis just to make sure that a *de re* construal for **which millionaire** can be obtained in (70).

(70)   Who wants to marry **which millionaire**?

Pointwise composition accounts of *wh*-questions, too, need to explicitly spell-out their assumptions on how intensionality is represented and how *de re* can be obtained before any question on pied-piping can be answered.

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[28]For example, Kratzer and Shimoyama (2002) makes use of a type-shift rule that shifts 'a function into sets' into 'a set of functions'. Shan (2004) shows that the set of functions obtained via Kratzer and Shimoyama's type-shift rule is not exactly the right set of functions, and argues that this type-shift rule in fact makes incorrect empirical predictions. Rooth's original suggestion, on the other hand, is along the lines of what has been recently called "superintensional" semantics (Erlewine, 2014).

2.4 Summary and roadmap

This chapter has discussed various aspects of an important problem with pied-piping in *wh*-questions that von Stechow identified. As von Stechow shows, under scopal accounts of *wh*-questions, the nature of the problem is straightforward: for the right meaning of *wh*-questions to be derived only the *wh*-phrase scopes above the interrogative complementizer. Accordingly, von Stechow's proposal was undoing pied-piping at LF, i.e. reconstructing at LF what should not have moved in syntax in the first place (i.e. pied-pipee). This proposal, presented under STI's assumptions, addresses the pied-piping problem, provided that there is no in-situ way of deriving *de re* construals. Hence, under a theory of intensionality which allows *de re* construals *in-situ*, reconstruction of the pied-pipee is not a fix to the pied-piping problem. As an example of such a theory, we have discussed BTI (Percus, 2000), where in-situ *de re* via binding is very much possible.

I have also discussed what the pied-piping problem is at its core, characterizing it as a ban on complete *de re* construals for a DP that embeds a *wh*-phrase (or its trace). Assuming that this empirical generalization is correct, the problem with pied-piping is also a problem under non-scopal accounts of *wh*-questions. In particular, we have seen that the same problem arises under non-scopal/in-situ accounts of *wh*-questions, i.e. the choice function analysis and the pointwise composition analysis, too. The former of the two analyses is equipped to address the pied-piping problem under STI's assumptions (thanks to Reinhart's proposal to derive *de re* construals in-situ via choice functions relativized to worlds). The pointwise composition analysis, on the other hand, needs to be reconciled with BTI, which to my knowledge has not yet been done.

All things being equal, I take the result of this comparison to favor a scopal account of *wh*-questions and STI. Here is my reasoning. The scopal account of *wh*-questions captures the fact that *wh*-phrases in matrix *wh*-questions are interpreted in the utterance world as a by-product of scope-taking. Under a choice function analysis, this is essentially stipulated by assuming a higher type for choice functions. Regarding the theory of intensionality, the pied-piping problem favors STI, as BTI fails to block complete *de re* construals for DPs that contain a *wh*-phrase (or its trace).

However, all things are not equal. von Stechow's solution works under STI but not BTI precisely because STI appears to undergenerate *de re* readings elsewhere. Furthermore, a *wh*-phrase inside an island is able to scope out of it and receive a *de re* construal precisely because von Stechow assumes that there is no punishment

for island-violating QR at LF. In-situ methods of deriving exceptional scope and *de re* have been proposed to address these issues. Hence, von Stechow's solution would work provided that these issues are addressed independently within his assumptions regarding scope-taking and intensionality.

Therefore, if we accept that von Stechow's empirical claim is valid, von Stechow's problem remains as a problem. This is because von Stechow's particular solution relies on STI and the assumption that *wh*-phrases obligatorily take scope via QR, both of which have faced independent empirical challenges. Then, in addressing von Stechow's problem, what needs to be achieved are as follows:

(71)   a.   Derive the ban on complete *de re* construal for a DP that contains a *wh*-phrase or its trace.
        b.   Derive island-insensitivity of *wh*-phrases/indefinites and island-sensitivity of other quantifiers
        c.   Derive exceptional *de re* [i.e. what appears to be in-situ *de re*]

There are various conceivable ways to spell out a theory that can achieve these at the same time. One could, for example, adopt BTI, along with choice functions, and try to address the overgeneration issues. Or one could spell out a grammar with pointwise composition and a theory of intensionality compatible with it. Instead, I will defend the idea that the traditional theory of scope-taking via QR and the traditional scope theory of intensionality are in fact empirically sufficient.

My goal in the next chapter is to spell out a theory of pied-piping which recasts the core insight of von Stechow's proposal into a setting where pied-piped phrases are scope-takers themselves. I show that this theory of pied-piping, which is a variant of Charlow (2019), allows us to derive the right meaning for *wh*-questions with pied-piping without undoing any movement at LF. In Chapter 4, I defend the idea that pied-piping under the QR-theory of scope is not a problem but in fact a solution to problems of exceptional scope and exceptional *de re*. The chapters that follow explore further consequences and attempt to address some of the problems that arise in this system.

Chapter 3

Pied-piping for *wh*-scope

In this chapter, I propose a scopal theory of pied-piping in *wh*-questions, which I refer to as the ∃-theory, where *wh*-phrases will be of a familiar type, namely existential quantifiers of type $< et, t >$. The ∃-theory is maximally simple in that it does not make use of any additional machinery like choice functions or pointwise composition, cf. Cable (2010); Kotek (2016), nor does it use any type shifters/morphemes other than those required to compose a simple *wh*-question without pied-piping.

The ∃-theory of pied-piping exclusively relies on the *type-flexible* variants of the morphemes used to generate proposition sets (von Stechow, 1996; Heim, 2012; Fox, 2012; Dayal, 2016). Under the ∃-theory, pied-piped phrases will be existential quantifiers and, as we shall see, have the same internal structure as *wh*-questions. Importantly, the internal structure of pied-piped phrases will allow *wh*-phrases to take scope via internal *wh*-movement (van Riemsdijk, 1985; Richards, 2000; Heck, 2009; Huhmarniemi, 2012) *within* pied-piped phrases. As will be shown, this derives the right meaning for pied-piped phrases without undoing any movement at LF.

The ∃-theory builds on the theory of exceptional scope in Charlow (2019) and is closely related to an earlier proposal in Dayal (1994) for scope-marking constructions. My proposal adopts from Charlow (2019) the crucial idea that pied-piping itself is scope-taking. There is a difference between the ∃-theory and Charlow (2019) that will be relevant in deriving exceptional *de re* in Chapter 4. While an exceptional scope-taker in Charlow (2019) composes with a function into sets, under the ∃-theory, all scope-takers are assumed to be composing with a function into truth values, i.e. QR always targets a type t node (Heim and Kratzer, 1998). In the appendix to this chapter, I present an alternative closer to (the letter of) Charlow (2019), for comparison. In the next chapter, I use the ∃-theory to derive exceptional scope and spell out a general theory of *de re* via pied-piping. I follow STI (von Fintel and Heim,

2011) here and throughout the chapters that follow.

3.1   The ∃-theory of scope

In section 2.1.1, we discussed two methods of generating proposition sets. Both methods make use of an interrogative complementizer, whose semantics is the propositional variant of the ID morpheme/type shifter (Partee, 1986). I henceforth call this ID. Under one of the methods (Heim, 2000), ID directly applies (via IFA) to the question nucleus (a type t node) and returns the set that contains its intension, as illustrated in (1). I will call this method, the **direct method**. Under the other method (von Stechow, 1996; Fox, 2012; Heim, 2012; Dayal, 2016), ID first composes with a propositional variable, abstracted over at the root node, and then with the question nucleus via IFA, as illustrated in (2). I will call this method, **the indirect method**. The choice between the two has immediate consequences for the denotation of a quantifier that will take scope above the question nucleus. In particular, the indirect method makes it possible for a quantifier over individuals (of type $< et, t >$) to take scope above ID. Under the direct method, the scope-taking object has to denote a more complex function of type $<< e, < st, t >>, < st, t >>$. That is, a quantifier needs to compose with a function into sets. I will often call this **(directly) quantifying into sets**, following Charlow (2019). (Scope sites are boxed below.)

(1)   **the direct method**

$$\boxed{<< s, t >, t >}$$

ID   ←IFA

question nucleus

(2)   **the indirect method**

$$<< s, t >, t >$$

λp $\boxed{t}$

$<< s, t >, t >$ ←IFA

ID $p_{< s, t >}$ *question nucleus*
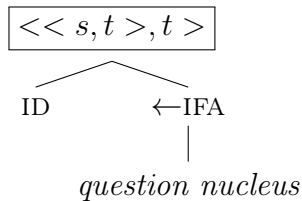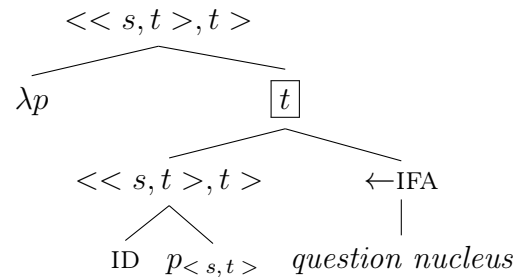
While the function that forms scope-takers compatible with the direct method is (3a), the function that forms scope-takers compatible with the indirect method is (3b).

(3)   a. $[\![\text{which}_{\text{heim}}]\!]^w = \lambda P_{< e, t >}.\ \lambda R_{< e, < st, t >>}.\ \lambda p_{< s, t >}.\ \exists x\ P(x){=}1\ \&\ R(x)(p){=}1$

b. $[\![\text{which}_{\text{karttunen}}]\!]^w = \lambda P_{< e, t >}.\ \lambda Q_{< e, t >}.\ \exists x\ P(x){=}1\ \&\ Q(x){=}1$

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Charlow (2019) takes the direct method as baseline and proposes a theory of pied-piping in which the morpheme that forms scope-takers corresponds to the type-neutral variant of Heim's *which*. This is the direct consequence of quantifying into sets. The ∃-theory will apply Charlow's insight into the indirect method. In other words, we will make use of the type-neutral ∃ morpheme in (4), instead of its version in (3b) that can only apply to a set of individuals.

(4) $[\![\exists]\!]^w = \lambda P_{<\alpha, t>}. \ \lambda Q_{<\alpha, t>}. \ \exists m \ [P(m)=1 \ \& \ Q(m)=1]$ cf. (3b)

3.1.1   Upgrading the indirect method

The compositional theory of *wh*-questions in von Stechow (1996); Heim (2012); Fox (2012); Dayal (2016) works with logical forms like (5b), which employs the indirect method of building proposition sets. Under the indirect method, the syntax of a *wh*-question is slightly more complex compared to the direct method. However, scope-taking objects are simply existential quantifiers that QR into a type t node (i.e. there is no need for quantifying into a set).

(5)   a.   Which cat meowed?

b.
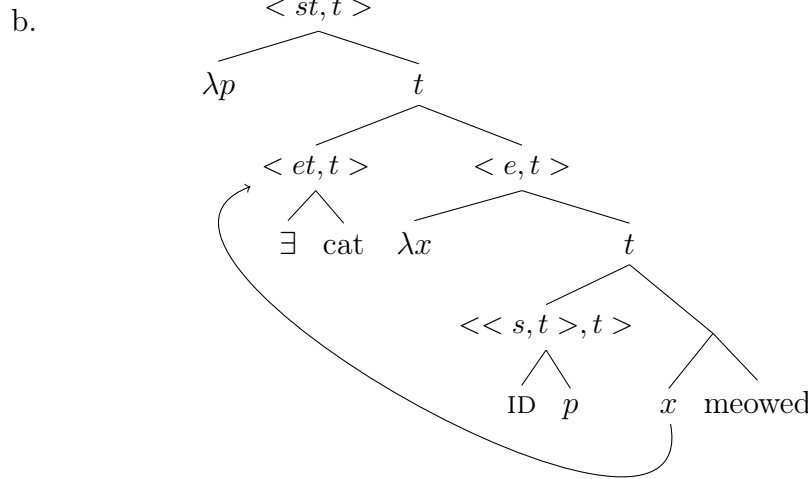
The compositional derivation of this logical form requires the three pieces in (6) that recur in each *wh*-question.

(6)   a.   the ID morpheme
       b.   the ∃-morpheme which forms an existential quantifier (i.e. *which* above)
       c.   λ-abstraction over the propositional variable (in ID's complement)

Adopting Fox's (2012) suggestion to compositionally derive the lambda abstraction over the propositional variable, we could assume that in the complement of ID, a semantically vacuous operator, labelled OP below, is base generated. For example, if OP denotes a type-neutral identity function, i.e. $\lambda\alpha.\ \alpha$, it can move out yielding the required λ-abstraction, as shown below.

(7)   a.   Which cat meowed?

       b.
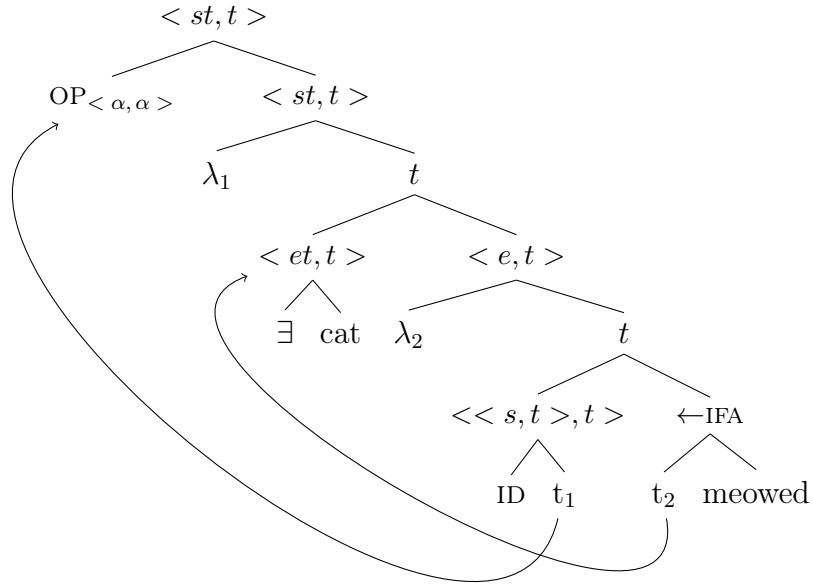
This composition relies on two contentful morphemes that recur in each *wh*-question, the $\exists$ morpheme, spelled out as *which* above, and the ID morpheme (which can be seen as the interrogative complementizer that attracts a *wh*-phrase into its specifier). Their denotations are given below.

(8)   a. $[\![\exists]\!]^w = \lambda P_{<e,t>}.\ \lambda Q_{<e,t>}.\ \exists x\ [P(x){=}1\ \&\ Q(x){=}1]$

       b. $[\![\text{ID}]\!]^w = \lambda p_{<s,t>}.\ \lambda q_{<s,t>}.\ q{=}p$

Here is the crucial insight I borrow from Charlow (2019). While ID applies to a proposition and returns the set that contains it, $\exists$ applies to a set of individuals and forms an existential quantifier over individuals. In an abstract sense, **ID forms sets, $\exists$ forms existential quantifiers out of sets.** In a grammar where these morphemes are type-neutral, the output of ID can be an input to $\exists$. Essentially, this feeding relationship is what we will exploit.

Let us do exactly that and define these morphemes type-neutrally, as in below. See also Heim (2012, 2018).[1]

(9) a. $[\![\exists]\!]^w = \lambda P_{<\alpha,t>}.\ \lambda Q_{<\alpha,t>}.\ \exists m\ [P(m)=1\ \&\ Q(m)=1]$

    b. $[\![\text{ID}]\!]^w = \lambda m_{<s,\alpha>}.\ \lambda n_{<s,\alpha>}.\ n=m$

To appreciate how the type-neutrality[2] will work, consider the toy LF below. ID insists on combining with the *intension* of its complement (as we shall see this is a crucial assumption in deriving the right meaning of *wh*-questions with pied-piping).[3] Hence it will compose with its sister via Intensional Functional Application. Hence, $[\![\beta P]\!]^w$ denotes the set that contains the individual concept $\lambda w'.\ [\![\text{the book}]\!]^{w'}$, as in (11a). $\exists$, on the other hand, is simply looking for a set. Hence, when $\exists$ composes with its sister in (10), it returns an existential quantifier over individual concepts, as shown in (11b).

(10)

αP
$\exists$ βP
ID
the book
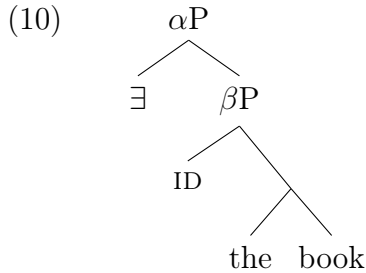
(11) a. $[\![\beta P]\!]^w = \lambda f_{<s,e>}.\ f = \lambda w'.\ [\![\text{the book}]\!]^{w'}$
    b. $[\![\alpha P]\!]^w = \lambda Q_{<<s,e>,t>}.\ \exists f_{<s,e>}\colon f = \lambda w'.\ [\![\text{the book}]\!]^{w'}\ \&\ Q(f)=1$

We will use this logic to turn pied-piped phrases into scope-takers. Crucially, pied-piped phrases in *wh*-questions always contain a *wh*-phrase. Under the $\exists$-theory, a *wh*-phrase contained in a pied-piped phrase α will take scope within α. To allow *wh*-phrases to scope within pied-piped phrases, we will employ **the indirect method**

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[1]Heim (2012, 2018) proposes type neutral variants of these morphemes on independent grounds, to be able to account for complex data involving functional readings of *wh*-questions. We will briefly discuss functional readings of *wh*-questions in Chapter 7, section 7.4). However, I should note that the denotations assumed for ID and $\exists$ in Heim (2012) are slightly different. I thank Kai von Fintel for pointing out the connection to Heim's work with respect to the type-neutrality assumption.

[2]Notably, the ID head is not entirely type-neutral but is looking for intensional arguments. We will come back to this point in section 3.1.3.

[3]The alternative that this lexical assumption excludes is an ID morpheme with complete type-neutrality, i.e. $[\lambda m_\alpha.\lambda n_\alpha.\ \text{m=n}]$. While this morpheme would still allow us to derive proposition sets (in addition to other sets, some of them useless), it would not ensure that we *only* derive the right set of meanings in case of pied-piping. We will discuss this again in section 3.1.3.

(i.e. abstraction over a variable in ID's sister) and create scope position of type t right above ID, as illustrated on our toy example below.

(12)   QUANTIFIER
         /   \
        ∃   SET
                 /   \
            λ_1 SCOPE POSITION
                          /   \
                    ID t_1 the   book
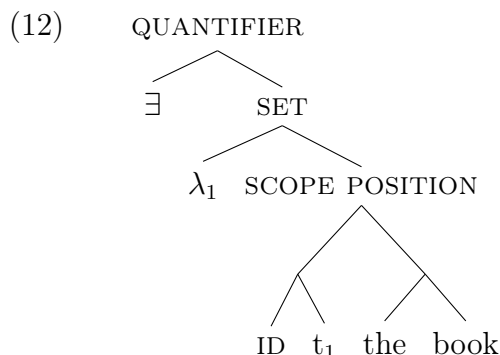
As shown below, the syntax of pied-piping consists in compositionally building a set and feeding that set to an ∃ morpheme. This gives us a generalized quantifier that will itself QR to take scope. Crucial for pied-piping is the type t node labelled SCOPE POSITION above. This position will be targeted by *wh*-phrases within pied-piped phrases. In other words, a *wh*-phrase in a pied-piped phrase will undergo **internal wh-movement** (van Riemsdijk, 1985; Richards, 2000; Cable, 2010) and will take scope within that pied-piped phrase.

Let us first observe how a set is built compositionally with these pieces and how a *wh*-phrase undergoes internal *wh*-movement. Consider the derivation below. Notice that the internal syntax of pied-piping is identical to the matrix syntax of a simple *wh*-question. Just like with matrix ID, the complement of the ID in the pied-piped phrase is the semantically vacuous identity function which moves out for type reasons, yielding λ-abstraction.[4] An existential quantifier, i.e. *who*, moves to the scope position of type t, right above the ID head. I will refer to this *wh*-movement within the pied-piped phrase as internal *wh*-movement.

---

[4]Roger Schwarzschild suggests another possibility. Instead of a semantically vacuous operator, we could let ∃ be merged as ID's sister and QR out. Thanks to the type-neutrality of ∃, this will yield the required abstraction. However, while this is possible for pied-piped phrases, ∃ is not suitable for generating proposition sets when we want to *keep* them as proposition sets. However, if the abstraction in the clausal spine is achieved via movement of an answerhood operator (Fox, 2012), Schwarzschild's suggestion can be implemented in pied-piping and the semantically vacuous operator can be dispensed with. However, to keep representations uniform, I will continue using OP-movement to yield the necessary abstraction.

(13)

$$<<s,e>,t>$$

OP$_{<\alpha,\alpha>}$ $<<s,e>,t>$

λ_1 t

$<et,t>$ $<e,t>$

who λ_2 t

$<<s,e>,t>$ $\leftarrow$IFA

ID   t$_1$ t$_2$

's   cat
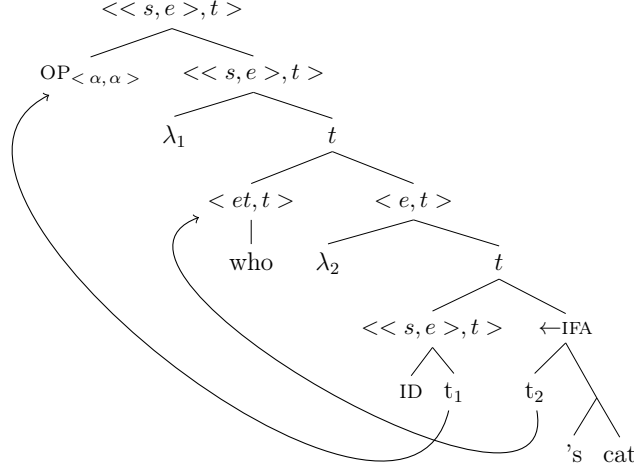
As shown below for convenience, the internal syntax of pied-piping mirrors the syntax of a *wh*-question (OP-movements are not shown by arrows). Simply by mirroring the syntax of a *wh*-question within the pied-piped phrase, we generate a set of individual concepts, i.e. an object of type $<<s,e>,t>$, just like we generate a set of propositions.[5] The semantic type of the objects in the created set is strictly determined by the type of the node identified with the variable/trace in ID's sister (i.e. **pied-pipee**).

(14)   whose cat   who left

$$<<s,e>,t>$$ $$<<s,t>,t>$$

λf t λp t

$<et,t>$ $<e,t>$ $<et,t>$ $<e,t>$

who λ_2 t who λ_2 t

$<<s,e>,t>$ $\leftarrow$IFA $<<s,t>,t>$ $\leftarrow$IFA
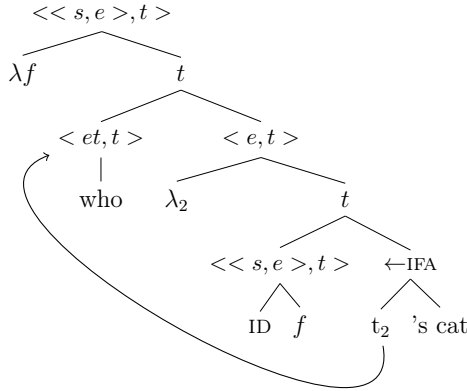
ID f t$_2$'s cat   ID p t$_2$ left
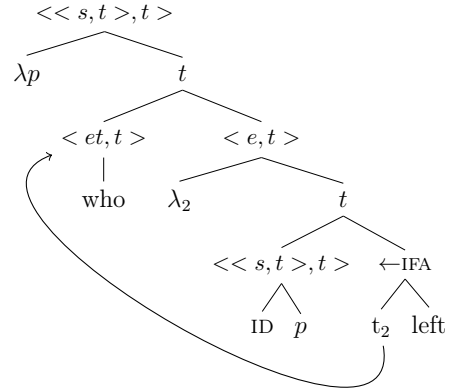
Creating a set is first of the two steps in compositionally building a scope-taker. Next, we merge an $\exists$ morpheme on top of this set-denoting node[6] and make an exis-

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[5] I am indebted to Danny Fox for teaching me the basic idea of how this can be implemented in pied-piping, (which he attributes to Irene Heim, as far as he can recall). In an earlier version of this theory, I was assuming that a variable Q of type $<s,\alpha>$ is merged with the pied-pipee and that Q is abstracted over at the root node. This earlier version yielded similar results but pied-piped phrases looked different from *wh*-questions.

[6] Of course, the $\exists$ morpheme at the edge of a pied-piped phrase is always phonologically null in

tential quantifier. Accordingly, *whose cat* ends up denoting an existential quantifier over individual concepts, i.e. it is of type $<<<s,e>,t>,t>$. This is an object that can take scope just like a simple *wh*-phrase can. One difference is that it contains a *wh*-phrase that takes scope within it. This is illustrated below.

(15)   a. $[\![\text{whose cat}]\!]^{\text{w}} = \lambda Q_{<<s,e>,t>}.\ \exists f_{<s,e>}\ \exists x\colon [\![\text{human}]\!]^{\text{w}}(x)\ \wedge$
        $[f = \lambda w'.\ \iota y\colon [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(x)(y)]\ \wedge\ Q(f){=}1$

    b.

$$<<<s,e>,t>,t>$$
$$\exists \qquad <<s,e>,t>$$
$$\text{OP}_{<\alpha,\alpha>} \qquad <<s,e>,t>$$
$$\lambda_1 \qquad t$$
$$\text{who} \qquad <e,t>$$
$$\lambda_2 \qquad t$$
$$<<s,e>,t>$$
$$\text{ID} \quad t_1 \qquad t_2 \quad \text{'s cat}$$
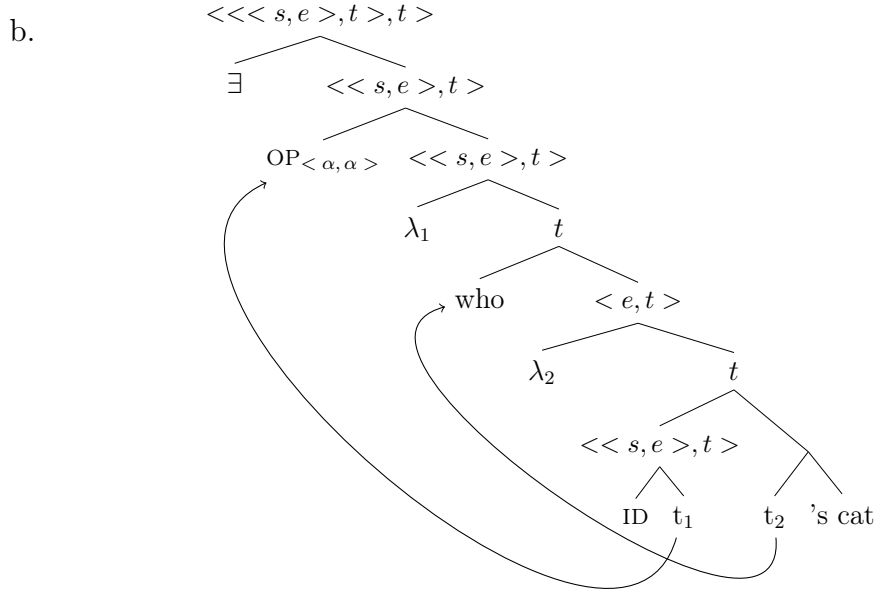
The logical form below illustrates how *whose cat* takes scope in a *wh*-question. The pied-piped phrase *whose cat* QRs (= undergoes *wh*-movement) above the matrix ID, just like a simple *wh*-phrase. Notably, *whose cat* is an existential quantifier of type $<<<s,e>,t>,t>$. Therefore, when it QRs, the lowest type of trace it can leave is an *intensional* trace of type $<s,e>$. How do we deal with an intensional trace? Given that *feed* expects an object of type e, FA or IFA cannot combine the two nodes. The two nodes will compose via Extensionalizing Functional Application proposed in von Fintel and Heim (2011). EFA is defined in (17). For readability, OP-movements are not shown by arrows here and in further examples.

English. One way to state this would be saying that only $\exists$ morphemes whose complement is of type $<e,t>$ have an overt pronunciation. See section 7.1 in Chapter 7 for relevant discussion. I thank Sabine Iatridou for pressing me on this issue.

(16)   Whose cat did Sue feed?

a. $[\![\text{whose cat Sue fed}]\!]^{\text{w}} = \lambda p.\ \exists f_{<s,e>}\ \exists x\text{: } [\![\text{human}]\!]^{\text{w}}(x)\ \wedge$
$[f = \lambda w'.\ \iota y\text{: } [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(x)(y)]\ \wedge\ [p = \lambda w'.\ [\![\text{fed}]\!]^{\text{w'}}(f(w'))(\text{Sue})]$

b.
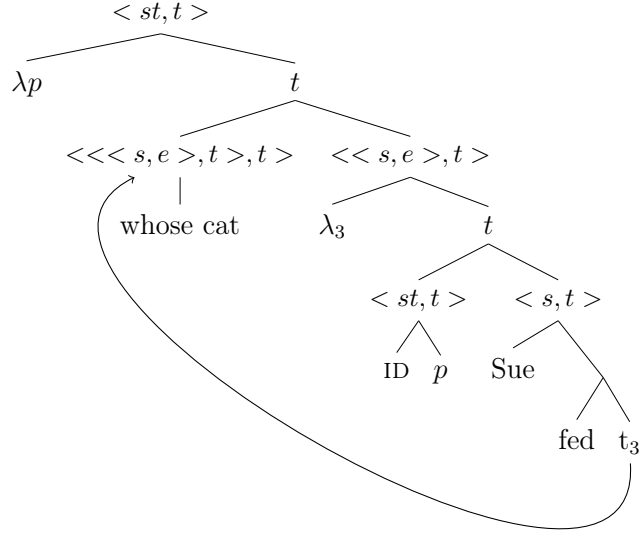
(17)   *Extensionalizing Functional Application*

If α is a branching node, $\{\beta,\gamma\}$ the set of its daughters, then for any w, g:

a.   if $[\![\beta]\!]^{\text{w,g}}(w)$ is a function whose domain contains $[\![\gamma]\!]^{\text{w,g}}$,
then $[\![\alpha]\!]^{\text{w,g}} = [\![\beta]\!]^{\text{w,g}}(w)([\![\gamma]\!]^{\text{w,g}})$

b.   if $[\![\beta]\!]^{\text{w,g}}$ is a function whose domain contains $[\![\gamma]\!]^{\text{w,g}}(w)$,
then $[\![\alpha]\!]^{\text{w,g}} = [\![\beta]\!]^{\text{w,g}}([\![\gamma]\!]^{\text{w,g}}(w))$

(partly) adopted from von Fintel and Heim $(2011)^{7}$

---

[7]EFA, as defined in von Fintel and Heim (2011), only extensionalizes functions. I added (17b) to the rule so that EFA can also extensionalize arguments. Thanks to Roger Schwarzschild for pointing this out.

The meaning that we derive from this logical from is given below.

(18) $[\![\text{whose cat Sue fed}]\!]^{\text{w}} = \lambda p.\ \exists f_{<s,e>}\ \exists x\text{: } [\![\text{human}]\!]^{\text{w}}(x) \land$
$[f = \lambda w'.\ \iota y\text{: } [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(x)(y)] \land [p = \lambda w'.\ [\![\text{fed}]\!]^{\text{w'}}(f(w'))(\text{Sue})]$

We can see that this is the right meaning for this *wh*-question. In other words, the *t's cat* part of the pied-piped phrase ends up being interpreted with respect to the intensional context created by the matrix ID. This is thanks to the fact that the ID morpheme also features in the syntax of pied-piped constituents.

The derived proposition set in (18) is identical to the proposition set von Stechow (1996) would derive via subextraction of *who* out of the pied-piped phrase and subsequent syntactic reconstruction of ['s cat] at LF. In other words, (18) is identical to (19). Notice in the $[\lambda w'.\ [\![\text{fed}]\!]^{\text{w'}}(f(\mathbf{w'}))(\text{Sue})]$ part of the formula that, the existentially bound individual concept f (that refers to the intension of the pied-pipee) is **not** evaluated in the utterance world.

(19) $\lambda p.\ \exists x\text{: } [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [p = \lambda w'.\ [\![\text{fed}]\!]^{\text{w'}}(\iota y\text{: } [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(x)(y))(\text{Sue})$

However, the composition above yields this result without assuming the subextraction of *who* and subsequent syntactic reconstruction of the remnant at LF. See the following subsection for further discussion and formal details of the composition.

To summarize, scope-taking in *wh*-questions is uniform under the ∃-theory. The internal syntax of pied-piped phrases mirrors the syntax of the clausal spine of a *wh*-question. Both in pied-piped phrases and in the clausal spine, what takes scope is an existential quantifier. Hence, plain *wh*-movement, pied-piping, and internal *wh*-movement within pied-piped phrases all exhibit one and the same scope-taking mechanism: an existential quantifier over (objects of type α) QRs above an ID head, i.e. becomes a specifier of an ID head.

The theory of pied-piping presented here borrows its main insight from Charlow (2019) (see the appendix to this chapter for a comparison). However, a similar method of generating scope-takers has a predecessor in Dayal's (1994) work on scope-marking constructions, where the scope marker is analyzed as a higher type existential quantifier that composes with a *wh*-question. See also Sauerland (2018) for an earlier idea on extending Dayal's insight to generating focus alternatives cyclically.[8]

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[8]I thank Uli Sauerland for pointing out the connection to Dayal's work, and sharing his work with me.

3.1.2 Formal details

In this section, I provide the formal details of the semantic composition under the $\exists$-theory. In what follows, I present the semantic derivation of the *wh*-question below, starting from the internal composition of *whose cat.*

(20) Whose cat did Sue feed?

(21) a. $[\![\text{whose cat}]\!]^{\text{w}} = \lambda Q_{<<s,e>,t>}.\ \exists f_{<s,e>}\ \exists x \colon [\![\text{human}]\!]^{\text{w}}(x) \wedge Q(f)$
$[f = \lambda w'.\ \iota y \colon [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(x)(y)] \wedge$

b.
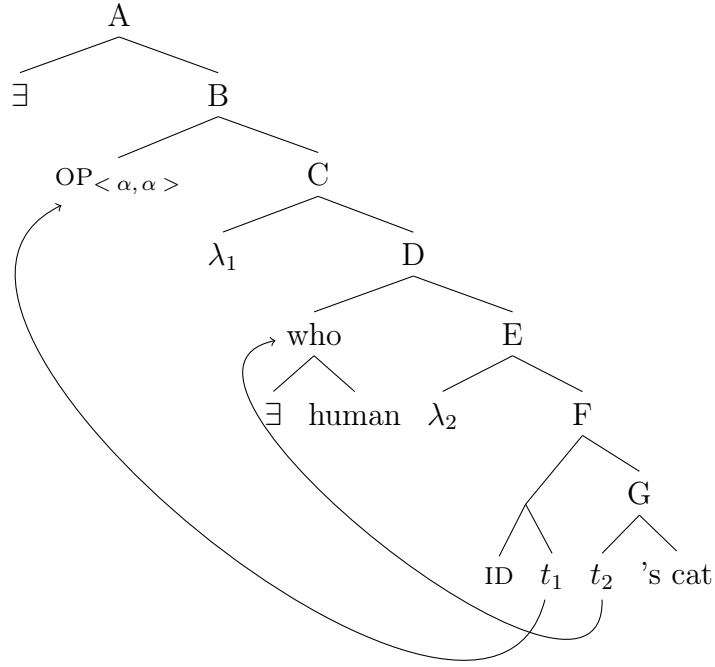
(22) a. $[\![\text{A}]\!]^{\text{w}} = [\![\exists]\!]([\![\text{OP}]\!]([\![\text{C}]\!]^{\text{w}})) =$

b. $[\lambda P_{<\alpha,t>}.\ \lambda Q_{<\alpha,t>}.\ \exists f \colon P(f)\ \&\ Q(f)]([\lambda R.\ R]([\![\text{C}]\!]^{\text{w}}))=$

c. $\lambda Q.\ \exists f \colon [\![\text{C}]\!]^{\text{w}}(f)\ \&\ Q(f) =$

d. $\lambda Q.\ \exists f \colon [\lambda h.\ [\![\text{D}]\!]^{\text{w},\ 1\rightarrow h}](f)\ \&\ Q(f) =$

e. $\lambda Q.\ \exists f \colon [\![\text{D}]\!]^{\text{w},\ 1\rightarrow f}\ \&\ Q(f) =$

f. $\lambda Q.\ \exists f\ \exists x \colon [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [\![\text{E}]\!]^{\text{w},\ 1\rightarrow f}(x)\ \&\ Q(f) =$

g. $\lambda Q.\ \exists f\ \exists x \colon [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [\lambda y.\ [\![\text{F}]\!]^{\text{w},\ 1\rightarrow f,\ 2\rightarrow y}](x)\ \&\ Q(f) =$ (via IFA)

h. $\lambda Q.\ \exists f\ \exists x \colon [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [[\![\text{ID t}_1]\!]^{1\rightarrow f} = \lambda w'.\ [\![\text{G}]\!]^{\text{w'},\ 2\rightarrow x}]\ \&\ Q(f) =^{9}$

i. $\lambda Q.\ \exists f\ \exists x \colon [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [f = \lambda w'.\ [\![\text{G}]\!]^{\text{w'},\ 2\rightarrow x}]\ \&\ Q(f) =$

j. $\lambda Q_{<<s,e>,t>}.\ \exists f\ \exists x \colon [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [f = \lambda w'.\ \iota y \colon [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(y)(x)]\ \&\ Q(f)$

---

[9]Given ID's type-flexible meaning, there is another possibility here: ID and t_1 could combine via IFA instead of FA. However, this results in vacuous binding. See section 4.2.3 for further discussion.

The following derivation uses the derived denotation for *whose cat* in (22j).

(23)   a. $[\![\text{whose cat (did) Sue fed}]\!]^{\text{w}} = \lambda p.\ \exists f_{<s,e>}\ \exists x:\ [\![\text{human}]\!]^{\text{w}}(x)\ \wedge$
        $[p = \lambda w'.\ [\![\text{fed}]\!]^{\text{w'}}(f(w'))(\text{Sue})] \wedge [f = \lambda w'.\ \iota y:\ [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(x)(y)]$

        b.
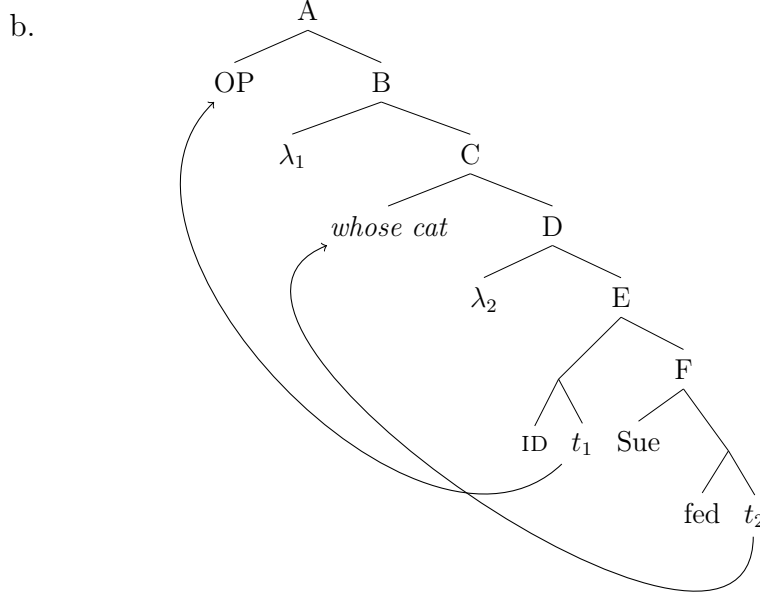
(24)   a. $[\![\text{A}]\!]^{\text{w}} = [\lambda R.\ R](\lambda p.\ [\![\text{C}]\!]^{\text{w, 1}\to\text{p}}) =$
        b. $\lambda p.\ [\![\text{whose cat}]\!]^{\text{w}}([\![\text{D}]\!]^{\text{w, 1}\to\text{p}}) =$
        c. $\lambda p.\ [\![\text{whose cat}]\!]^{\text{w}}(\lambda f.\ [\![\text{E}]\!]^{\text{w, 1}\to\text{p, 2}\to\text{f}}) =$ (via IFA)
        d. $\lambda p.\ [\![\text{whose cat}]\!]^{\text{w}}(\lambda f.\ [\![\text{ID}\ t_1]\!]^{\text{w, 1}\to\text{p}} = \lambda w'.\ [\![\text{F}]\!]^{\text{w', 2}\to\text{f}}) =$
        e. $\lambda p.\ [\![\text{whose cat}]\!]^{\text{w}}(\lambda f.\ p = \lambda w'.\ [\![\text{Sue fed}\ t_2]\!]^{\text{w', f/2}}) =$ (from (22j))
        f. $\lambda p.\ [\lambda Q_{<<s,e>,t>}.\ \exists f\ \exists x:\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [f = \lambda w'.\ \iota y : [\![\text{cat}]\!]^{\text{w'}}(y)\ \&$
        $[\![\text{own}]\!]^{\text{w'}}(y)(x)]\ \&\ Q(f)](\lambda f.\ p = \lambda w'.\ [\![\text{Sue fed}\ t_2]\!]^{\text{w', 2}\to\text{f}}) =$
        g. $\lambda p.\ \exists f_{<s,e>}\ \exists x:\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [f = \lambda w'.\ \iota y : [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(y)(x)]$
        $\&\ [p = \lambda w'.\ [\![\text{fed}\ t_2]\!]^{\text{w', 2}\to\text{f}}(\text{Sue})] =$ (via EFA)
        h. $\lambda p.\ \exists f_{<s,e>}\ \exists x:\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [f = \lambda w'.\ \iota y : [\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(y)(x)]$
        $\&\ [p = \lambda w'.\ [\![\text{fed}]\!]^{\text{w'}}(f(w'))(\text{Sue})]$

Notice that the extension of the function *fed* at w' applies to the extension of the (existentially bound) individual concept f at w'. Hence, the derived denotation in (24h) for (23a) is identical to the function in (25a). In other words, the derived meaning is identical to the meaning we would derive if [t's cat] syntactically reconstructed below the matrix ID or did not move in the first place.

3.1.3 Further discussion

An important question is whether we can effectively block what von Stechow argued to be an unattested reading, given in (25b), where the entire pied-piped phrase is *de re*. For us to be able to give an answer to this question, we need a general theory of *de re* that addressees the undergeneration issues of STI. Hence, I defer the discussion of this to next chapter, where I will provide such a theory.

(25) a. $\lambda p.\ \exists x\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ p = \lambda w'.\ [\![\text{fed}]\!]^{\text{w'}}(\iota y{:}[\![\text{cat}]\!]^{\text{w'}}(y)\ \&\ [\![\text{own}]\!]^{\text{w'}}(y)(x))(\text{S})$

  b. $\lambda p.\ \exists x\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ p = \lambda w'.\ [\![\text{fed}]\!]^{\text{w'}}(\iota y{:}[\![\text{cat}]\!]^{\text{w}}(y)\ \&\ [\![\text{own}]\!]^{\text{w}}(y)(x))(\text{S})$

The crucial assumption which allows us to derive only the *attested* readings of *wh*-questions with pied-piping concerns the nature of the ID morpheme. The meaning we assigned to this morpheme is what entails the *semantic reconstruction*[10] of any constituent identified with the variable in ID's complement (i.e. "the pied-pipee"). However, the ID morpheme does more than scope reconstruction in this system. Compare the two different ID morphemes given below, both of which can yield reconstruction semantically in our setup. Crucially, only one of them is restrictive enough to derive (only) the right meaning for *wh*-questions that involve pied-piping.

(26) a. $[\![\text{ID}_1]\!] = \lambda m_{<s,\alpha>}.\ \lambda n_{<s,\alpha>}.\ n{=}m$

  b. $[\![\text{ID}_2]\!] = \lambda m_{\alpha}.\ \lambda n_{\alpha}.\ n{=}m$ where α is any type

Remember that we used ID_1 and made sure that the trace of a pied-piped phrase is always intensional in order to address von Stechow's objection to pied-piping at LF. This is because ID_1 is a function that insists on taking intensional arguments. Crucially, if we used ID_2 within pied-piped phrases, however, ID_2 could have the option of composing with FA or IFA (due to complete type-neutrality). If it composes with FA, the pied-pipee would still scopally reconstruct but would be interpreted *de re*, for the trace of the pied-piped phrase would be an extensional type. Since ID_2 does not require its arguments to be intensional, there would be nothing that guarantees that it composes with IFA. The direct empirical consequence of this is simply what von Stechow (1996) objected to in the first place. Therefore, something needs to prevent ID_2, if it at all exists in grammar, from appearing in *wh*-questions. Hence, a lexical stipulation that the ID morpheme take intensional arguments allow us to derive the right set of meanings for *wh*-questions with pied-piping *and* block overgeneration.[11]

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[10]I discuss the nature of reconstruction under the $\exists$-theory in more detail in Chapter 5.

[11]It should be noted that if ID_2 were used to compose a *wh*-question, there would be nothing to

Finally, one should of course ask why it is the case that pied-piped *wh*-phrases have to have an ID in them or why the ID within pied-piped *wh*-phrases is identical to the one that forms *wh*-questions.

It is important to emphasize that ID is the head that -syntactically speaking-triggers movement to its specifier in the clausal spine (canonically known as *wh*-movement to spec-CP). (See the tree below for easy reference). There is a growing body of evidence that movement of this sort takes place *within* pied-piped phrases as well. This is typically referred to as 'internal *wh*-movement' or 'secondary *wh*-movement' (van Riemsdijk, 1985; Richards, 2000; Cable, 2010; Huhmarniemi, 2012). The theory provided here allows us to model scope-taking in *wh*-questions in a uniform manner. Internal *wh*-movement and canonical *wh*-movement receive uniform treatment. Pied-piping in *wh*-questions, as a distinct mysterious phenomenon, disappears and is reduced to scope-taking of the canonical sort (simple Quantifier Raising). I think this provides a natural answer to the question why grammar *requires* the ID_1 morpheme within pied-piping, too.

(27) a. Whose cat meowed?
   (OP-movements out of ID's sister not shown)

   b.

$$\langle st, t \rangle$$

λp ... t

$\langle\langle\langle s, e \rangle, t \rangle, t \rangle$ ... $\langle\langle s, e \rangle, t \rangle$

$\exists$ $\langle\langle s, e \rangle, t \rangle$ λf t

λf t **ID** p f meowed

$\langle et, t \rangle$ $\langle e, t \rangle$

$\exists$ human λx t

ID f x 's cat

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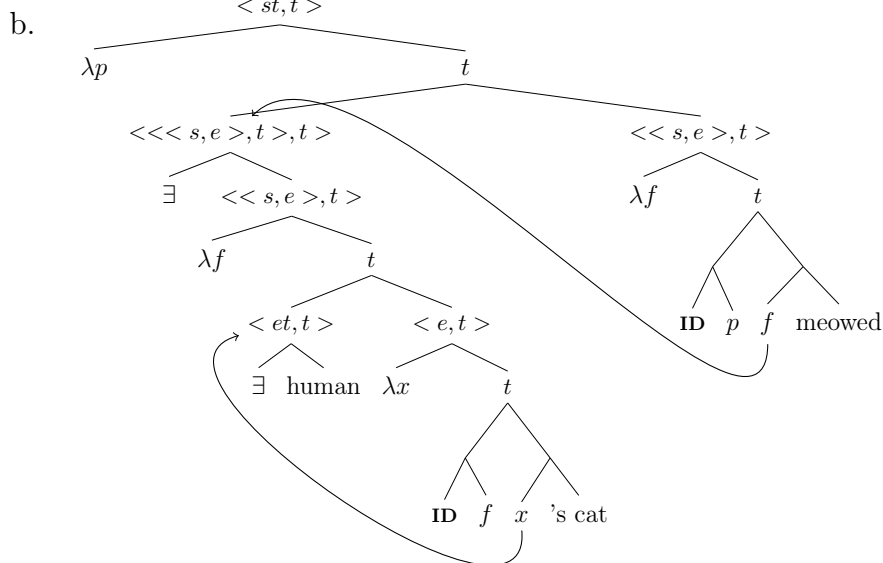
insist that the question nucleus be an intensional object, i.e. a proposition of type $\langle s, t \rangle$, and we could in principle simply end up with an object of type $\langle t, t \rangle$ as the meaning derived for a simple *wh*-question like "who left?". But given that this useless object will be independently filtered out and ID_2 can *also* compose with IFA, this does not constitute an independent argument in favor of the lexical assumption for ID_2.

3.2 Appendix: An alternative theory of pied-piping closer to (the letter of) Charlow 2017

Recall Heim's logical forms for *wh*-questions (Heim, 2000), which employ the direct method of building proposition sets. As shown in (28b), the syntax of a *wh*-question is simple. Two ingredients recur in the composition of *wh*-questions. First, there is an interrogative complementizer, labelled ID below. This head composes with its sister (i.e. question nucleus) via IFA and returns the set that contains its intension. The second ingredient is a head that generates scope-taking objects, labelled Q below after Elliott (2015) (and spelled out by *which*). Notice that the meaning of the scope-taking object is complex, as it QRs above a proposition set and has to compose with a function into sets. In particular, Q takes a set of individuals P and a function R from individuals to proposition sets and applies each member of P to R. The end result is the Hamblin-denotation of a *wh*-question. The meanings for Q and ID are given in (29).

(28)   a.   Which cat meowed?

        b.

$$< st, t >$$

$$<< e, < st, t >>, < st, t >> \qquad < e, < st, t >>$$

$$\text{Q}_{\text{which}} \quad \text{cat} \qquad \lambda_1 \quad << s, t >, t >$$

$$\text{ID}$$

$$\text{t}_1 \quad \text{meowed}$$
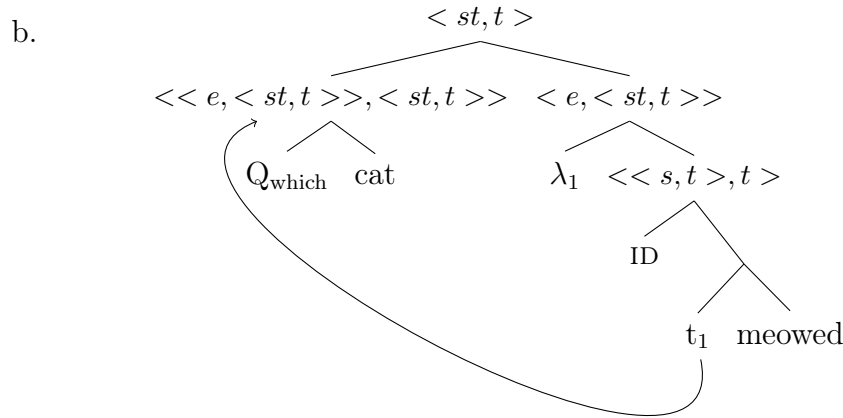
(29)   a. $[\![\text{ID}]\!]^{\text{w}} = \lambda p_{< s, t >}. \ \lambda q_{< s, t >}. \ q = p$

        b. $[\![\text{Q}]\!]^{\text{w}} = \lambda P_{< e, t >}. \ \lambda R_{< e, < st, t >>}. \ \lambda p. \ \exists x : P(x){=}1 \ \& \ R(x)(p) = 1$

Upgrading Heim's logical forms for *wh*-questions, Charlow (2019) proposes a general theory of exceptional (island-violating) scope of indefinites which relies on pied-piping. The ingenious insight in Charlow (2019) is that the ingredients in Heim's logical forms for *wh*-questions already provide an account of exceptional scope that relies on pied-piping. They only need to be defined type-neutrally. That is, ID will not just compose with clauses but ojects of type α where α is any type. And the

same will be true for the Q morpheme.

Here, I demonstrate how Charlow's theory can be extended to *wh*-questions[12] and be used to derive the right meaning for *wh*-questions that involve pied-piping. An important note: departing from Charlow's take on the representation of intensionality, I continue to assume Scope Theory of Intensionality (STI) (see Chapter 2).[13]

As noted above, Charlow's crucial insight is to give type-neutral meanings for the ingredients of Heim's logical forms for *wh*-questions. Therefore, we go from (30) to (31).

(30)   a. $[\![\text{ID}]\!]^{\text{w}} = \lambda p_{<s,t>}. \ \lambda q_{<s,t>}. \ q = p$
       b. $[\![\text{Q}]\!]^{\text{w}} = \lambda P_{<e,t>}. \ \lambda R_{<e,<st,t>>}. \ \lambda p. \ \exists x\!: P(x){=}1 \ \& \ R(x)(p) = 1$

(31)   a. $[\![\text{ID}]\!]^{\text{w}} = \lambda M_{<s,\alpha>}. \ \lambda N_{<s,\alpha>}. \ M = N$
       b. $[\![\text{Q}]\!]^{\text{w}} = \lambda P_{<\beta,t>}. \ \lambda R_{<\beta,<\gamma,t>>}. \ \lambda p_{\gamma}. \ \exists m\!: P(m){=}1 \ \& \ R(m)(p) = 1$

Admittedly, it becomes harder to see the intuition behind the type-neutral variants of these morphemes. Hence, it will be more efficient to use the hybrid set-function notations for these morphemes, as Charlow (2019) does. The meanings for these morphemes in hybrid set-function notation are given in (32) below. As can be seen below, ID takes the **intension** of its complement (which can be of any type) and returns the set that contains it. The Q morpheme, on the other hand, combines with a set P and applies each member of P to a function K into sets. Essentially, Q morpheme makes it possible to quantify into a set[14]. Notably, these are identical in every respect to the ingredients that Heim's logical forms uses except for the fact that the meanings in (31)/(32) are type-flexible.

(32)   a. $[\![\text{ID}]\!]^{w} = \lambda M_{<s,\alpha>}. \ \{M\}$
       b. $[\![\text{Q}]\!]^{w} = \lambda P. \ \lambda K. \ \bigcup_{m \in P} K(m)$

Defining these ingredients type-neutrally has an obvious consequence. Semanti-

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[12]I owe my thanks to Simon Charlow for useful discussion. I have benefited from Elliott (2015) who applies Charlow's theory to *wh*-questions. However, Elliot does not provide a discussion on how Charlow's theory would address von Stechow's objection to pied-piping in *wh*-questions. See also Elliot and Sauerland (2019).

[13]Remember that STI does not by itself provide a empirically satisfactory theory of *de re*. Therefore, the presentation here only aims to show how Charlow's theory can derive the right reading for pied-piping in *wh*-questions under the assumptions of STI. I will not discuss how one could *block* the wrong reading for pied-piping under this alternative. In the next chapter, I will do this for the ∃-theory alternative.

[14]A reminder on the hybrid notation: $\bigcup_{x \in \textbf{human}} \{\lambda w'. \ x \text{ left in } w'\}$ is equivalent to the function $\lambda p. \ \exists x \ \textbf{human}(x) \wedge p = \lambda w'. \ x \text{ left in } w'$

cally, there is no reason why they should not apply to objects of any type.

What is crucial about ID is that it insists that its complement be an intensional object. Under the assumptions of STI, this means ID will compose with its complement via Intensional Functional Application. This is illustrated below. ID always gives the set that contains the intension of the object it applies to.

(33)   ⟦ID Sue's cat⟧^{w} =
        {$\lambda w'$. ⟦Sue's cat⟧$^{w'}$}
        $\lambda f_{<s,e>}$. $f = \lambda w'$. ⟦Sue's cat⟧$^{w'}$ *function notation*

The Q morpheme, on other hand, does not make any reference to intensionality. It is simply looking for a set (of objects of any type) to form a scope-taking object. The Q morpheme, whose denotation is repeated in (34), forms a scope-taking object, which I will call QP, when it combines with its sister, as shown in (35). In (35) is an object that can take scope in a *wh*-question, equivalent to *which book*.

(34)   ⟦Q⟧$^w = \lambda P_{<\alpha,t>}$. λK. $\bigcup_{m \in P} K(m)$

(35)   ⟦Q book⟧^{w} =
        λK. $\bigcup_{x \in \llbracket book \rrbracket^w} K(x)$
        λK. λQ. $\exists x$ ⟦book⟧$^w(x)$ & $Q = K(x)$ *function notation*

The type-flexibility of the Q morpheme and the ID morpheme will be crucial in deriving the right meaning for pied-piping in *wh*-questions. Before we see how pied-piping will work, let us consider a simple case of scope-taking in Charlow's system. Notice that this will be identical to Heim's logical forms.

As illustrated in (36), QPs are able to take scope above a set that ID forms. The output of the derivation is shown below in the mixed set-function notation and is equivalent to the function in (36c). One point that needs to be clarified is what sort of scopal objects QPs are. Of particular interest is the question what type of trace they leave when they QR. Notice that even though the Q morpheme is defined type neutrally, we know what type its trace can be. For example, in the LF below, QP can combine with a function K, whose domain includes objects of type e. Hence, it follows that the trace of the QP can be of type e.

(36) a. $[\![\text{which book is long}]\!]^{\text{w}} =$

b.
$$\bigcup\nolimits_{x \in [\![\text{book}]\!]^{\text{w}}} \{\lambda w'.\ x \text{ is long in } w'\}$$

$\lambda K.\ \bigcup\nolimits_{x \in [\![\text{book}]\!]^{\text{w}}} K(x) \qquad \lambda x.\ \{\lambda w'.\ x \text{ is long in } w'\}$

$\quad$ Q $\quad$ book $\qquad\qquad\qquad$ λ_1 $\quad$ $\{\lambda w'.\ g(1) \text{ is long in } w'\}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ ID

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ t_1 $\quad$ long
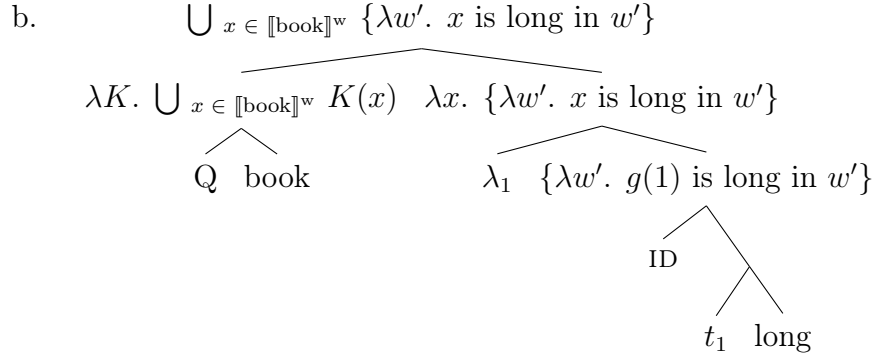
c. $\lambda p.\ \exists x\ [\![\text{book}]\!]^{\text{w}}(x)\ \&\ p = \lambda w'.\ x \text{ is long in } w'$

Let us see now how the type neutrality of Q and ID provide an account of pied-piping. Unfortunately, as the size of the pied-piped constituent increases, the formulas become harder to read. Hence, it might be useful to go over the syntax of pied-piping before its semantics. For example, the *wh*-question **whose book is long** will roughly have the LF in (37) (lambda binders of traces not shown). Namely, there are two movement steps: **who** moves into a scope position above the ID *within* the pied-piped phrase and the entire pied-piped phrase moves into a scope position above the ID in the clausal spine. In both cases, ID forms a set, above which a QP takes scope. (The node α will soon be referred to in the text.)

(37) Whose book is long?

QP_2

Q $\qquad$ $\boxed{\alpha}$ $\qquad\qquad$ ID

$\qquad$ who_1 $\qquad\qquad\qquad$ t_2 $\quad$ long

$\qquad$ Q $\quad$ human $\quad$ ID

$\qquad\qquad\qquad$ t_1 $\quad$'s book
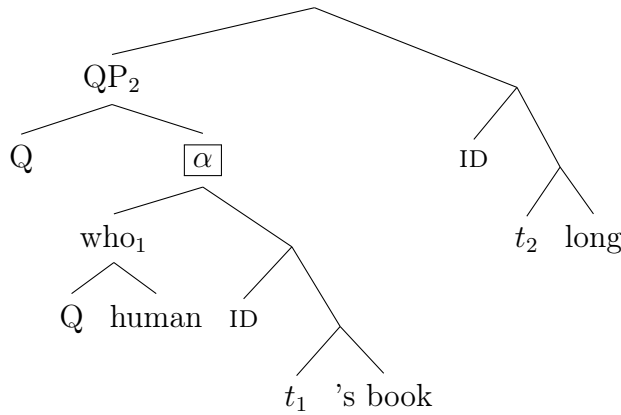
Consider below the (partial) LF for the node α. Notice that the ouput of this derivation is a set of individuals concepts, equivalent to the function in (38b). (Remember that the intensionalization of the complement of ID is thanks to ID itsef.)

(38) a. $\bigcup_{x \in [\![\text{human}]\!]^{\text{w}}} \{\lambda w'. \iota y: y \text{ is } x\text{'s book in } w'\}$

$\lambda K. \bigcup_{x \in [\![\text{human}]\!]^{\text{w}}} K(x)$ $\lambda x. \{\lambda w'. \iota y: y \text{ is } x\text{'s book in } w'\}$

Q   human λ_1 $\{\lambda w'. \iota y: y \text{ is } g(1)\text{'s book in } w'\}$

ID

t_1 's book

b. $\lambda f_{<s,e>}. \exists x\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ f = \lambda w'. \iota y: y \text{ is } x\text{'s book in } w'$

We now have a set which a Q morpheme can combine with to form a scope-taker, as in (39). This is the denotation for the entire pied-piped phrase, which is equivalent to the function in (40).

(39) $[\![\text{whose book}]\!]^{\text{w}} = [\![Q]\!]^{\text{w}} ([\![\alpha]\!]^{\text{w}}) =$
$[\![Q]\!]^{\text{w}}(\bigcup_{x \in [\![\text{human}]\!]^{\text{w}}} \{\lambda w'. \iota y: y \text{ is } x\text{'s book in } w'\})=$ (from (38a))
$\lambda K. \bigcup_{f \in \bigcup_{x \in [\![\text{human}]\!]^{\text{w}}} \{\lambda w'. \iota y: y \text{ is } x\text{'s book in } w'\}} K(f)$

(40) $\lambda K.\ \lambda Q.\ \exists f\ \exists x\ [\![\text{human}]\!]^{\text{w}}(x)\ \&\ [f = \lambda w'. \iota y: y \text{ is } x\text{'s book in } w']\ \&\ [Q=K(f)]$

As we have seen above, this complex QP takes scope above the clausal ID. How do we know what the semantic type of its trace is? This QP is looking for a function K whose domain includes individual concepts of type $< s, e >$. Hence, when *whose book* moves, its trace must also be of type $< s, e >$. Notably, however, the trace of *whose book* cannot compose with its sister via FA or IFA, as *long* requires an object of type e but the trace of *whose book* is of type $< s, e >$. To compose the two nodes, Extensional Functional Application (von Fintel and Heim, 2011) will be used.

The logical form of the *wh*-question below is in (41b). The typed-derivation for the entire logical form is in (42).

(41)   a. $[\![\text{whose book is long}]\!]^w =$

b. $\bigcup_{f \in \bigcup_{x \in [\![\text{human}]\!]^w} \{\lambda w'.\ \iota y:\ y \text{ is } x\text{'s book in } w'\}} \{\lambda w'.\ f(w') \text{ is long in } w'\}$

$[\![\text{whose book}]\!]^w \quad \lambda f_{<s,e>}.\ \{\lambda w'.\ f(w') \text{ is long in } w'\}$

$\lambda_1 \quad \{\lambda w'.\ g(1) \text{ is long in } w'\}$

ID

t_1 long

(42)

$<st,t>$

$<<se,<st,t>>,<st,t>>$ $<se,<st,t>>$

Q $<se,t>$ λf $<st,t>$

ID

$<<e,<se,t>>,<se,t>>$ $<e,<se,t>>$ f long

Q   human λx $<<s,e>,t>$

ID

x 's book

The output of this semantic derivation is characterized by the function in (43b).

(43) $[\![\text{whose book is long}]\!]^w =$

a. $\bigcup_{f \in \bigcup_{x \in [\![\text{human}]\!]^w} \{\lambda w'.\ \iota y:\ y \text{ is } x\text{'s book in } w'\}} \{\lambda w'.\ f(w') \text{ is long in } w'\} =$

b. $\lambda p.\ \exists f\ \exists x\ [\![\text{human}]\!]^w(x)\ \&\ f = \lambda w'.\ \iota y:\ y \text{ is } x\text{'s book in } w'\ \&\ p = \lambda w'.$
$f(w') \text{ is long in } w'$

The function in (43b) is the desired function because the extension of the function *fed* at w' applies to the extension of the (existentially bound) individual concept f at w'. Hence, the function in (43b) is identical to the function in (44).

(44) $\lambda p.\ \exists x\ [\![\text{human}]\!]^w(x)\ \&\ p = \lambda w'.\ [\iota y:\ y \text{ is } x\text{'s book in } w']\text{ is long in } w'$

In other words, the derived meaning is equivalent to the meaning we would derive if ['s cat] *syntactically* reconstructed at LF below the matrix ID (which was von Ste-chow's solution) or did not move in the first place. As we have seen above, Charlow's theory of scope (worked out under the assumptions of STI) allows us to 'semantically

reconstruct' the pied-pipee (i.e. the constituent that we would get if the pied-piper were extracted out of the pied-piped phrase). That is, the pied-pipee ends up getting interpreted within the intensional complement of the matrix ID, as desired. Therefore, this system is able to derive the right reading for pied-piping in *wh*-questions without undoing any movement at LF. Pied-piping at LF, then, yields the right result when the ID morpheme is type-flexible, insists on intensional arguments, and obligatorily occurs within pied-piped phrases.

Finally, consider below how the *wh*-question "*whose cat meowed?*" is derived under Charlow's theory of pied-piping and the ∃-theory variant presented in the previous section. They yield equivalent results, yet the former resorts to quantifying into sets whereas the latter does not.

(45)

Root: $< st, t >$
- Left: $<< se, < st, t >>, < st, t >>$
  - **Q**
  - $< se, t >$
    - $<< e, < se, t >>, < se, t >>$
      - **Q**   human
    - $< e, < se, t >>$
      - λx $<< s, e >, t >$
        - **ID**
          - x 's cat
- Right: $< se, < st, t >>$
  - λf $< st, t >$
    - **ID**
      - f meowed

(46)

Root: $< st, t >$
λp t
- Left: $<<< s, e >, t >, t >$
  - ∃ $<< s, e >, t >$
    - λf t
      - $< et, t >$ $< e, t >$
        - ∃ human λx t
          - **ID** f x 's cat
- Right: $<< s, e >, t >$
  - λf t
    - **ID** p f meowed
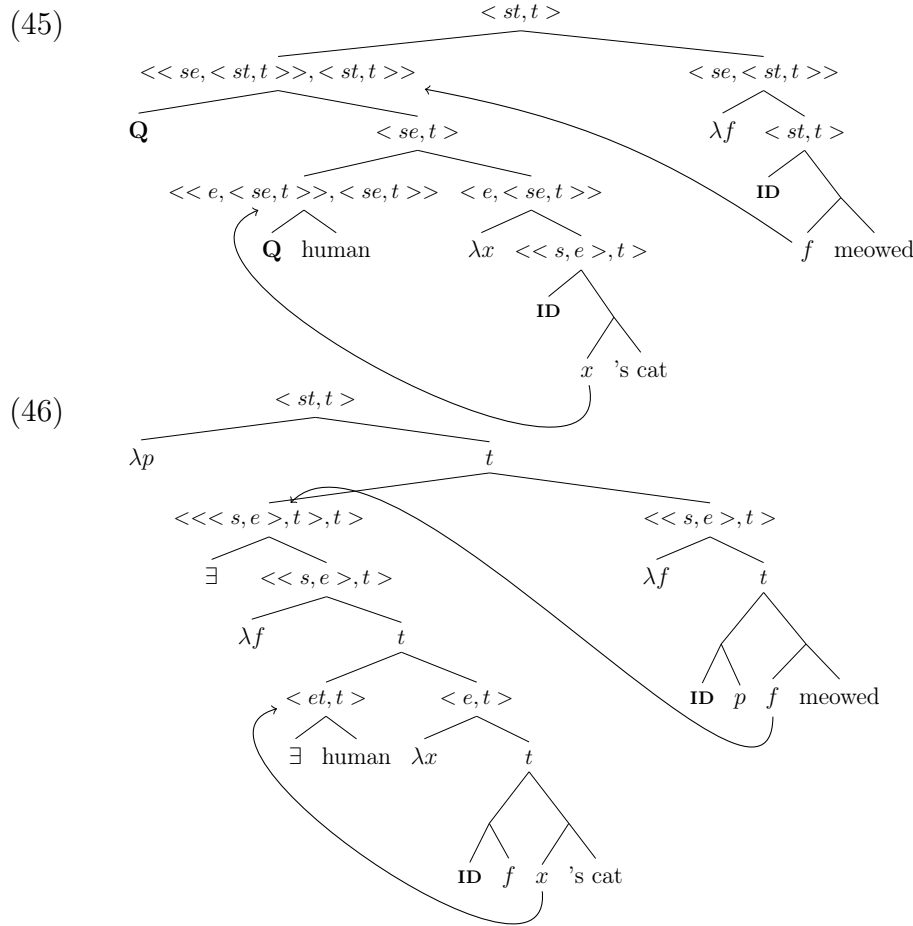
As will be discussed in the next chapter, the ∃-theory variant will benefit from the availability of a scope position of type-t within pied-piped phrases in deriving the *de re* construal of DPs which appear to be inside scope/extraction islands.

Chapter 4

Pied-piping for exceptional scope and exceptional *de re*

In the previous chapter, I proposed a theory of pied-piping in *wh*-questions that exclusively makes use of the type-flexible variants of the ingredients that von Stechow (1996) uses to derive the Hamblin-denotation of a *wh*-question. In the first part of this chapter, I show how this theory, like Charlow's (2019), can readily be extended to island-violating *wh*-scope and more generally island-violating scope of indefinites, i.e. "**exceptional scope**" as Charlow (2019) names it. All we need to assume for this extension is that the ID head that I have argued to feature in the internal syntax of pied-piped phrases like 'whose mother' can also be merged on top of an extraction island, creating a scope position at its edge.

The proposal relies on a syntax where **island pied-piping** (Nishigauchi, 1990; Richards, 2000; Cable, 2010) and **(internal) *wh*-movement** to the edge of a pied-piped phrase (van Riemsdijk, 1985; Richards, 2000; Heck, 2008, 2009) are available. Both of these have been argued to be attested in *wh*-questions. There are overt island pied-piping languages like Finnish (Huhmarniemi, 2012), as illustrated in (1).

(1)   **Overt Island pied-piping in Finnish**

    a.   [$_\text{island}$ **kenelle** kirjoitetun   kirjeen]$_1$ Pekka luki **t**$_1$?
            who.ALL written.PTCP letter.ACC Pekka read
      'Who$_1$ is such that Pekka read the letter written to them$_1$?'
      Huhmarniemi (2010:18)

    b.   ***kenelle**$_1$ Pekka luki [$_\text{island}$ **t**$_1$ kirjoitetun   kirjeen]?
      who.ALL Pekka read   written.PTCP letter.ACC
      Huhmarniemi (2012:329c)

Moreover, overt pied-piping in *wh*-questions typically[1] requires the *wh*-phrase to be at the left edge of the pied-piped phrase (Heck, 2008; Cable, 2010). This is conceivably a result of *wh*-fronting inside pied-piped phrases[2], as illustrated by the Finnish data below. While internal *wh*-movement within pied-piped phrases currently may be less well-understood than canonical *wh*-movement in the clausal spine, there is evidence that it is real —at least in some languages. This suggests that a scope position at the edge of pied-piped phrases is not a far-fetched idea after all. See Chapter 6 for relevant discussion on syntactic properties of overt island pied-piping and internal *wh*-movement.

(2)   **Finnish internal wh-movement**   Huhmarniemi (2010:15)

    a.   Pekka halusi   lähteä [auttamaan kodittomia   koiria]
          Pekka wanted leave   help.MA   homeless.PAR dogs.PAR
          'Pekka wanted to go to help homeless dogs.'

    b.   [**Ketä**$_1$ auttamaan t$_1$]$_2$ Pekka halusi   lähteä t_2
          who   help.MA   Pekka wanted leave
          'Who$_1$ is such that Pekka wanted to go to help them$_1$?'

    c.   *[auttamaan **ketä**]$_2$ Pekka halusi   lähteä t$_2$
          help.MA   who   Pekka wanted leave

In the second part of this chapter, I discuss how the ∃-theory of pied-piping can be used to address the scope paradox concerning universal quantifiers that arise under assumptions of the Scoping Theory of Intensionality (STI). In particular the availability of *de re* construals for universal quantifiers that take scope within extraction islands (or scope islands) — which I will call **exceptional *de re*** — was argued to justify a more permissive system that relies on binding of object language world (or situation) pronouns (Percus, 2000). I will show that under the ∃-theory pied-piping can also derive **exceptional *de re*** strictly under the assumptions of STI, building on von Fintel and Heim's (2011) account of narrow scope-*de re* that relies on scope reconstruction. Finally, I revisit von Stechow's problem and show that nothing I say regarding exceptional *de re* changes the result we obtained in Chapter 3

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[1]Richards (2019) argues for a correlation between optional *wh*-in-situ in questions and optional *wh*-in-situ within pied-piped phrases. Danny Fox informs me that Hebrew might be an exception to this. Here I put aside important questions on what governs *wh*-in-situ and where it is licensed. See also Chapter 6 for relevant discussion.

[2]Overt manifestations of this sort of internal movement are not unconstrained, however. I will come back to this issue in Chapter 6.

4.1 Deriving exceptional scope via QR

As we briefly discussed in Chapter 1, there is a cross-linguistically robust asymmetry where indefinites and *wh*-phrases (as opposed to other quantificational DPs) appear to be privileged in allowing almost unlimited scoping possibilities (Farkas, 1981; Fodor and Sag, 1982; Heim, 1982; Ludlow and Neale, 1991; Ruys, 1992; Abusch, 1994; Reinhart, 1997, a.o). Most importantly, they can scope out of extraction islands. See below the contrast between an indefinite and a universal quantifier that is linearly inside the antecedent of a conditional, a canonical island for extraction. While the indefinite 'a rich relative of mine' can scope above the conditional, 'every rich relative of mine' cannot (Reinhart, 1997; Charlow, 2019).

(3)   a.   If **a rich relative of mine** dies, I'll inherit a house.
          ✓ $\exists x$: x is a rich relative of mine & if x dies, I'll inherit a house.

      b.   If **every rich relative of mine** dies, I'll inherit a house.
          × $\forall x$: x is rich relative of mine → if x dies, I'll inherit a house.

The data below from Turkish illustrates the contrast between the universal quantifier *her müşteriye* 'every customer' vs. the indefinite *bi müşteriye* 'a customer' and the *wh*-phrase *hangi müşteriye* 'which customer'. The relevant island here is a complex quantifier phrase that embeds a relative clause.

(4)   [island **her müşteriye**   gönderdiğimiz çoğu ürün]   defoluydu.
            every customer.DAT send.REL.1PL most product defective.PST
      × 'Every customer x is s.t. most products that we sent to x were defective.'

(5)   [island **bi müşteriye**   gönderdiğimiz çoğu ürün]   defoluydu.
            a customer.DAT send.REL.1PL most product defective.PST
      ✓ 'There is a customer x is s.t. most products that we sent to x were defective.'

(6)   [island **hangi müşteriye**   gönderdiğimiz çoğu ürün]   defoluydu?
            which customer.DAT send.REL.1PL most product defective.PST
      ✓ 'Which customer x is s.t. most products that we sent to x were defective?'

As was discussed in Chapter 1 and 2, this peculiar asymmetry has been largely taken to be an indication of a fundamental difference in the way indefinites and *wh*-phrases can take scope (albeit not by everyone (von Stechow, 1996; Abusch, 1994, e.g)). That is, the QR theory of scope-taking has been found to be insufficient to explain the exceptional scope-taking possibilities for indefinites and *wh*-phrases. Hence,

additional machinery like choice functions (Reinhart, 1997), alternative semantics (Beck, 2006; Kotek, 2016), or a combination of them (Cable, 2010) have been argued to be part of grammar. Importantly, these mechanisms are able to generate the right scope for these expressions through logical forms where they are in-situ (i.e. do not QR). However, these mechanisms are typically assumed to *co-exist* with the mechanism of Quantifier Raising (via movement) in that quantificational DPs that are not *wh*-phrases or indefinites *do* respect movement islands (i.e. they cannot QR out of them). In that sense, these non-QR mechanisms can be seen as "enrichments" on a baseline grammar, as Charlow (2019) puts it. Then, the justification of these enrichments is contingent on there being no empirically satisfactory way to derive exceptional scope for indefinites and *wh*-phrases via Quantifier Raising — that is, without having to assume that extraction islands are not islands for extraction when it comes to existential quantifiers.

Charlow (2019) has argued that there *is* a way to derive exceptional scope via QR. In particular, he has shown that if grammar can turn islands into scope-taking objects via freely available type-shifters, pied-piping *can* in fact derive exceptional scope, cf. von Stechow (1996). In what follows, I briefly discuss how this system is able to derive exceptional scope. Next, I present in more detail how the theory of pied-piping I call the ∃-theory can yield the same results by simplifying the implementation of Charlow's core idea even further. While the two systems derive exceptional scope in very similar ways, the ∃-theory takes all scope-taking objects to be generalized quantifiers that compose with a function into truth values (i.e. QR always targets a type-t node). In Charlow's system, however, exceptional-scope-takers are objects that compose with a function into sets (i.e. they quantify into a set). This difference between the two systems makes different predictions in the way exceptional scope is limited to *wh*-phrases and indefinites, as we shall see.

4.1.1 Charlow (2019) on exceptional scope

As we have also discussed in the appendix to the previous chapter, the theory of pied-piping in Charlow (2019) is able to derive the right reading for pied-piping in *wh*-questions under the assumptions of Scope Theory of Intensionality. Although I demonstrated the core idea of Charlow's theory through pied-piping in *wh*-questions, the empirical focus of Charlow (2019) is actually the peculiar behavior of indefinites that scope out of extraction islands, which he calls **exceptional scope**.

Charlow (2019) argues that exceptional scope can be derived via pied-piping if grammar allows complex scope-takers to be generated via iteration of two type-flexible type shifters ID and Q, whose denotations are repeated below. Recall that ID is the type shifter that forms sets and Q is the type-shifter that takes a set and forms a scope-taker (i.e. an object that existentially quantifies into sets). (I continue to use STI for intensionality, departing from Charlow.)

(7) a. $\llbracket \text{Q} \rrbracket^{\text{w}} = \lambda P.\ \lambda K.\ \bigcup_{m \in P} K(m)$

   b. $\llbracket \text{ID} \rrbracket^{w} = \lambda M_{<s,\alpha>}.\ \{M\}$

In what follows, I illustrate how Charlow's theory would derive the right scope for the island-violating *wh*-question in (8). The logical form for this Turkish *wh*-question is given below.

(8) [$_{\text{island}}$ **hangi müşteriye** gönderdiğimiz çoğu ürün] defoluydu?
        which customer.DAT send.REL.1PL most product defective.PST
        ✓'Which customer x is s.t. most products that we sent to x were defective?'

(9)
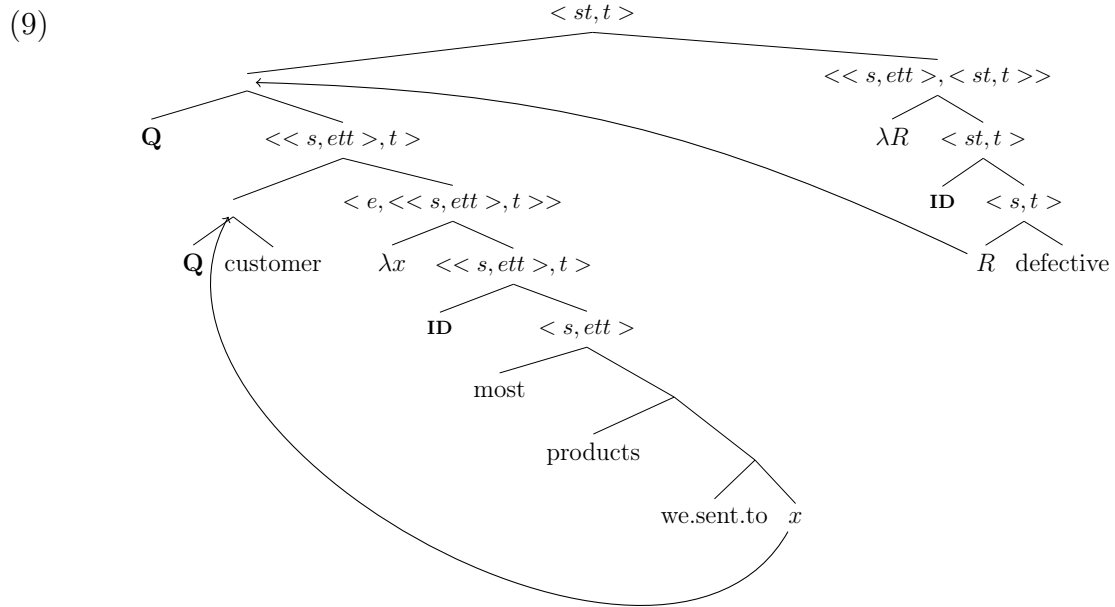
[A note on intensional types: when a node A composes with the intension of its sister B via IFA, I type B as if A and B compose via FA, to make it easy to follow the derivations.]

As shown below, the logical form for this *wh*-question involves two steps of quantifying into a set. The type shifter ID is merged on top of the quantificational DP, forming a singleton set that contains the intension of that DP. The *wh*-phrase quantifies into this set by QRing above it, giving us a non-singleton set of the same type, whose members vary by customers. Finally, another Q morpheme is merged on top of this structure forming a scope-taker that QRs above and scopes into a proposition set formed by merging an ID on the clause, i.e. the question nucleus. The end result is a non-singleton proposition-set, i.e. the Hamblin denotation of a *wh*-question, given in function notation in (10) (as hybrid set-function notation is a typographical mess).

(10) $\lambda p.\ \exists R_{<s,<et,t>>}\ \exists x:$ $[\![$customer$]\!]^{\mathrm{w}}(x)$ & $[p = \lambda w'.\ R(w')([\![$defective$]\!]^{\mathrm{w'}})]$ & $[R = \lambda w'.\ [\![$most$]\!]^{\mathrm{w'}}(\lambda y.\ [\![$products$]\!]^{\mathrm{w'}}(y)$ & $[\![$sent$]\!]^{\mathrm{w'}}(y)(\text{to-}x)(\text{we}))]$

Note that the function above is identical to the function in (11).[3]

(11) $\lambda p.\ \exists x:$ $[\![$customer$]\!]^{\mathrm{w}}(x)$ & $[p = \lambda w'.\ [\![$most$]\!]^{\mathrm{w'}}(\lambda y.\ [\![$products$]\!]^{\mathrm{w'}}(y)$ & $[\![$sent$]\!]^{\mathrm{w'}}(y)(\text{to-}x)(\text{we}))([\![$defective$]\!]^{\mathrm{w'}})]$
        "Which customer$_i$ is such that most products we sent to them$_i$ were defective?"

For indefinites that scope above an island, Charlow employs a method that is very much similar to what an analysis using Alternative Semantics/Pointwise Composition would posit, e.g. (Kratzer and Shimoyama, 2002). A closure operator, categorematically defined for proposition-sets below[4] applies to a non-singleton proposition set (i.e. a *wh*-question denotation) and returns true if there is a true member of that set.

(12) $[\![\maltese]\!]^{\mathrm{w}} = \lambda Q_{<<s,t>,t>}.\ \exists p:\ Q(p) = 1$ & $p(w){=}1$

Accordingly, the only difference between the logical form for the sentence below (for the given wide scope reading of the indefinite) and the logical form for the *wh*-question above is that the former will have $\maltese$ apply at the root node, deriving the reading where the indefinite has scope over the island. The simplified version of the derived truth conditions[5] for this reading of the sentence below is given in (29b).

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[3]This is because in (10) the extension of the existentially bound variable R at w' composes with the extension of the matrix predicate *defective* at w' (via Extensionalizing Functional Application). This semantically reconstructs the complement of the ID head inside the pied-piped phrase into the question nucleus, i.e. below the matrix ID head.

[4]This is again slightly different from Charlow's closure operator in that I am presenting his proposal under STI's assumptions.

[5]The derived truth conditions are actually as follows: the extension of $[\![$(13)$]\!]$ at w is true iff $\exists p$

(13)   [$_{\text{island}}$ **bi müşteriye**   gönderdiğimiz çoğu ürün]   defoluydu.
              a   customer.DAT send.REL.1PL most product defective.PST
             ✓'There is a customer x is s.t. most products that we sent to x were defective.'

(14) $[\![(13)]\!]^{\text{w}} = [\![↯ (10)]\!]^{\text{w}} = 1$ iff
    $\exists p\ \exists x$: $[\![\text{customer}]\!]^{\text{w}}(x)$ & $p(w)=1$ & $p = \lambda w'.\ [\![\text{most}]\!]^{\text{w'}}(\lambda y.\ [\![\text{products}]\!]^{\text{w'}}(y)$
    & $[\![\text{sent}]\!]^{\text{w'}}(y)(\text{to-}x)(\text{we}))([\![\text{defective}]\!]^{\text{w'}}) = 1$ iff
    $\exists x$: x is a customer & most products that we sent to x were defective

We can now see how different scoping possibilities for indefinites and *wh*-phrases vs. other quantificational DPs can be captured under this system. It should suffice to compare the lexical entries below. Indefinites and *wh*-phrases can only quantify into sets (typically formed by an ID[6]) whereas other quantificational DPs being regular generalized quantifiers will not be able to quantify into a set created by an ID (simply due to a type-mismatch). Therefore, even though both types of quantificational objects take scope via QR, exceptional scope for the latter is lexically blocked.

(15)   a. $[\![\text{every customer}]\!]^{\text{w}} = \lambda P.\ \forall x\ [\![\text{customer}]\!]^{\text{w}}(x) \rightarrow P(x)$

        b. $[\![\text{a customer}]\!]^{\text{w}} = [\![\text{which customer}]\!]^{\text{w}} =$[7]
           $\lambda K.\ \bigcup_{x \in [\![\text{customer}]\!]^{\text{w}}} K(x)$ (hybrid notation)
           $\lambda K.\ \lambda p.\ \exists x\ [\![\text{customer}]\!]^{\text{w}}(x)$ & $K(x)(p)$ (function notation)

In the following section, I show how the $\exists$-theory yields the same results without assuming that indefinites and *wh*-phrases quantify into sets. That is, an important difference from Charlow's theory will be that indefinites and *wh*-phrases will still have generalized quantifier denotations just like other quantificational DPs. Hence, we will not (be able to) resort to a lexical blocking effect to state the different scoping possibilities for quantificational DPs. Rather, logical forms that involve an exceptional

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$\exists R_{< s, < et, t >>}\ \exists x$: $[\![\text{customer}]\!]^{\text{w}}(x)$ & $[p = \lambda w'.\ R(w')([\![\text{defective}]\!]^{\text{w'}})]$ & $[R = \lambda w'.\ [\![\text{most}]\!]^{\text{w'}}(\lambda y.$ $[\![\text{products}]\!]^{\text{w'}}(y)$ & $[\![\text{sent}]\!]^{\text{w'}}(y)(\text{to-}x)(\text{we}))]$ & $p(w)$. This is equivalent to the truth conditions in (14).

  [6]Though not necessarily. For example, it is conceivable for narrow scope indefinites in object position to quantify directly into the predicate they complement. That is, in a sentence like 'Sue hugged a puppy', if we assume that $[\![\text{hug}]\!]^{\text{w}} = \lambda x.\ \{y:\ y$ kissed x in w$\}$, then $[\![\text{hugged Q puppy}]\!]^{\text{w}}$ will denote $\bigcup_{x \in [\![\text{puppy}]\!]^{\text{w}}} \{y:\ y$ hugged x in $w\}$, the set of things that hugged a puppy (i.e. in function notation: $\lambda x.\ \exists y\ [\![\text{puppy}]\!]^{\text{w}}(y)$ & $[\![\text{hugged}]\!]^{\text{w}}(y)(x))$.

  [7]Of course, an important question is how do $[\![\text{a}]\!]$ and $[\![\text{which}]\!]$ get to be spelled out differently. For languages with distinct spell-outs for indefinites and *wh*-phrases like English and Turkish, morphological rules need to be formulated that determine which Q heads get spelled out overtly and by which morphemes. I will not attempt to do this for Charlow's theory.

scope derivation for quantificational DPs that are not *wh*-phrases or indefinites will return semantically anomalous truth conditions (e.g. *a contradiction*).

4.1.2   The ∃-theory on exceptional scope

Under the ∃-theory, exceptional scope for indefinites and *wh*-phrases is generated in the same way we derived the right meaning for pied-piped constituents in *wh*-questions. The core idea is that the two heads/type-shifters are freely available in the grammar of scoping. Denoting type-flexible functions, they will be able to apply to any scope/extraction island.

(16)   a. $[\![\exists]\!] = \lambda P_{<\alpha,t>}.\ \lambda Q_{<\alpha,t>}.\ \exists m\ [P(m){=}1\ \&\ Q(m){=}1]$

      b. $[\![\text{ID}]\!] = \lambda m_{<s,\alpha>}.\ \lambda n_{<s,\alpha>}.\ n{=}m$

The essential part of generating exceptional scope is **syntactically** turning the island into an existential quantifier. However, crucially, this is *not* a type-shift rule but is fully syntactisized. This is what creates a scope position at the edge of an island and allows us to derive exceptional scope. The syntactic derivation is exactly what we did for small-scale pied-piping and employs the indirect method of building a proposition set (von Stechow, 1996; Fox, 2012; Heim, 2012). We allow ourselves to create a scope position (of type t) at the *edge* of an extraction/scope island with the help of an ID function whose complement is a null operator that moves out, yielding λ-abstraction. This part of the derivation gives us a set that contains the intension of whatever the island denotes. Finally, this set is turned into a scope-taker (i.e. an existential quantifier) by merging it with an ∃ head. This derivation, in some sense, unpacks what would be an Intensionalizing Existential Lift if it were a type shift rule[8], as schematized in the logical form below, for the DP *the cat Sue fed*.

---

[8]Strictly speaking, this cannot be a type-shift because of the intensionalization component. But we could define a morpheme E that composes with its sister via IFA (or syncategorematically):
$[\![\text{E}]\!]^w = \lambda P_{<s,\alpha>}.\ \lambda \Re_{<<s,\alpha>,t>}.\ \exists Q_{<s,\alpha>}\colon \Re(Q){=}1\ \&\ Q = P.$

(17)   a. $\lambda P_{<<s,e>,t>}. \exists f_{<s,e>}: P(f)=1 \ \& \ f = \lambda w'.[\![\text{the cat Sue fed}]\!]^{\text{w'}}$

b.

$<<<s,e>,t>,t>$

$\exists$ $<<s,e>,t>$

$\text{OP}_{<\alpha,\alpha>}$ $<<s,e>,t>$

λ_1 $\boxed{t}$

$<<s,e>,t>$ $\leftarrow$IFA

ID t_1 the cat Sue fed
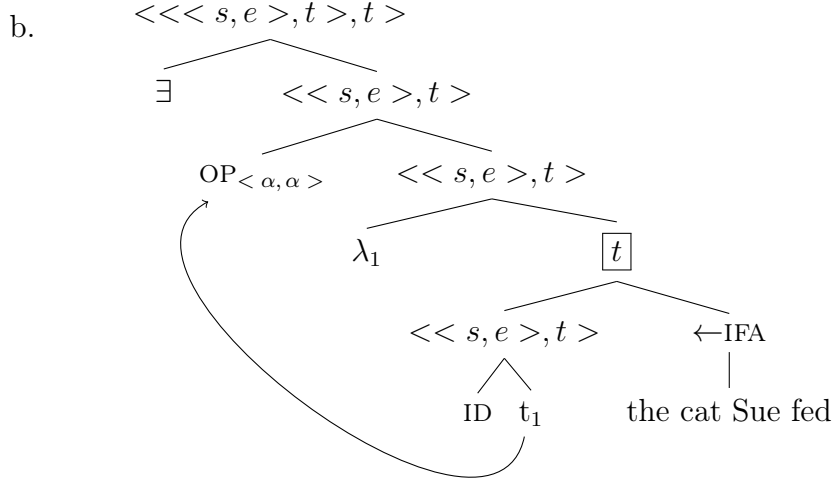
Notice that the final denotation, given in (17a), is an existential quantifier over individual concepts. What will be important in deriving exceptional scope is the boxed scope position of type t right at the edge of the island. It should be emphasized that if we turned islands into existential quantifiers via a type-shift rule or a single morpheme, there would be no scope position of type t.[9]

Deriving exceptional *wh*-scope

The derivation of an island-violating *wh*-question will be identical to the derivation of small-scale pied-piping. For a concrete example, let us go over the syntactic derivation of the Turkish *wh*-question below[10], where the *wh*-phrase **hangi müşteriye** "which customer" is linearly inside a quantification DP containing a relative clause. The proposed logical form for (18) will be derived through the covert movement of the *wh*-phrase to the edge of the island and subsequent covert movement of the entire island, which carries the *wh*-phrase to its scope position. See also Özsoy (1996) for a similar syntactic approach to exceptional *wh*-scope in Turkish that follows the influential proposal by Nishigauchi (1990).

(18)   [island **hangi müşteriye**   gönderdiğimiz çoğu ürün]   defoluydu?
            which customer.DAT send.REL.1PL most product defective.PST
        ✓'Which customer x is s.t. most products that we sent to x were defective?'

---

[9]As we shall discuss briefly in section 4.2.3, it seems important that we keep to the ID function which insists that its arguments be intensional. This ensures that when an island DP QRs above an intensional operator, it will still be interpreted, as if it is below that intensional operator.

[10]A tangential issue is that in Turkish, relative clauses appear to the left of a head-initial determiner. This is a typical position for modifiers and is invariant across declaratives and questions.

The logical form for the *wh*-question in (18) is given below. Deriving this logi-cal form involves two instances of scope-taking. First, the *wh*-phrase, shown as [∃ customer] takes scope above the ID merged right above the island (just like 'who' takes scope above an ID head within the pied-piped phrase 'whose mother'). Second, the entire island, turned into an existential quantifier [over objects of type $< s, < et, t >>$] by the merger of a null ∃ morpheme, moves above the matrix ID. (To improve read-ability, I am not showing the null OP-movements (whose traces are shown as variables Q and p).)

(19)
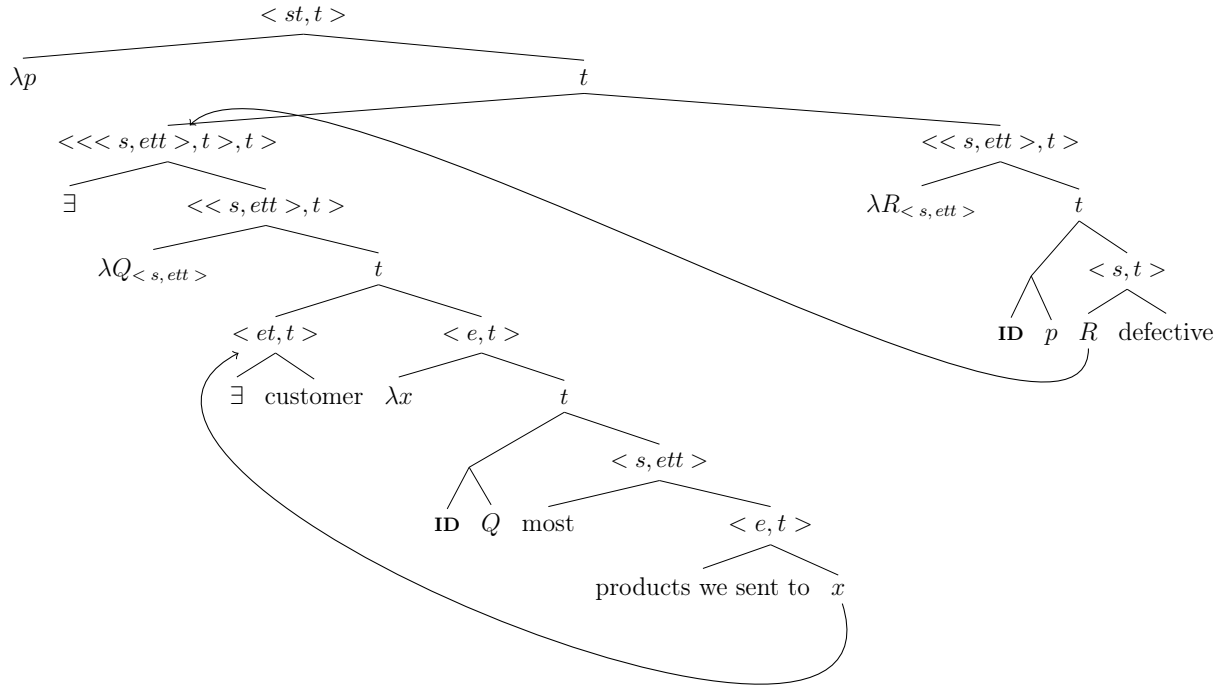
Notably, no scope-taking here involves quantifying into sets. That is, both the *wh*-phrase and the island it pied-pipes are of the type $<<< \alpha >, t >, t >$ and take scope in the same way generalized quantifiers take scope, targeting a type t node. This is the main difference from Charlow's way of generating exceptional scope which involves quantifying into sets. Accordingly, the denotation for the existentially lifted island, within which [∃ customer] takes scope, is as in (20).

(20)   ⟦**hangi müşteriye** gönderdiğimiz çoğu ürün⟧$^{\text{w}}$ =
         $\lambda \Re_{<< s, ett >, t >}. \ \exists Q_{< s, ett >} \ \exists x$: ⟦customer⟧$^{\text{w}}$ & $\Re(Q)$ & $[Q = \lambda w'.$ ⟦most⟧$^{\text{w'}}(\lambda y.$ ⟦products⟧$^{\text{w'}}(y)$ & ⟦sent⟧$^{\text{w'}}(y)(\text{to-}x)(\text{we}))$

The meaning derived from the logical form in (19) is given in (21), the exact same

function that we derived using Charlow's way of deriving a *wh*-question meaning. Note that the trace of the piped-piped island is intensional and composes with its sister *defective* via EFA. This can be seen below in the $\lambda w'.\ R(\mathbf{w'})([\![\text{defective}]\!]^{w'})$ part of the denotation.

(21) $[\![(18)]\!]^{\text{w}} =$
$\lambda p.\ \exists R_{< s,\, < et,\, t\, >>}\ \exists x\colon [\![\text{customer}]\!]^{\text{w}}(x)\ \&\ [p = \lambda w'.\ R(w')([\![\text{defective}]\!]^{\text{w'}})]\ \&$
$[R = \lambda w'.\ [\![\text{most}]\!]^{\text{w'}}(\lambda y.\ [\![\text{products}]\!]^{\text{w'}}(y)\ \&\ [\![\text{sent}]\!]^{\text{w'}}(y)(\text{to-}x)(\text{we}))]$

This is again identical to the function in (22), and hence the right meaning for the *wh*-question under discussion.

(22) $\lambda p.\ \exists x\colon [\![\text{customer}]\!]^{\text{w}}(x)\ \&\ [p = \lambda w'.\ [\![\text{most}]\!]^{\text{w'}}(\lambda y.\ [\![\text{products}]\!]^{\text{w'}}(y)\ \&$
$[\![\text{sent}]\!]^{\text{w'}}(y)(\text{to-}x)(\text{we}))([\![\text{defective}]\!]^{\text{w'}})]$
"Which customer$_i$ is such that most products we sent to them$_i$ were defective?"

Deriving exceptional scope for indefinites

Under the $\exists$-theory, deriving exceptional scope for indefinites is identical to deriving *wh*-scope. The only difference from the derivation of an island violating *wh*-question will be that the final QR position of the pied-piped island will *not* be above an ID, as the desired meaning is a not proposition-set. Hence, unlike in Charlow's analysis, there is no need for a closure operator, for no proposition set needs to be generated for the island to take scope.[11]

Consider again the Turkish sentence below. The derivation in (24) illustrates how the wide-scope interpretation for the indefinite is derived.

(23) [$_{\text{island}}$ **bi müşteriye** gönderdiğimiz çoğu ürün] defoluydu.
     a customer.DAT send.REL.1PL most product defective.PST
     ✓'There is a customer x is s.t. most products that we sent to x were defective.'

---

[11]Remember that in Charlow's theory, objects that take exceptional scope have to quantify into sets, hence a proposition-set has to be generated under Charlow's assumptions.

(24)

t

$<<<s,ett>,t>,t>$ $<<s,ett>,t>$

$\exists$ $<<s,ett>,t>$ $\lambda R_{<s,ett>}$ t

$\lambda Q_{<s,ett>}$ t R defective

$<et,t>$ $<e,t>$

$\exists$ customer λx t

$<s,ett>$

ID Q most $<e,t>$

products we sent to x
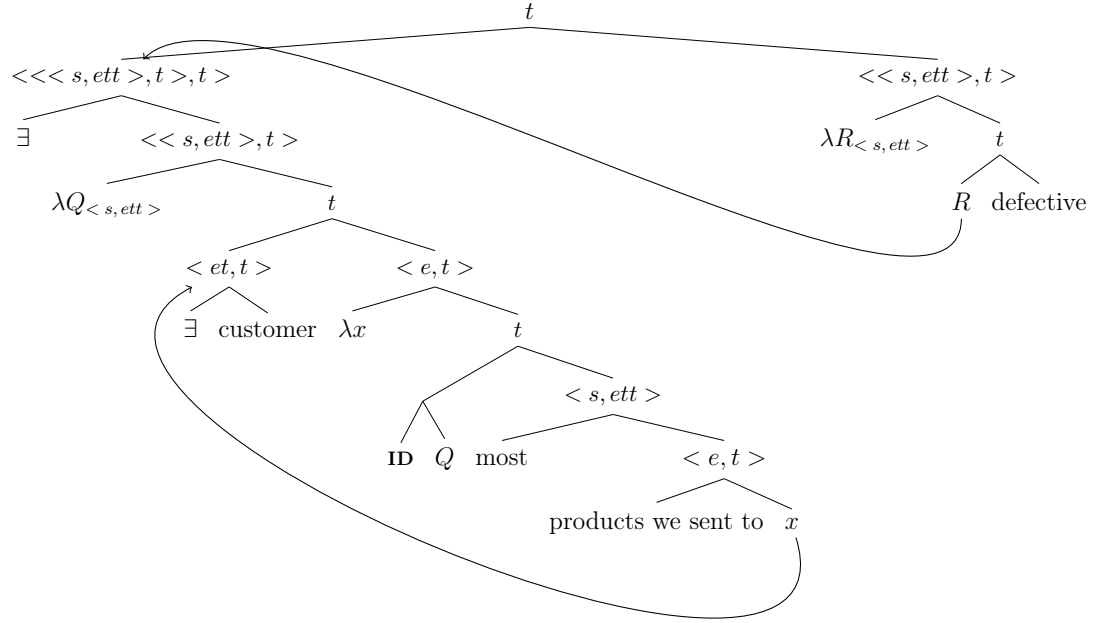
The derived truth conditions for (23) are provided in (25), which is equivalent to the truth conditions given in (26).

(25) $[\![(23)]\!]^{\text{w}} = 1$ iff $\exists R_{<s,<et,t>>}$ $\exists x$: $[\![\text{customer}]\!]^{\text{w}}(x)$ & $R(w)([\![\text{defective}]\!]^{\text{w}})$ & $[R = \lambda w'.\ [\![\text{most}]\!]^{\text{w'}}(\lambda y.\ [\![\text{products}]\!]^{\text{w'}}(y)$ & $[\![\text{sent}]\!]^{\text{w'}}(y)(\text{to-}x)(\text{we}))]$

(26) $[\![(23)]\!]^{\text{w}} = 1$ iff $\exists x$: $[\![\text{customer}]\!]^{\text{w}}(x)$ & $[\![\text{most}]\!]^{\text{w}}(\lambda y.\ [\![\text{products}]\!]^{\text{w}}(y)$ & $[\![\text{sent}]\!]^{\text{w}}(y)(\text{to-}x)(\text{we}))([\![\text{defective}]\!]^{\text{w}})$

To summarize, the proposed syntax of turning islands into existential quantifiers creates a scope position right above the island. An existential quantifier that QRs into this position automatically takes scope outside the island. To put it simply, this way of deriving exceptional scope for indefinites in fact only affects what QRs into the edge of the island, everything else is intensionally evaluated and gets scope in its trace position.[12] Below is a schematic representation with useful labels on important nodes.

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[12]See Chapter 5 for a more detailed discussion.

(27)

∃
 λ₁
  WHAT TAKES EXCEPTIONAL SCOPE
   ∃ ...
   λ₂   EDGE SCOPE POSITION
        WHAT SEMANTICALLY RECONSTRUCTS
     ID t₁
        ... t₂
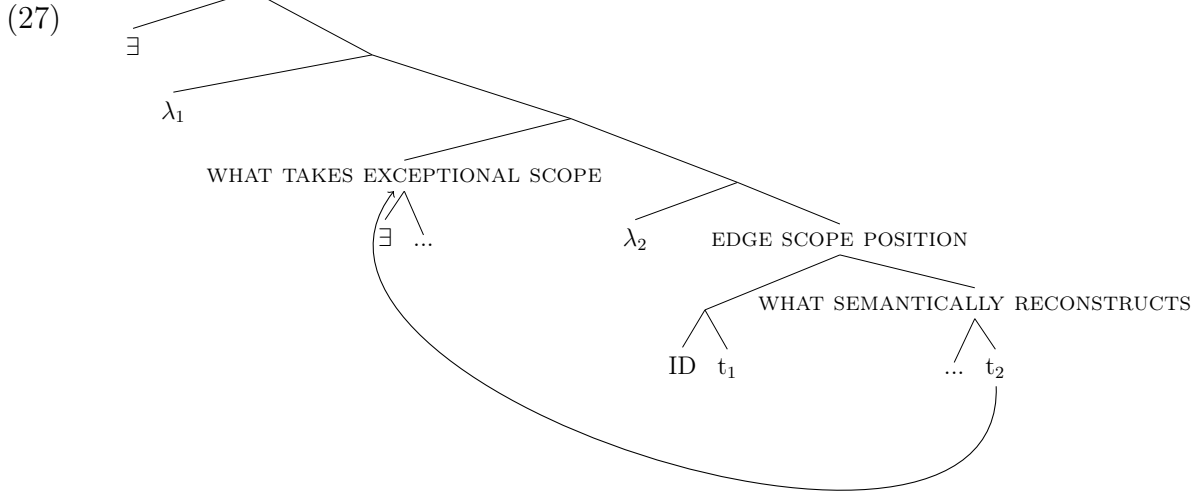
I should emphasize that the difference between island-violating scope of *wh*-phrases and island-violating scope of indefinites is nothing out of the ordinary. If the pied-piped island takes scope where a simple *wh*-phrase takes scope (i.e. right above an ID), we have a non-singleton proposition set, i.e. the denotation of a *wh*-question. If the pied-piped island takes scope where a simple indefinite takes scope, we have the denotation of a declarative. That is, the scope position of 'a book' in (28a) and the scope position of an island that contains a wide-scope indefinite is the same. In the same way, the scope position of an island that contains a matrix-scope *wh*-phrase is the same as the scope position of 'which book' in (28b), i.e. right above an ID.

(28)   a.   Susan read **a book**.
        b.   **Which book** did Susan read?

A question that naturally arises is the morphological distinctness of *wh*-phrases and indefinites (in languages like English and Turkish that have such a distinction). For now, it is useful to notice that there is enough information to state the morphological distinctness of indefinites and *wh*-phrases but it is not straightforward to do so. In short, a *wh*-phrase is always a specifier to an ID head, and if it is contained in an ∃ Phrase, that ∃ Phrase, too, is a specifier of an ID head. In Chapter 7, I present an attempt to characterize of the morphological distinctness of *wh*-phrases and indefinites.

Restricting exceptional scope

In the previous two sections, we have seen that island-violating scope of existential quantifiers can be generated via creating a scope position at the island-edge and then QRing the island. For this theory to have any merit, it needs to block island-violating scope for quantificational phrases that are not indefinites or *wh*-phrases. The pair of examples below is repeated from before to remind the contrast we need to capture.

(29)   [island **her müşteriye**   gönderdiğimiz çoğu ürün]   defoluydu?
              every customer.DAT send.REL.1PL most product defective.PST
        × 'Every customer x is s.t. most products that we sent to x were defective.'

(30)   [island **bi müşteriye**   gönderdiğimiz çoğu ürün]   defoluydu.
              a customer.DAT send.REL.1PL most product defective.PST
        ✓'There is a customer x is s.t. most products that we sent to x were defective.'

A logical form that attempts give wide scope for "her müşteriye" *every customer* for the sentence above is given below. It is identical to the logical form in (24) in every respect except that what moves to the edge scope position is a universal quantifier.

(31)
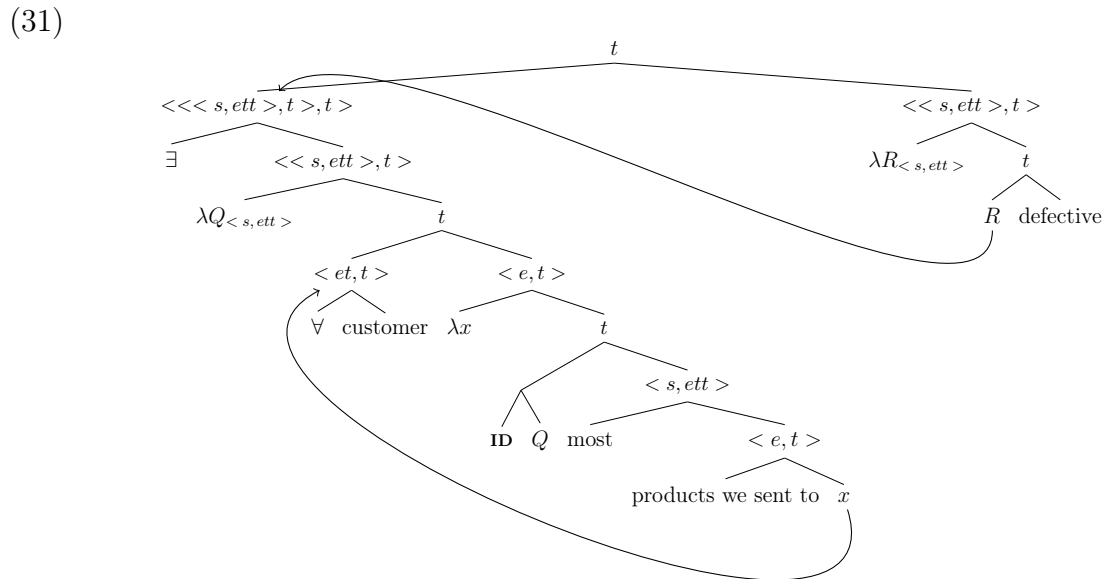
As can be seen below, the derived truth conditions for (31) given in (32) are anomalous (involve a contradiction). The problematic part is the part of the truth conditions that requires there to be some R such that for every customer x, R equals to the intension of "most products we sent to x". Suppose that there are only two customers in w: Sue and Bill. Then, the truth conditions require R to equal to the

intension of "most products we sent to **Sue**" *and* the intension of "most products we sent to **Bill**". Since R cannot be equal to two distinct objects, (32) is a contradiction.

(32) $[\![(31)]\!]^w = 1$ iff $\exists R_{< s, < et, t >>}\ \forall x$: $[\![customer]\!]^w(x) \rightarrow [R = \lambda w'. [\![most]\!]^{w'}(\lambda y.$ $[\![products]\!]^{w'}(y)\ \&\ [\![sent]\!]^{w'}(y)(\text{to-}x)(\text{we}))]\ \&\ R(w)([\![defective]\!]^w)$

As a matter of fact, any quantifier that encodes distributivity (hence, universal quantification) will yield a contradiction and will fail to scope out of an island by pied-piping it (see also Ruys (1992)). For example, in Turkish where distributive numerals are overtly marked, it is only plain numerals that allow exceptional scope out of islands. As shown in the example below, an overtly marked distributive numeral fails to receive a wide scope construal. Under the current system, this is captured by the fact the logical form that generates exceptional scope for indefinites and *wh*-phrases simply returns a contradiction when the quantifier that moves to the edge of an island encodes universal quantification in it.[13]

(33)   [island **bir**-er   **müşteriye**   gönderdiğimiz çoğu ürün]   defoluydu.
                    one-DIST customer.DAT send.REL.1PL most product defective.PST
         ✓'Most products such that we sent each of them to a (different) customer were defective'.
         # 'There is a customer x is s.t. most products that we sent to x were defective.'

The unavailability of island-violating scope for quantifiers that are not indefinites or *wh*-phrases receives a reasonable explanation under this system. We do not need to resort to a lexical stipulation on the type of quantificational DPs. They can all have generalized quantifier denotations. Neither is there a need for a mysterious ban on QRing certain quantificational DPs into the position where indefinites and *wh*-phrases take exceptional scope. The morphemes available to grammar that are independently needed to compose a simple *wh*-question are also able to generate island-violating scope for *wh*-phrases and indefinites but simply return anomalous truth conditions for exceptional scope derivations of other quantificational DPs. I take this to constitute further evidence that the $\exists$-theory's perspective on pied-piping is on the right track.

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[13]I thank Luka Crnič for pointing out the relevance of this type of data.

4.2 Generating exceptional *de re*

Throughout the discussion so far, I have assumed the theory of intensionality laid out in von Fintel and Heim (2011), without addressing its undergeneration issues. Under the Scope Theory of Intensionality (STI), as Keshet (2011) names it, the position of an object[14] in the logical form determines the possible world it is evaluated in. As was briefly discussed in Chapter 2, due to this strict relationship between LF-position of an object and its intensional status, STI has been argued to empirically fall short and hence been largely replaced by a theory of intensionality (Percus, 2000) that resorts to in-situ binding of object language world pronouns in syntax (henceforth Binding Theory of Intensionality, BTI). The purpose of this section is to show that STI no longer faces these empirical challenges when the pied-piping theory of exceptional scope that we have been exploring under the name '∃-theory' is in the picture.

The discussion that follows is organized into three sub-sections. In the first sub-section, I go over what is called the **third reading** (a *de re* construal for a DP that is narrow scope with respect to an intensional operator) and discuss von Fintel and Heim's account of it that involves **scope reconstruction**. In the second sub-section, I show how von Fintel and Heim's (2011) account of the **third reading** can be extended to **exceptional *de re***, i.e. the ability of a DP to be transparent with respect to an intensional operator ω even when it **cannot** scope above ω. In the third sub-section, I go back to von Stechow's problem and show that under the proposed theory of pied-piping, STI is able to block complete *de re* readings for pied-piped phrases while BTI fails to do so. I show that the proposed theory of pied-piping makes the prediction that nothing can scope of out of a *de re* island, which the problem von Stechow identified with pied-piping is just an example of.

4.2.1 What the third reading implies for STI

The Scope Theory of Intensionality, as laid out in von Fintel and Heim (2011), is a restrictive theory of intensionality, where an object under an intensional operator can only be evaluated in the intensional context created by that operator. Accordingly, there is simply no 'in-situ' way for an object to be evaluated in the utterance world if it is below an intensional operator at LF . The only way for an object to escape the intensional context created by an intensional operator is to move above it. Accordingly, under STI, movement is not only a theory of scope but also of *de re*. Exactly

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[14]DPs that have moved above an intensional operator should probably not be part of this characterization, for if they leave an intensional trace, they *can* semantically reconstruct.

for this reason, STI has been argued to be too restrictive in that there are cases in which a DP that scopes below an intensional operator is *de re* (Fodor, 1970; Farkas, 1981; Cresswell, 1990; Ludlow and Neale, 1991; Abusch, 1994; Farkas, 1997; Percus, 2000, a.o).

Let us start with two simple cases where the scope of a DP directly tells us which world it is evaluated in, exactly as STI predicts. Let us take the sentence in (34) to have the logical form in (35), where the indefinite *a congresswoman for New York* moves above and consequently gets evaluated above the intensional operator *likely*. In this case, STI predicts that *a congresswoman for New York* will have the *de re* construal, i.e. be evaluated in the utterance world, where the sentence is true iff there is an actual congresswoman for NY (in the utterance world, say Alexandria Ocasio-Cortez) such that she is likely to fight for universal healthcare.

(34)   **A congresswoman for New York** is <u>likely</u> to fight for universal healthcare.

(35) $[\![$A congresswoman for NY λ_1 [likely [t$_1$ to fight for UH]]$]\!]^w = 1$ iff
        $[\![$A congresswoman for NY$]\!]^w(\lambda x.\ [\![$likely$]\!]^w(\lambda w'.[\![$fight for UH$]\!]^{w'}(x))$

On the other hand, for the sentence in (36), STI predicts a distinct reading if the logical form for it is (37). In the LF in (37), *a congresswoman for New York* takes scope below *likely* and is evaluated in the intensional context created by *likely* (rather than in the utterance world). That is, it receives what is called the *de dicto* construal. Under this reading, the sentence asserts that in likely future worlds, some or other individual who has the property of being a congresswoman for NY fights for universal healthcare (i.e. there does not have to be any congresswomen for NY in the utterance world.)

(36)   It is <u>likely</u> that **a congresswoman for New York** will fight for universal healthcare.

(37) $[\![$likely [a congresswoman for NY fight for UH]$]\!]^w = 1$ iff
        $[\![$likely$]\!]^w(\lambda w'.[\![$a congresswoman for NY$]\!]^{w'}([\![$fight for UH$]\!]^{w'}))$

What is usually taken to be problematic for STI is the so-called **third reading** (Fodor, 1970), where an object that scopes *below* an intensional operator has a *de re* construal (i.e. it is transparent with respect to that operator). von Fintel and Heim (2011) explains the third reading for *a friend of mine* in (38) as follows: "*Mary looks at the ten contestants and says 'I hope one of the three on the right wins — they are so shaggy — I like shaggy people.'. She doesn't know that those are my friends.* In

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that scenario, (38) can be a felicitous report of Mary's hope.

(38)   Mary hopes that **a friend of mine** will win the race.

The third reading of *a friend of mine* requires it to take **narrow scope** with respect to *hope*, for in Mary's hope-worlds possibly different people win the race (i.e. one of the three people she points to). However, in the given scenario, that the winner have the property of being a friend of the speaker is clearly not part of Mary's belief-worlds. After all, she doesn't know that three people she points to are the speaker's friends. Hence, *a friend of mine* is interpreted *de re*, i.e. outside the intensional context created by *hope*, while it has **narrow scope** with respect to *hope*.[15]

How can a DP that have narrow scope with respect to an intensional operator have the *de re* construal? Under STI's assumptions, a DP can have a *de re* construal relative to an intensional operator if and only if it (or a phrase that dominates it) is above that operator at LF. Then, the problem for STI can be formulated as follows: how can the existential quantifier in the sentence above still scope below *hope* while it has to be outside the scope of *hope* at LF to be understood *de re*. This is a dilemma that arises under the combination of the QR-theory of scope and the Scope Theory of Intensionality, and it has been referred to as a *scope paradox*. The commonly adopted solution (called the 'standard' theory) to this dilemma is to quit STI and instead employ Binding Theory of Intensionality (Percus, 2000; Keshet, 2008, 2010; Schwarz, 2012) that involves binding of syntactically present world pronouns. BTI makes it possible for a DP below an intensional operator to have a *de re* construal via binding.

As an alternative to BTI, von Fintel and Heim (2011) also discuss a solution to this problem that preserves STI's assumptions on intensionality and does not posit world pronouns. It is useful to notice that there is another way to understand the dilemma that the third reading raises. Assuming that STI is the right theory, a DP that has the third reading with respect to an intensional operator is necessarily above that intensional operator at LF. Then, the question about the third reading is of a different nature: how can a DP above an intensional operator ω be narrow scope with respect to ω? The solution von Fintel and Heim (2011) propose looks at the 'third reading' problem from this perspective. Accordingly, the third reading is a problem because of the assumption that QR has to shift scope. When this assumption is abandoned, namely when we let QR[16] *optionally* shift scope, the third reading is no

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[15]In contrast, the wide scope+*de re* construal for *a friend of mine* would be required, for example, in a context where there is a particular person x who happens to be a friend of the speaker and Mary hopes that x wins the race; she may think that the speaker doesn't know x.

[16]Here I am using the term QR loosely to mean DP-movement visible at LF.

longer a dilemma.

As a matter of fact, scope shift is not intrinsic to LF-visible movement. Assuming that movement is interpreted as λ-abstraction, as illustrated below, α denotes a function. If the DP is quantificational, e.g. if it is of type $< et, t >$, and the function α denotes is in the DP's domain, we obtain scope shift. However, if it is the other way around, namely if the DP is in the domain of the function α denotes, there is no scope shift. The latter arises when the trace of the DP is of the same type as the DP. In other words, if both the DP and its trace are of type $< et, t >$, there will be no scope shift, for the node α will denote a function of type $<< et, t >, t >$ and the DP is in the domain of this function. In this case, the DP is said to undergo **semantic reconstruction for scope** in that movement does not result in scope shift.

(39)
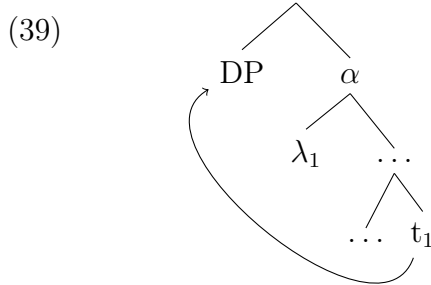
The solution that von Fintel and Heim (2011) proposes for the third reading exploits the flexibility of leaving higher type traces (i.e. essentially type-neutral λ-abstraction). That is, to receive the third reading, *a friend of mine* in the sentence above has to move above *hope* but leave a trace of type $<< e, t >, t >$, rather than a trace of type e.[17] This entails **semantic reconstruction for scope**. However, since *a friend of mine* will still be above *hope* at LF, it will be *de re*. This is illustrated below.

(40)   a. $⟦$a friend of mine $\lambda_{1<\text{et,t}>}$ Mary hopes t_1 win the race$⟧^w = 1$ iff

   b. $⟦$a friend of mine$⟧^w(\lambda Q_{< et, t >}.\ ⟦$Mary hopes$⟧^w(\lambda w'.\ Q(⟦$win the race$⟧^{w'})))$
        $= 1$ iff

   c. $⟦$Mary hopes$⟧^w(\lambda w'.\ ⟦$a friend of mine$⟧^w(⟦$win the race$⟧^{w'}))$

This solution is perfectly capable of generating the third reading. However, as far as I can see, it has not been commonly adopted. The major drawback of this

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[17]An alternative would be to lift the DP. In that case, the DP would be of type $<< ett, t >, t >$ and could not leave a trace of type e.

solution is that it appears to require us to have conflicting assumptions on what can QR out of certain domains. In other words, it does not by itself provide a solution to the problem of exceptional *de re*. To illustrate, under the reading of (41a) that does not attribute contradictory beliefs to Mary, *everyone in this room* must be *de re*, which —under STI's assumptions— entails that it moves above *think*. Indeed, there is no way for *everyone in this room* to have the *de re* construal if it is inside the complement of *think* at LF.[18] That is, STI cannot generate the truth conditions in (41b) if *everyone in this room* does not "escape" the intensional context created by *think*.

(41)   a.   Mary thinks that everyone in this room is outside. Keshet (2011): ex. 4
        b.   ⟦Mary thinks⟧^{w}($\lambda w'$.⟦everyone in this room⟧^{w}(⟦outside⟧$^{w'}$))

The fact that a universal quantifier has to QR out of a tensed clause to receive a *de re* construal has been found to be at odds with data like (42), which suggests that a universal quantifier cannot QR out of a tensed clause (May, 1977) (though see Wilder (1997)).

(42)   von Fintel and Heim (2011): pg. 113
        a.   **Some politician** will address **every rally in John's district**.
              ✓∀ > ∃
        b.   **Some politician** thinks that he will address **every rally in John's district**. * ∀ > ∃

An even more concerning fact for STI is that *de re* is available to DPs that are inside extraction islands. For example, the DP *everyone in this room* in (43) has to receive the *de re* construal (as nobody can be both *in the room* and *outside* in the same world). But *everyone in this room* is string-wise inside an if-clause, which is an extraction island (Ross, 1967). For it to receive a *de re* construal, *everyone in this room* would need to QR out of the antecedent of a conditional.

(43)   If **everyone in this room** were outside, it would be empty. Keshet (2011):

As we have seen in the previous section, universal quantifiers cannot scope above an island it originates in, as shown in (44). Then, the question is if **every rich relative of mine** cannot be moved out of the island to scope above it, how can it

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[18]Note that this is possible under Keshet's 2011 revised take on STI, provided that we have a composition rule that can combine quantifiers of type $< et, t >$ and properties of type $< e, st >$.

be moved out of the same island for *de re*? To summarize, deriving the right truth conditions for (43) under STI faces two challanges: [1] *everyone in this room* has to move out of an extraction island to be outside the scope of the relevant intensional operator [2] this movement is mysteriously not allowed to be scope-shifting, i.e. it cannot leave a trace of type e but has to leave a trace of type $< et, t >$.[19]

(44)   If **every rich relative of mine** dies, I'll inherit a house.
        $\times$ $\forall x$: x is rich relative of mine $\rightarrow$ if x dies, I'll inherit a house.

In short, exceptional *de re* has remained an important challenge against STI. In what follows, I show that the way we derived exceptional scope for indefinites and *wh*-phrases also allows us to derive exceptional *de re*, without any additional assumptions. In other words, we derive the ability of a universal quantifier to be transparent with respect to an intensional operator it cannot scope above.

4.2.2   Pied-piping for *de re*

To recap, STI makes it impossible for a DP to have a *de re* construal when it is below an intensional operator. It has been argued that this leads to a paradoxical stance on movement out of certain domains. In particular, it seems as though we have to claim that a DP that cannot move out of a domain to scope above it *can* do so to receive a *de re* construal. In this section, I show that pied-piping (as it is spelled out in the ∃-theory) helps eliminate this paradox and consequently addresses a very important objection to STI.

The ∃-theory is based on the idea that grammar can turn any object α into an existential quantifier —via two type-neutral morphemes: ID that forms a set that contains (the intension of) α, and ∃ that forms an existential quantifier with this set. What is crucial is that the indirect method of building a proposition set via ID (von Stechow, 1996; Fox, 2012; Heim, 2012), when it is generalized to objects of any type, allows us to have a scope position of type t right above an ID. As we have seen, this scope position allows us to give a uniform analysis to overt pied-piping in *wh*-questions, and island-violating scope of indefinites and *wh*-phrases. In this section, we will simply employ the exact same logic to derive exceptional *de re*.

As shown in the tree diagram below, a DP that moves to the edge scope position above an ID will have a *de re* construal, provided that no intensional operator scopes

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[19]If the scope shift were possible, (43) would allow an interpretation like "everyone in this room x is such that if x were outside, it would be empty", which it does not.

above the entire pied-piped structure.

(45) What gets pied-piped

∃

λ₁

$\boxed{\text{DP}_{de\ re}}$

λ₂   edge scope position

What semantically reconstructs

ID   t₁   ...   t₂
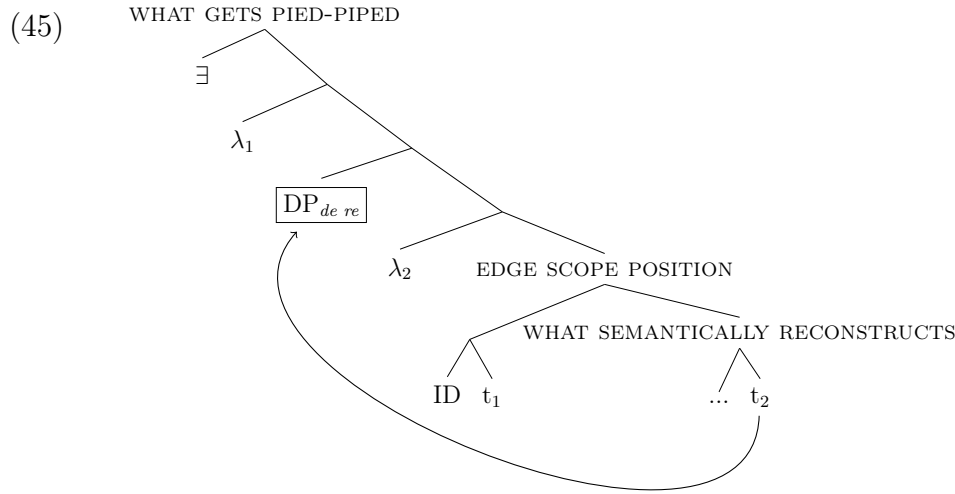
Let us illustrate this way of deriving *de re* via movement with the simple example in (46). We would like to derive a *de re* construal for the universal quantifier *everyone in this room*. Let us assume for the sake of argument that the universal quantifier cannot QR out of a tensed clause. In that case, grammar gives us the option of creating a scope position at its edge, QRing the universal quantifier into this position, and then pied-piping the entire clause above the intensional operator *think*. The simplified syntactic derivation is schematized below (λ-binders are not shown).

(46)   Mary thinks that **everyone in this room**$_{de\ re}$ is outside.

(47)

QP₂

∃

everyone in this room₁

Mary thinks

t₂

ID   *embedded clause*

t₁   outside
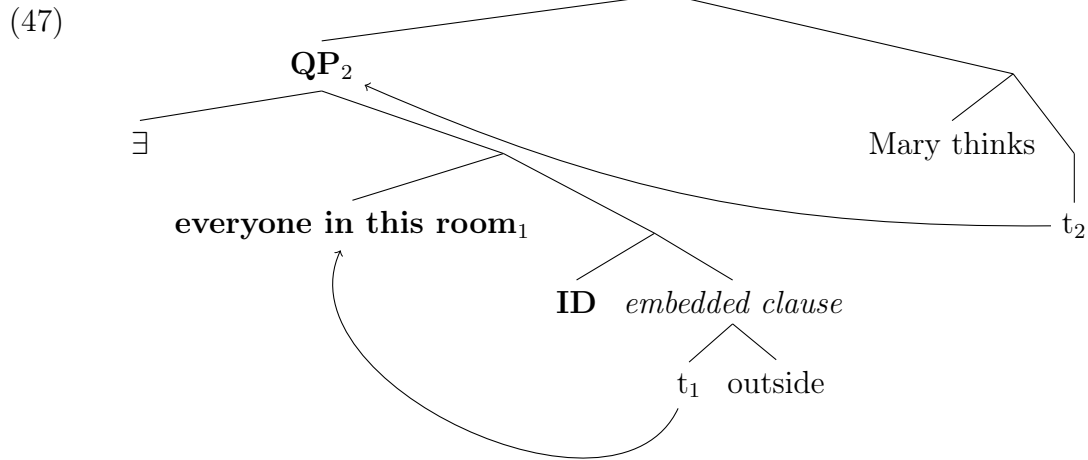
This syntactic derivation carries *everyone in this room* above *think*, along with the clause that it originates in. Notably, while this derivation gives *everyone in this room* a *de re* construal, it forces the embedded clause to semantically reconstruct because QP₂ is a quantifier over propositions and t₂ is a trace of type $< s, t >$.

The logical form for this derivation is provided below. What is crucial is that *everyone in this room* leaves a trace of type $< et, t >$, rather than a trace of type e.[20] As we have discussed, if *everyone in this room* left a trace of type e, we would simply generate a contradiction.[21]. This is essentially von Fintel and Heim's account of the third reading. What the pied-piping does, however, is do justice to the assumption that a universal quantifier cannot QR out of a tensed clause. We only need to allow it to QR to the *edge* of it.

(48)
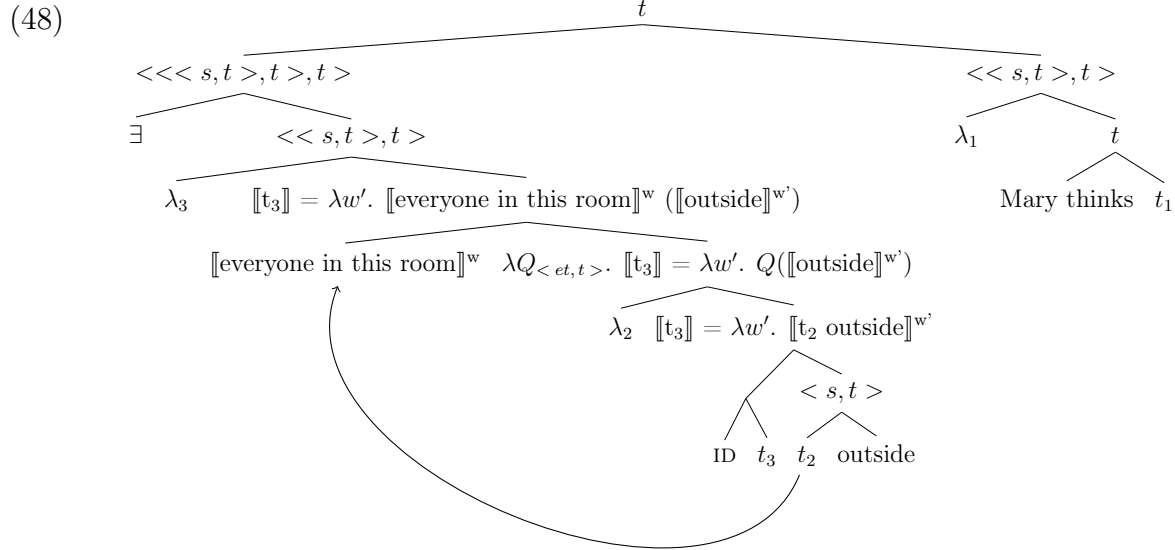
The meaning derived from this logical form is given below.

(49) $[\![(48)]\!]^{\mathrm{w}} = 1$ iff
        $\exists p$: $[p = \lambda w'.\ [\![\text{everyone in this room}]\!]^{\mathrm{w}}\ ([\![\text{outside}]\!]^{\mathrm{w'}})] \wedge [\![\text{think}]\!]^{\mathrm{w}}(p)(\text{Mary})$

The derived truth conditions are equivalent to the truth conditions given in (50). In other words, (48) is true iff Mary believes of everyone actually in this room to be outside.

(50) $[\![(48)]\!]^{\mathrm{w}} = 1$ iff $[\![\text{thinks}]\!]^{\mathrm{w}}(\lambda w'.\ [\![\text{everyone in this room}]\!]^{\mathbf{w}}([\![\text{outside}]\!]^{\mathrm{w'}}))(\text{Mary})$

The same idea extends to genuine extraction islands, e.g. the antecedent of a conditional. A logical form sketch for (51) is given below [grossly simplifying the representation of the modal-restrictor analysis of if-clauses (Kratzer, 1986; von Fintel and Heim, 2011)].

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[20]See the subsection *Restricting exceptional scope* under section 4.1.2.
[21]i.e. $\exists p$: $\forall x\ [\![(\text{person}) \text{ in this room}]\!]^{\mathrm{w}}(x) \rightarrow [p = \lambda w'.\ [\![\text{outside}]\!]^{\mathrm{w'}}(x)] \wedge [\![\text{think}]\!]^{\mathrm{w}}(p)(\text{Mary})$

(51)   If **everyone in this room** were outside, it would be empty.

(52)

t

$<<<s,t>,t>,t>$ ——— $<<s,t>,t>$

$\exists$ $<<s,t>,t>$

λ_3 $[\![t_3]\!] = \lambda w'.\ [\![\text{everyone in this room}]\!]^w\ ([\![\text{outside}]\!]^{w'})$

$[\![\text{everyone in this room}]\!]^w$ $\lambda Q_{<et,t>}.\ [\![t_3]\!] = \lambda w'.\ Q([\![\text{outside}]\!]^{w'})$

λ_2 $[\![t_3]\!] = \lambda w'.\ [\![t_2\ \text{outside}]\!]^{w'}$

$<s,t>$

ID t_3 (if)

t_2 outside

$<<s,t>,t>$

λ_1 t

it empty

would t_1
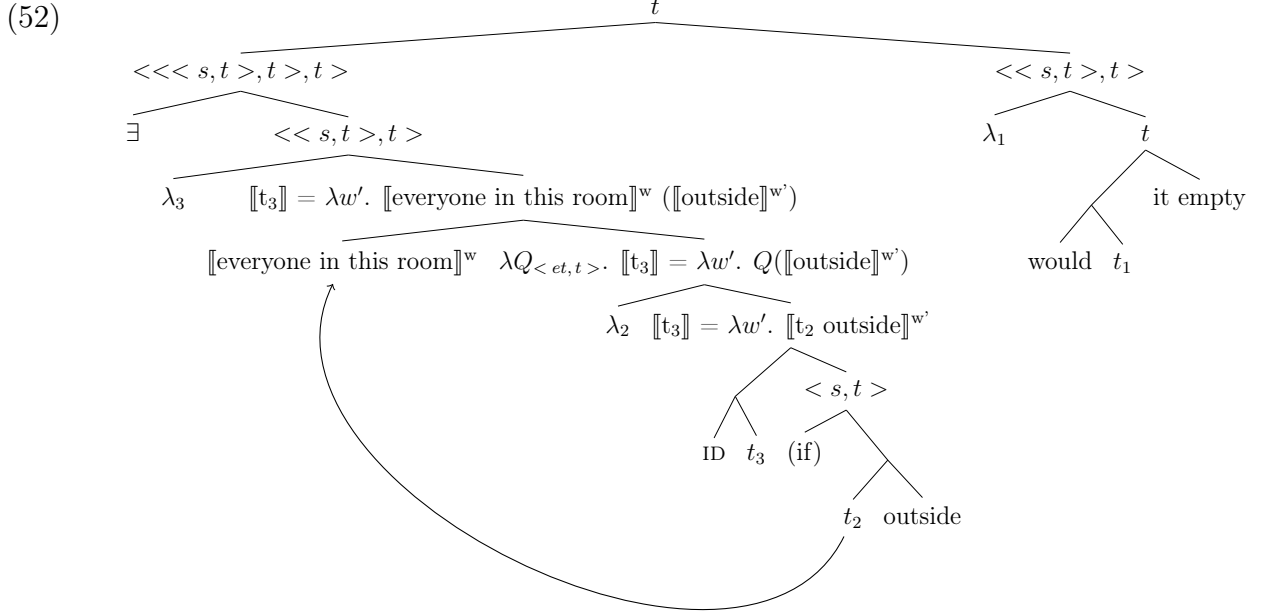
In both of these cases, the universal quantifier that takes narrow scope with respect to an intensional operator has a *de re* construal with respect to it. This is thanks to the fact that a universal quantifier moving to the edge scope position in a pied-piped phrase can only leave a trace of type $<et,t>$. While this is the only option that derives non-anomalous truth conditions in case of a universal quantifier, a 'pied-piping' existential quantifier has the options of leaving a trace of type e or a trace of type $<et,t>$. As an example, let us consider the sentence below.

(53)   If **a book on your bookshelf** were not there, your bookshelf would look better.

Given that the condition in (53) cannot hold in the same world, the indefinite phrase **a book on your bookshelf** must be evaluated outside the antecedent of the conditional, i.e. in the utterance world. However, it can scope inside the antecedent of the conditional or outside it.

The speaker who utters (53) might be saying there is a particular book on their addressee's bookshelf and if it wasn't there, the addressee's bookshelf would look better (maybe that book is too big and stands out among the other books). They might also be saying (53) because they think the bookshelf looks cramped and if any one of the books is removed, the bookshelf would look better. This latter reading is the third reading where the indefinite scopes below an intensional operator but

receives a *de re* interpretation. I should note that the grammatical distinctness of the logical form that generates the wide scope/*de re* construal for the indefinite and the one that generates the narrow scope/*de re* construal is questionable. This is because the third reading for the indefinite entails the wide scope reading (Reinhart, 1997). For illustration purposes, I provide two LFs. The only difference between two derivations is whether *a book on your bookshelf* is the argument of its sister or takes its sister as its argument.[22]

(54) truth conditions for the third reading (narrow scope/*de re*)
$\exists p$: $[p = \lambda w'.$ ⟦a book on your bookshelf⟧^{w} (⟦not there ⟧$^{w'}$)] $\wedge$ ⟦would⟧$^w(p)(\lambda w'.$ ⟦your bookshelf look better⟧$^{w'}$)

(55) LF for the third reading (narrow scope/*de re*)

[the trace of the indefinite is of type $< et, t >$]

(56) truth conditions for the wide scope/*de re* reading
$\exists p\ \exists x$: ⟦a book on your bookshelf⟧$^w(x)$ & $[p = \lambda w'.$ ⟦not there⟧$^{w'}(x)]$ $\wedge$ ⟦would⟧$^w(p)(\lambda w'.$ ⟦your bookshelf look better⟧$^{w'}$)

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[22]I am sympathetic to the idea that this achieved in a non-deterministic way: if λ-abstracts are entirely type neutral, a quantifier can apply to the λ-abstract or vice versa. However, I do not think this assumption is crucial for allowing scope reconstruction via higher type traces.

(57)   LF for the wide scope/*de re* reading

[the trace of the indefinite is of type e]

$<<<s,t>,t>,t>$

$\exists$ $<<s,t>,t>$

λ_3 $\exists x$: $[\![\text{book on bs}]\!]^w(x)$ & $[\![t_3]\!] = \lambda w'.$ $[\![\text{not there}]\!]^{w'}(x)$

$[\![\text{a book on bs}]\!]^w$ $\lambda x.$ $[\![t_3]\!] = \lambda w'.$ $[\![\text{not there}]\!]^{w'}(x)$

λ_2 $[\![t_3]\!] = \lambda w'.$ $[\![t_2 \text{ not there}]\!]^{w'}$

$<s,t>$

ID t_3 (if)

t_2 not there

$<<s,t>,t>$

λ_1 t

would t_1 bs look better
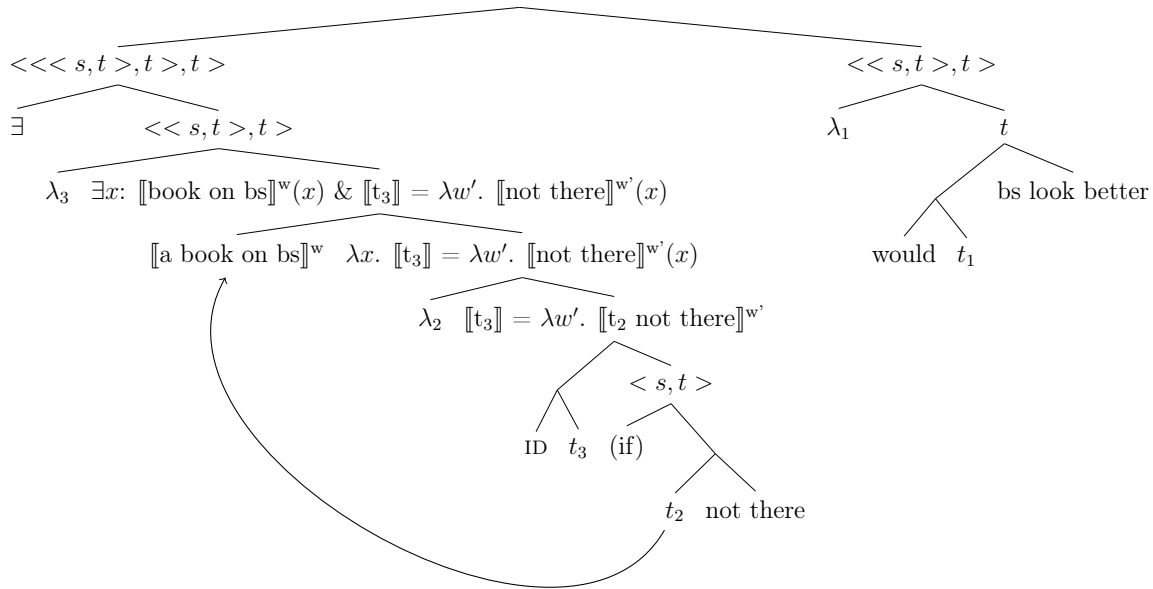
As shown in logical forms above, the current system allows two distinct derivations for an indefinite with a *de re* construal inside an island. However, it does not provide this flexibility to a universal quantifier (and other quantifiers that bring in distributivity). One could ask why grammar should allow the composition in (55) given the entailment relationship I have mentioned above. One potential answer is that island-violating *wh*-questions require exactly this composition for a Hamblin set to be derived in a parallel example like (58) from Turkish. The logical form for (58) will look exactly like (55) with the difference that the existentially lifted conditional antecedent will QR above an ID in the matrix clause, generating a Hamblin set.

(58)   [island Raftaki hangi kitap orada olmasaydı]   raf   daha iyi   görünürdü
             on.shelf which book there be.COND.PST shelf more good would.look
         'Which book on the bookshelf is s.t. if it were not there, the bookshelf would
         look better?'

To summarize, DPs within extraction/scope islands can escape the intensional context created by an intensional operator if they move to a scope position created at the island edge and the island subsequently QRs above the intensional operator. Even though this way of deriving *de re* (as opposed to via binding world pronouns in syntax) admittedly looks more complex syntactically, it simply makes use of what I

have argued is independently needed for island-violating scope and overt pied-piping in *wh*-questions.

4.2.3   Back to von Stechow's problem

Having laid out a theory of *de re* under STI's assumptions with the help of the ∃-theory, we are now ready to ask the question whether grammar derives von Stechow's empirical claim given in (59), as I have formulated it. This is the continuation of the discussion in section 3.1.3 in Chapter 3.

(59)   von Stechow on DP pied-piping
         A DP containing a *wh*-phrase (or its trace) cannot receive a complete *de re* construal.

Recall that under the assumptions of the ∃-theory, pied-piped phrases are always existential quantifiers with an internal scope position created by merging an ID. *Wh*-phrases always target this scope position created by ID (just like with *wh*-movement in the clausal spine), as shown below.

(60)
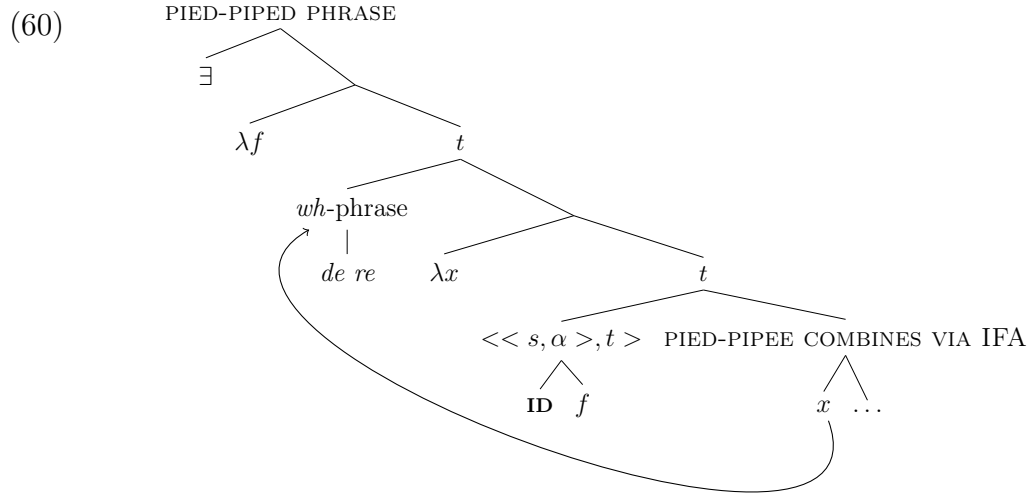
What allowed us to derive the right meaning for pied-piped phrases was the fact that ID insists on composing with intensional arguments. The question, then, is if this lexical assumption on ID is sufficient to block complete *de re* readings for pied-piped phrases.

Let us now ask the more tricky question. Does the movement of the pied-pipee above ID generate complete *de re* readings for pied-piped phrases? While this movement might be illicit for reasons of being too local, let us assume for the sake of argument that it is allowed.

First, observe in the derivation below that if the entire pied-pipe, the node labelled β, moves above ID, β can compose with its sister via IFA. For β to compose with its sister via IFA, the trace of β identified with the trace in ID's sister needs to be intensional, i.e. of type $<s,e>$. Hence, this movement leaving an intensional trace, even if it were allowed to take place, could not make the pied-pipee *de re*.

(61)   a. $[\![\text{whose cat}]\!]^{\text{w}} =$

   b. $<<<s,e>,t>,t>$

   $\exists \quad <<s,e>,t>$

   λ_3

   who

   $\lambda_2 \qquad t$

   $\beta \qquad <<s,e>,t>$

   $t_2 \quad \text{'s cat} \quad \lambda_1 \qquad t$

   $<<s,e>,t> \quad t_1$

   ID t_3
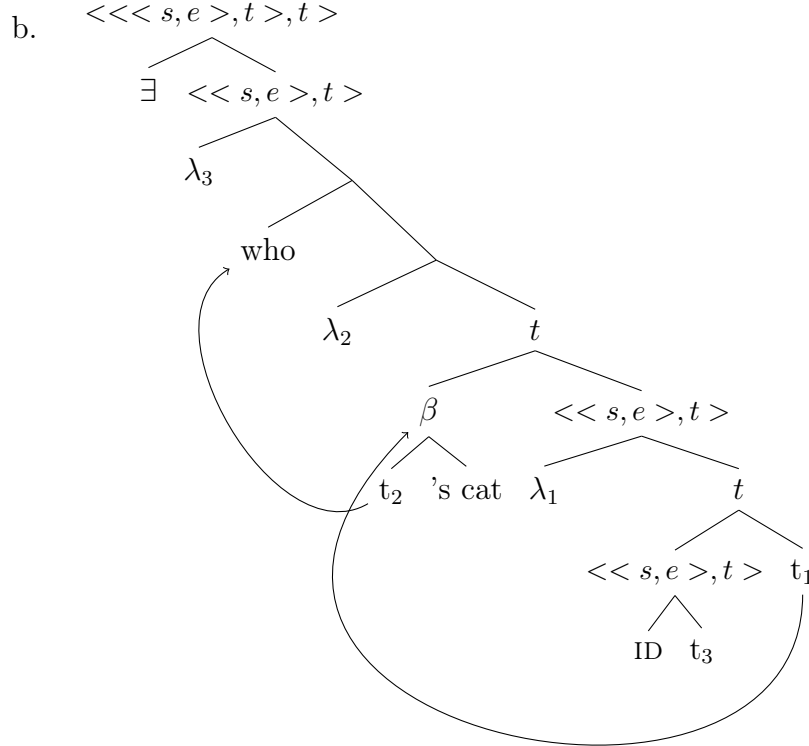
The more important question is whether β could leave a trace of type e? If this happens, β's sister will denote a function of type $<e,t>$ and will compose with β via FA. This means that β cannot be evaluated in the intensional context of the question nucleus, but receives a *de re* construal. Hence, if β leaves a trace of type e, a complete *de re* construal for the entire pied-piped phrase arises.[23] But could β leave a trace of type e?

In (62) is the denotation of β's sister computed, assuming that β's movement leaves a trace of type e. Notice that what ends up being identified with ID's sister is a function that maps every world to a constant entity in the actual world (akin to the

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[23]Assume that the logical form for '*whose cat meowed?*' contains the derivation in (61b) where β's trace is type e. In that case, a complete *de re* construal is derived:
$\lambda p.\ \exists x\ \exists f\colon [\![\text{human}]\!]^{\text{w}}(x)\ \&\ p = \lambda w.\ [\![\text{meowed}]\!]^{\text{w'}}(f(\text{w'}))\ \&\ f = \lambda w'.\ \iota y\ [\![\text{cat}]\!]^{\text{w}}(y)\ \&\ [\![\text{own}]\!]^{\text{w}}(y)(x)$

function $[\lambda w'.[\![\text{Eiffel Tower}]\!]^w]$ that maps every world to the Eiffel Tower). I speculate that grammar avoids this type of vacuous binding —at least when it can be avoided. As we have seen above, the alternative derivation where the trace is of type $< s, e >$ avoids vacuous binding.

(62) $[\![\lambda_1 \text{ ID } t_3 \text{ } t_1]\!]^{w, g}$ =

  $\lambda x.$ $([\![\text{ID } t_3 \text{ } t_1]\!]^{w, g[1\to x]})$ =

  $\lambda x.$ $([\![t_3]\!]^{w, g[1\to x]} = \lambda w'.$ $[\![t_1]\!]^{w', g[1\to x]})$ =

  $\lambda x.$ $([\![t_3]\!]^{w, g[1\to x]} = \lambda w'.$ $g^{[1\to x]}(1))$ =

  $\lambda x.$ $([\![t_3]\!]^{w, g[1\to x]} = \lambda w'.$ $x)$

To recap, given that under STI's assumptions there is no movement-free way to obtain *de re* (via binding etc.), the ∃-theory is able to derive the ban on complete *de re* readings for pied-piping. Of course, for this result to be achieved, our theory of pied-piping has to have the two crucial features in (63), which the ∃-theory has. In this chapter, I hope to have shown that (63a) is not tailor-made just to account for von Stechow's problem but is also a required component of what we have said about exceptional scope and exceptional *de re*. The feature in (63b) remains as a lexical assumption which, as far as I can see, is only motivated by its empirical coverage. Finally, we have considered a derivation (that assumes a potentially illicit movement of the pied-pipee) that can yield complete *de re* readings for pied-piped phrases if vacuous binding is allowed. I have speculated that what blocks this composition might be a ban on (or dispreference for) vacuous binding.

(63) a. ID has to be part of the syntax of pied-piped phrases

  b. ID insists on intensional arguments

A relevant question to ask at this point is if these assumptions also allow BTI to block complete *de re* readings. As the derivation below shows illustrating pied-piping under BTI's assumptions, the assumptions I made regarding pied-piping are still not sufficient under BTI. The intensional trace of a pied-piped phrase can combine with a world pronoun that can in principle be bound locally or by the highest λ-binder. The latter option derives a *de re* construal for the pied-piped phrase. Therefore, if we want to capture von Stechow's claim under the ∃-theory, BTI needs an additional assumption that requires a world pronoun whose sister is an intensional trace to be bound by the most local λ-binder.[24]

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[24]An assumption on non-vacuous binding is also needed under BTI. For example, in the LF below,

(64)   Whose cat meowed?
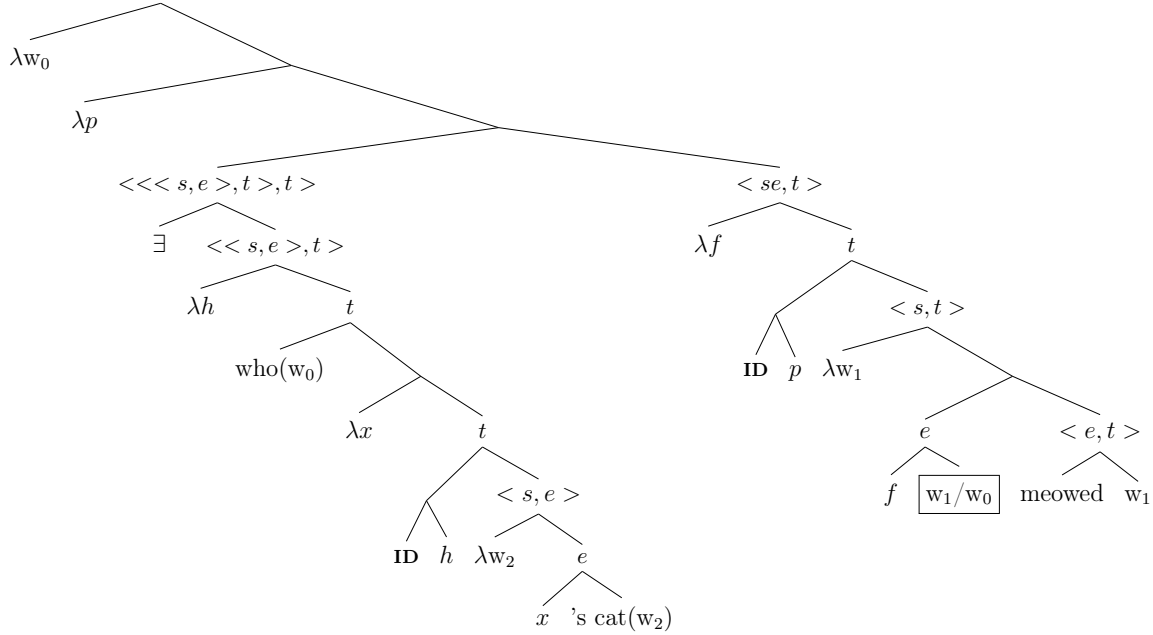
Finally, I should note that the core assumption that allows ∃-theory to derive von Stechow's empirical claim is that ID insists on intensional arguments. If this empirical claim turns out to be wrong, this assumption on ID's meaning needs to be dropped and ID needs to entirely type-neutral. It is useful to notice that what can be derived using the intensional ID is a proper subset of what can be derived using the completely type neutral ID. Hence, whether we keep ID intensional is entirely contingent empirical questions. As a matter of fact, the proposed system of pied-piping with intensional ID makes an even more general prediction that can be tested. Under the assumption that scoping out of an island requires pied-piping that island, it predicts (65). This derives from the assumption that for an existential quantifier to scope out of an island, ID has to merged on top of that island. Once this is done, the island being scoped out cannot be *de re* simply because of the meaning we gave to ID.

(65)   Let α be a DP inside another (island) DP β.
         If α scopes above an intensional operator ω while β scopes below ω, β cannot be *de re* with respect to ω.

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the world pronoun of *'s cat* has to be bound locally. A ban on vacuous λ-binders would make sure that this is the case.

In other words, the current system predicts that von Stechow's empirical claim is not only true for *wh*-phrases but existential quantifiers in general. The following example is just to give an idea on how this can be tested.

(66)   Mary speaking: *I adopted 6 kittens, 3 kittens from a shelter in Somerville and 3 kittens from a shelter in Cambridge. My 2-year old thinks that a cat fairy brought them! The kittens I adopted from the shelter in Somerville got sick. Now, she asks me all the time why they got sick.*

   a.   The 2-year old knows that [DP **every kitten her mother adopted from a shelter in Somerville**] got sick.

   b.   The 2-year old knows that [DP**every kitten her mother adopted from a shelter near of Boston**] got sick.

In (66a), the indefinite **a shelter in Somerville** need not scope out of the DP. Hence (66a) should have a true reading where the entire DP is *de re*. This seems to be borne out.

Is this the case in (66b)? The context above makes it clear that the indefinite **a shelter near of Boston** *needs* to scope out of the universal quantifier because it is false that every kitten Mary adopted from some or other shelter near of Boston got sick [the kittens from the shelter in Cambridge are perfectly healthy.] The question then, does (66b) have a true reading despite the fact that the DP is being scoped out by **a shelter near of Boston**? Given that Mary's daughter have false beliefs about how the 6 kittens ended up in her house, (66b) can only be true under a *de re* construal. This requires interpreting the embedded clause as '*there is a certain shelter near of Boston such that every kitten Mary adopted from that shelter got sick*'. However, it seems false that the 2-year old knows this. In other words, it seems that an indefinite cannot scope out of a *de re* DP.

This is predicted under the assumptions that exceptional scope requires pied-piping and the ID, as it is defined, is part of the syntax of pied-piping. If the data is real, it constitutes further support for von Stechow's claim regarding *wh*-questions.

Chapter 5

On the nature of reconstruction

In the previous chapters, I have proposed the ∃-theory of pied-piping, combining the insights in Charlow (2019) and Fox (2012); Heim (2012). This perspective on how grammar "by-passes" islands have empirical ramifications outside the phenomena that it is designed to account for. On the good side, we have seen two consequences of the proposed theory. With no further assumptions, exceptional scope derivations for universal quantifiers are blocked in that they return anomalous truth conditions. Moreover, we have been able to exploit pied-piping to derive exceptional *de re* under STI's assumptions. On the other hand, many important questions arise under the proposed theory.

In particular, under the proposed theory, the syntactic derivation of island-violating scope and island-internal *de re* involves pied-piping of these islands. By definition, pied-piping comes at a cost, displacing objects that should have remained in-situ. A particular example of this is a pronoun leaving the scope of its binder as a result of pied-piping. I will show that this is not a fatal problem and sketch an analysis that achieves binding reconstruction semantically (Sternefeld, 2001b; Charlow, 2019). To make semantic reconstruction more tractable, I provide an implementation that is syntactisized (inspired by a proposal due to Keshet (2011)) and fairly deterministic.

Moreover, I show that a grammar based on STI's assumptions *requires* that semantic reconstruction for binding be available. For example, a DP that contains a bound pronoun may end up in a position above its binder, simply in order to receive a *de re* construal. Given that undoing the movement is not an option in this case, it follows that semantic reconstruction for binding has to be available.

Finally, I discuss the known limits of semantic reconstruction in the light of a challenging set of data that involve binding theoretic facts (Lebeaux, 1990; Romero, 1998; Fox, 1999; Fox and Nissenbaum, 2004; Lechner, 2018).

5.1 On semantic reconstruction

Recall that we have made use of the idea that the λ-abstract that a movement creates is in some sense a type-neutral function into truth values. Precisely thanks to this character of λ-abstracts, when a quantificational DP QRs there are two options to compose the DP and its sister: $[\![DP]\!]^{w,g}([\![\alpha]\!]^{w,g})$ or $[\![\alpha]\!]^{w,g}([\![DP]\!]^{w,g})$. While the former option shifts the scope of the DP, the latter option entails *scope reconstruction*. The availability of scope reconstruction is what made an analysis of the third reading possible under STI (von Fintel and Heim, 2011).

(1)

        DP α

            λ_1 ...

             ... t_1
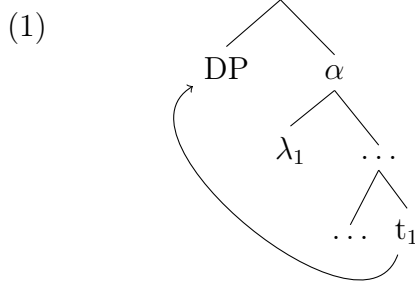
The method of scope reconstruction described above has been termed **semantic reconstruction** (Cresti, 1995; Fox, 1999; Romero, 1998; Fox, 1999; Sternefeld, 2001b; Lechner, 2018). In case of the movement of a regular generalized quantifier like *some girl*, semantic reconstruction for scope can be understood to be what results from leaving a trace of type $< et, t >$.

Under the $\exists$-theory, however, more complex quantifiers are created syntactically. Recall that any phrase YP of type α can be syntactically lifted into a phrase QP, as schematized below. Due to the meaning we gave to ID, QP is a quantifier of type $<<< s, \alpha >, t >, t >$, in particular an existential quantifier over objects of type $< s, \alpha >$.

(2) $QP_{<<< s, \alpha >, t >, t >}$

        $\exists$ $<< s, \alpha >, t >$

         λ_3 t

                YP

          ID t_3
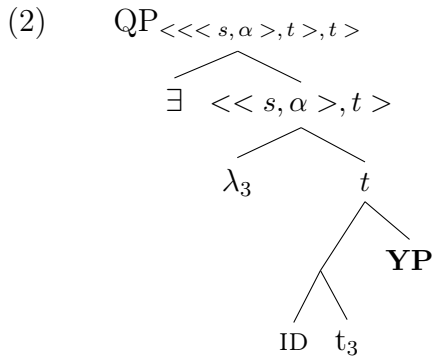
This entails that when QP undergoes Quantifier Raising, the lowest type of trace it can leave is $< s, \alpha >$. To illustrate, in the logical form in (3), the lowest type for the trace of QP is $< s, ett >$.

(3)
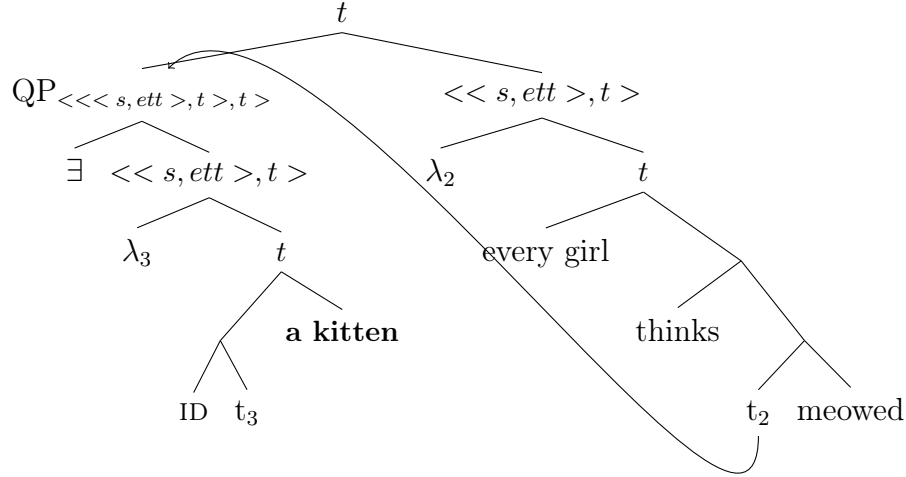
We have seen that the truth conditions derived from this logical form is identical to the truth conditions that would be derived from the logical form in (4), where *a kitten* is in-situ. In that sense, I have argued that the pied-pipee (what is identified with ID's sister) **semantically reconstructs** in (3).

(4)   [every girl [thinks [a kitten meowed]]]

Let us be more precise. The pied-pipee *a kitten* semantically reconstructs for **scope** and **opacity** (i.e. intensional status). It reconstructs for opacity in that the trace t_2 is of type $< s, ett >$ and can only combine with *meowed* via EFA, which feeds the local evaluation world to t_2. And it reconstructs for scope because t_2 is a quantificational trace and take *meowed* as its argument. Moreover, reconstruction of the pied-pipee for scope and opacity is guaranteed in that if the λ-abstract QP's movement creates is construed to be of type $< e, t >$ (i.e. type e trace), QP and its sister cannot compose by any rules.

We have also seen that the effect of pied-piping may not be vacuous when a phrase moves out of the pied-pipee. As schematized below, if XP moves out of YP (the pied-pipee) and lands in the type t scope position right above the ID within QP, XP always escapes reconstruction for opacity, and escapes reconstruction for scope if XP is an existential quantifier and leaves a type e trace. This derivation will allow XP to be

evaluated in the same world QP is evaluated in and take scope where QP takes scope (the latter only if XP is an existential quantifier and leaves a type e trace). We have seen that this makes correct empirical predictions, deriving *de re* interpretations for DPs trapped in islands and wide scope interpretations for existential quantifiers inside islands. Moreover, under the assumption that pied-piping is the only way to scope out of islands, we also derive the inability of universal quantifiers to scope out of islands and make the general prediction that if an XP scopes out of a YP and moves above an intensional operator ω by pied-piping YP, YP cannot be *de re* with respect to ω.

(5)
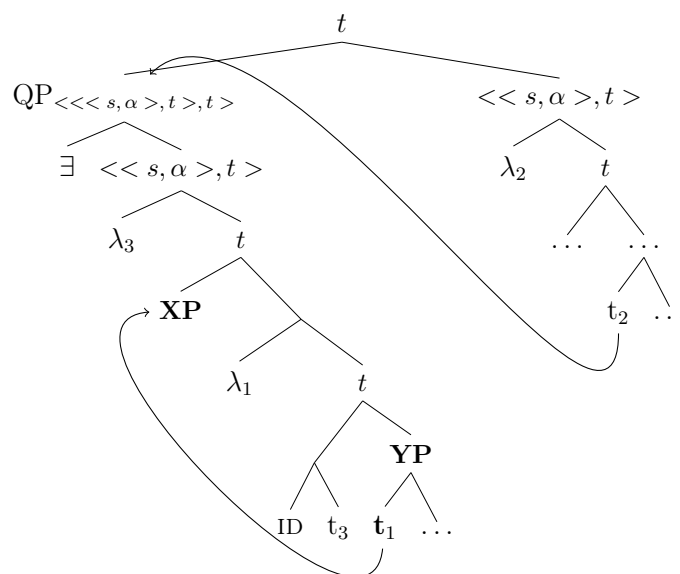
While the proposed theory of pied-piping has good empirical coverage, it also poses important challenges. Under the current approach, pied-piping involves movement of "extra" material (i.e. pied-pipee)— extra by meaning considerations. While the meaning given to the ID head ensures that the pied-pipee semantically reconstructs for opacity and scope, the effects of movement are *not* limited to scope and opacity.

A particularly obvious case is the movement of (a constituent that contains) a bound pronoun. What happens when this movement targets a position that is above the binder of that pronoun? The standard answer would be that that movement, if it takes place, has to be undone.

For example, while the string in (6a) can have the LF (6b), it is commonly assumed that the string in (7a) cannot have the LF in (7b) but shares the LF in (6b).[1]

---

[1]That is, if one assumes a semantics like the one proposed in Heim and Kratzer (1998). In Heim and Krazter, the interpretation function is paramterized to an assignment function, i.e. $[\![\alpha]\!]^g$, and a

(6) a. Every girl hugged her mother.
     b. LF: every girl λ_1 t_1 hugged her$_1$ mother

(7) a. Her mother, every girl hugged.
     b. LF: [her$_1$ mother] λ_2 every girl λ_1 t_1 hugged t_2

In other words, a string like (7a) would be assumed to involve **syntactic reconstruction** (i.e. undoing the movement). This ensures that at LF, the variable inside the fronted DP (i.e. her$_1$) is under the scope of its binder, i.e. λ_1.

As was acknowledged and addressed in Charlow (2019), pied-piping, too, can displace a bound pronoun π to a position that is above π's binder. Yet, given that bound readings are still possible, the logical forms assumed for sentences that involves pied-piping of a pronoun have to accommodate this. The example Charlow (2019) discusses is given in (8).

(8) Everybody$_1$ loves it [when **a famous expert on indefinites** cites him$_1$].
     $= \exists x$ famous expert on indefinites(x): every y loves it when x cites y

                                                          Charlow (2019), p.29

Under Charlow's proposal on exceptional scope of indefinites, as well as under its $\exists$-theory variant, the wide scope for **a famous expert on indefinites** is derived by pied-piping the adjunct island that contains the indefinite, to a position above **everybody**, as sketched in (9) (irrelevant details of the LF omitted). As can be seen in (9), this logical form would have the same problem that we discussed above, in that under common assumptions about how variable binding is achieved (Heim and Kratzer, 1998), we fail to predict that **him** can get a bound interpretation.

(9) [$_{QP}$ [**a famous expert on indefinites**]$_2$ [when t_2 cites **him**$_1$]] λ_0
                                    everybody λ_1 **t**$_1$ loves it **t**$_0$

Notably, undoing the movement is not an option here. If we undo the movement, the wide scope reading for the indefinite is lost, as well. For the indefinite to receive its wide scope, the pied-piped constituent labelled QP in (9) that contains the indefinite has to be interpreted in the position it moves to. As Charlow (2019) shows, this is not a fatal problem for the pied-piping approach. It *is* possible to achieve reconstruction for variable binding without undoing any movement.[2] His proposal involves using

---

lambda binder λ_n modifies the assignment function to include a mapping for n its domain. In this system, the LF in (7b) will be undefined, as $g(1)$ is only defined at the nodes that λ_1 c-commands.

[2]See also Jacobson (2004); Krifka (2018).

semantic reconstruction to achieve binding reconstruction, a method pioneered by Sternefeld (2001b). I will not adopt the way Charlow (2019) achieves binding reconstruction whose proposal entirely abandons the Heim and Kratzer view that the interpretation function carries an assignment function parameter. Instead, I will sketch a way to implement semantic reconstruction, preserving the Heim and Kratzer view. In the following sub-section, I discuss how semantic reconstruction not only for binding but also for opacity can be achieved in a fairly syntactisized way. The proposed system will also dispense with the composition rules IFA and EFA.

5.2 Semantic reconstruction syntactized

I assume that interpretation function is relativized to two parameters: $[\![\alpha]\!]^{\mathbf{g,\ w}}$ (Heim and Kratzer, 1998; von Fintel and Heim, 2011). To make LFs more transparent and semantic reconstruction 'visible', I will posit natural language operators that can abstract out on these parameters. I propose that there are two natural language operators $_w\wedge$ and $_a\wedge$ that can abstract out on the parameters of the interpretation function, as shown below.[3] The first of these was already proposed in Keshet (2011). Notice that the abstractor $_w\wedge$ dispenses with IFA.[4]

(10) a. $[\![_w\wedge\ \ \alpha]\!]^{\mathrm{w,\ g}} = \lambda w'.\ [\![\alpha]\!]^{\mathrm{w',\ g}}$ (Keshet, 2011)

     b. $[\![_a\wedge\ \ \alpha]\!]^{\mathrm{w,\ g}} = \lambda g'.\ [\![\alpha]\!]^{\mathrm{w,\ g'}}$ (to be slightly revised)

A direct consequence of this is that corresponding to an object of type γ, grammar can now generate objects of type $< s, \gamma >$, objects of type $< a, \gamma >$, objects of type $< s, < a, \gamma >>$, and so forth. This is illustrated below.

(11) a. $[\![_w\wedge\ \ \mathrm{Sue\ left}]\!]^{\mathrm{w,\ g}} = \lambda w'.\ [\![\mathrm{Sue\ left}]\!]^{\mathrm{w',\ g}}$

                                       [denotes an object of type $< s, t >$]

     b. $[\![_a\wedge\ \ \mathrm{the\ book}]\!]^{\mathrm{w,\ g}} = \lambda g'.\ [\![\mathrm{the\ book}]\!]^{\mathrm{w,\ g'}}$

                                       [denotes an object of type $< a, e >$]

     c. $[\![_a\wedge\ \ _w\wedge\ \ \mathrm{every\ boy}]\!]^{\mathrm{w,\ g}} = \lambda g'.\ \lambda w'.\ [\![\mathrm{every\ boy}]\!]^{\mathrm{w',\ g'}}$

                                  [denotes an object of type $< a, < s, ett >>$]

---

[3]The subscripted w and a to the left of $\wedge$ are just symbolic reminders of which parameters these operator abstract on. They do not mean anything in the composition.

[4]Notably, thanks to $_a\wedge$, we could now have a categorematic meaning for λ-binder that composes via FA: $[\![\Lambda_i]\!]^{\mathrm{g,\ w}} = \lambda P_{< a, \gamma >}.\ \lambda f.\ P(g^{[i \to f]})$

However, both $_w\wedge$ and $_a\wedge$ are still defined syncategorematically, as they abstract out on the parameters on the interpretation function.

In addition, I posit two additional (categorematically defined) morphemes: one that extensionalizes intensions (hence dispenses with EFA) and one that saturates functions from assignments to ordinary meanings. They are categorematically defined in (12) and compose via FA.

(12)   a. $[\![_w\vee]\!]^{\mathbf{w}, \mathrm{g}} = \lambda f_{< s, \gamma >}.\ f(\mathbf{w})$ where γ is any type
      b. $[\![_a\vee]\!]^{\mathrm{w}, \mathbf{g}} = \lambda f_{< a, \gamma >}.\ f(\mathbf{g})$ where γ is any type

Notably, the identities in (13) and (14) hold.

(13) $[\![\ _w\vee\ _w\wedge\ \gamma\ ]\!]^{\mathrm{w},\ \mathrm{g}} = [\![\gamma]\!]^{\mathrm{w},\ \mathrm{g}}$

      a. $[\![\ _w\vee\ _w\wedge\ \gamma\ ]\!]^{\mathrm{w},\ \mathrm{g}} =$ (by FA)
      b. $[\![\ _w\vee]\!]^{\mathrm{w},\ \mathrm{g}}\ ([\![_w\wedge\ \gamma\ ]\!]^{\mathrm{w},\ \mathrm{g}}) =$ (by (12a))
      c. $[\![\ _w\wedge\ \gamma\ ]\!]^{\mathrm{w},\ \mathrm{g}}(w) =$ (by (10a))
      d. $[\ \lambda w'.\ [\![\gamma]\!]^{w',\mathrm{g}}\ ](w) =$ (by FA)
      e. $[\![\gamma]\!]^{\mathrm{w},\mathrm{g}}$

(14) $[\![\gamma]\!]^{\mathrm{w},\ \mathrm{g}} = [\![\ _a\vee\ _a\wedge\ \gamma\ ]\!]^{\mathrm{w},\ \mathrm{g}}$

      a. $[\![\ _a\vee\ _a\wedge\ \gamma\ ]\!]^{\mathrm{w},\ \mathrm{g}} =$ (by FA)
      b. $[\![\ _a\vee]\!]^{\mathrm{w},\ \mathrm{g}}\ ([\![_a\wedge\ \gamma\ ]\!]^{\mathrm{w},\ \mathrm{g}}) =$ (by (12b))
      c. $[\![\ _a\wedge\ \gamma\ ]\!]^{\mathrm{w},\ \mathrm{g}}(g) =$ (by (10b))
      d. $[\ \lambda g'.\ [\![\gamma]\!]^{\mathrm{w},\ \mathrm{g}'}\ ](g) =$ (by FA)
      e. $[\![\gamma]\!]^{\mathrm{w},\mathrm{g}}$

That these identities hold entails, for example, that the logical forms in (15a) and (15b) are equivalent.

(15)   a.   b.
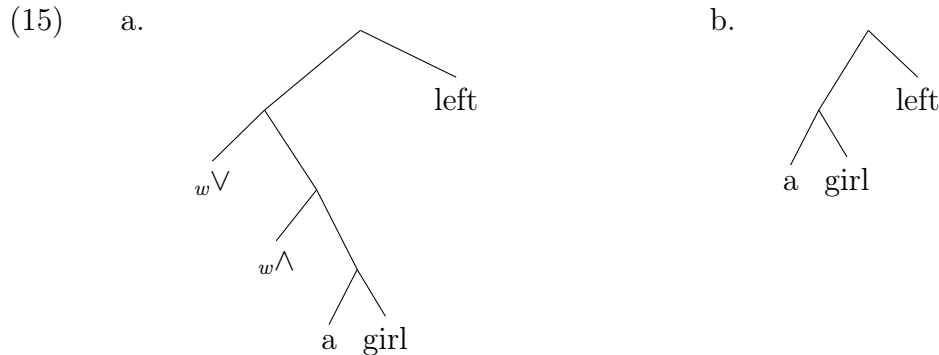
The general schema that will be crucial for achieving semantic reconstruction is given in (16). When a phrase by $\wedge$ moves out, the trace of this movement will compose with $\vee$, deriving the reconstruction for opacity, binding or both, depending on which

$\wedge$ and $\vee$ morphemes are merged in the structure.[5]

(16)   Reconstruction Configuration: WHAT TRACE CONTRIBUTES

$$\vee \quad \text{WHAT MOVES OUT}$$

$$\wedge \quad \text{XP}$$
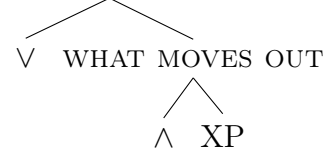
5.2.1   Reconstruction for Opacity

Let us first illustrate how semantic reconstruction for opacity works. The sentence in (17) is reported in von Fintel and Heim (2011) to have the salient interpretation where *a neat-freak* is *de dicto* and narrow scope with respect to the modal *must*. While undoing the movement is also a possibility, the current system allows us to achieve reconstruction for scope and opacity without undoing the movement.

(17)   A neat-freak$_{\textit{de dicto, narrow scope}}$ must have been here.

$$t$$
$$< s, ett > \qquad << s, ett >, t >$$
$$_w\wedge \quad \text{a neat-freak} \qquad \lambda_1 \qquad t$$
$$\text{must} \qquad < s, t >$$
$$_w\wedge$$
$$< et, t > \quad \text{have been here}$$
$$_w\vee \quad \text{t}_1$$
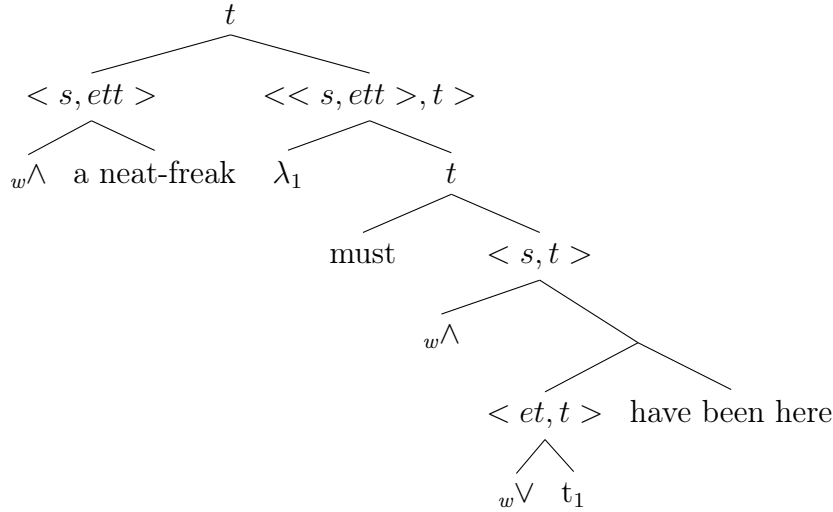
Notice in the logical form above that when the constituent [$_w\wedge$ a neat-freak] moves out, its trace is $< s, ett >$. The morpheme $_w\vee$ applies to the trace and returns its extension at the local evaluation world. This effectively reconstructs the indefinite for opacitiy. Crucially, if the trace were $< s, e >$, there would be a type-mismatch at the root node of the tree as [$_w\wedge$ a neat-freak] would not be able to compose with a λ-abstract of type $<< s, e >, t >$. Therefore, (18a) holds. This is a welcome result if it is true that a DP that is wide scope with respect to an intensional operator cannot be *de dicto* with respect to that intensional operator (von Fintel and Heim, 2011).[6]

---

[5]Obviously, many potential logical forms will be filtered out due to type mismatch.

[6]See Keshet (2011) for a brief discussion on so called wide scope *de dicto* readings.

(18)   **Opacity-Scope Correlation in Semantic Reconstruction**

    a.   Reconstruction for **opacity** entails reconstruction for **scope**.

    b.   Reconstruction for **scope** does <u>not</u> entail reconstruction for **opacity**.

Recall from Chapter 4 that scope reconstruction via quantificational traces (von Fintel and Heim, 2011) does **not** entail reconstruction for opacity, which allows an account the narrow scope *de re* readings (i.e. the third reading) under STI's assumptions. Hence, (18b) holds.

5.2.2   Semantic reconstruction for Variable Binding

Next is an illustration of reconstruction for variable binding without undoing the movement. Notice that in the derivation below for the sentence in (19), the constituent $[_a\wedge$ he$_1$'s mother] denotes a function of type $<a,e>$ from assignments to individuals. And the crucial step in the derivation is where this function is saturated by $g^{[1\to x]}$. This makes sure that $[\![$he$_1$'s mother$]\!]$ is interpreted relative to a g that maps 1 to x, making possible variable binding without undoing the movement. This is achieved thanks to what $_a\vee$ does to the trace of $[_a\wedge$ he$_1$'s mother]: it applies to the trace an assignment whose domain contains the mapping from 1 to x, simply by virtue of being in the scope of λ_1.

(19)   His$_1$ mother, every boy$_1$ likes.

$$[\![\text{every boy}]\!](\lambda x.\ x \text{ likes } x\text{'s mother})$$
$$|$$
$$[\![\text{every boy}]\!](\lambda x.\ [\![\text{likes}]\!]([\![\text{he}_1\text{'s mother}]\!]^{g^{[1\to x]}})(x))$$
$$|$$
$$[\![\text{every boy}]\!](\lambda x.\ [\![\text{likes}]\!]([\lambda g'.\ [\![\text{he}_1\text{'s mother}]\!]^{g'}](g^{[1\to x]}))(x))$$

$\lambda g'.\ [\![\text{he}_1\text{'s mother}]\!]^{g'}$ $\lambda f_{<a,e>}.\ [\![\text{every boy}]\!](\lambda x.\ [\![\text{likes}]\!]([\![t_2]\!]^{g^{[1\to x],\ [2\to f]}}(g^{[1\to x],[2\to f]}))(x)$

      $_a\wedge$ $[\![\text{he}_1\text{'s mother}]\!]^{g}$ λ_2

                      $\forall$ boy $\lambda x.\ [\![\text{likes}]\!]([\![t_2]\!]^{g^{[1\to x]}}(g^{[1\to x]}))(x)$

                               λ_1

                                t_1

                                   likes $[\![t_2]\!]^{g}(g)$

                                        $_a\vee$ t_2
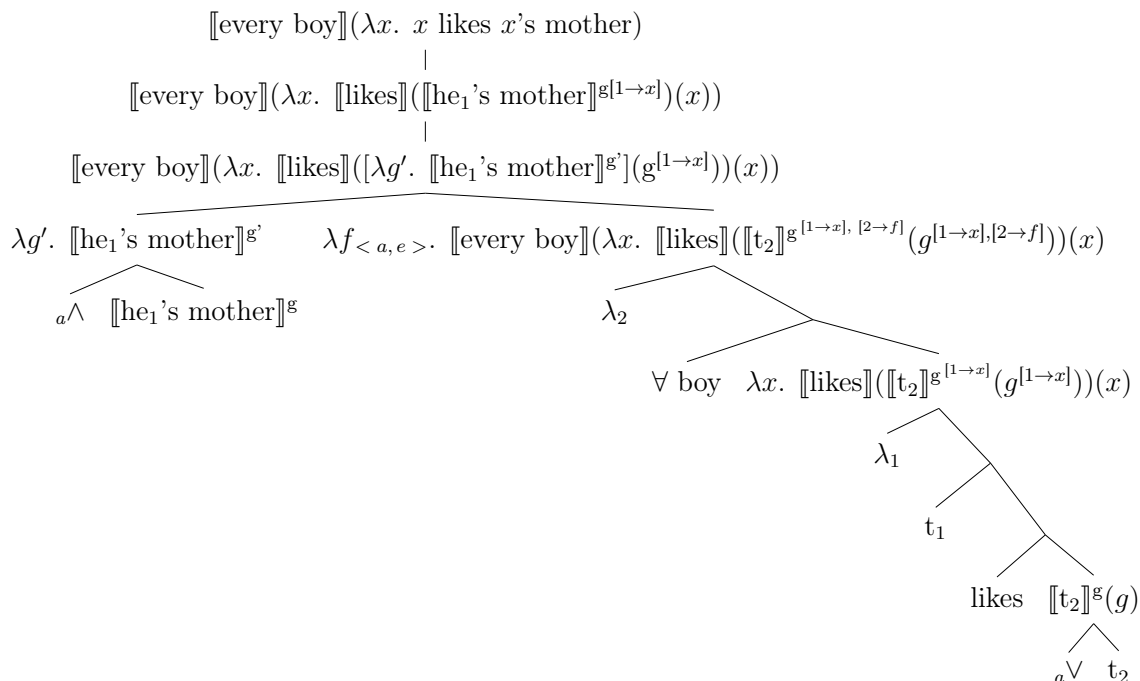
Before we turn to how this system helps us in pied-piping cases, let us consider one more case. This is a more involved example that shows binding reconstruction and opacity reconstruction are disassociated while binding reconstruction entails scope reconstruction. Consider the sentence in (20), which involves a DP that is narrow scope and *de re* with respect to an intensional operator, but at the same time contains a variable whose binder is within the complement of the intensional operator.[7] It is easy to see that this sentence under the intended reading is problematic for STI[8] if one assumes that binding reconstruction is only possible via undoing the movement because undoing the movement would simply result in a *de dicto* construal.

(20)   Sue wants every boy$_1$ to meet with [a relative of his$_1$]$_{de\ re,\ narrow\ scope}$
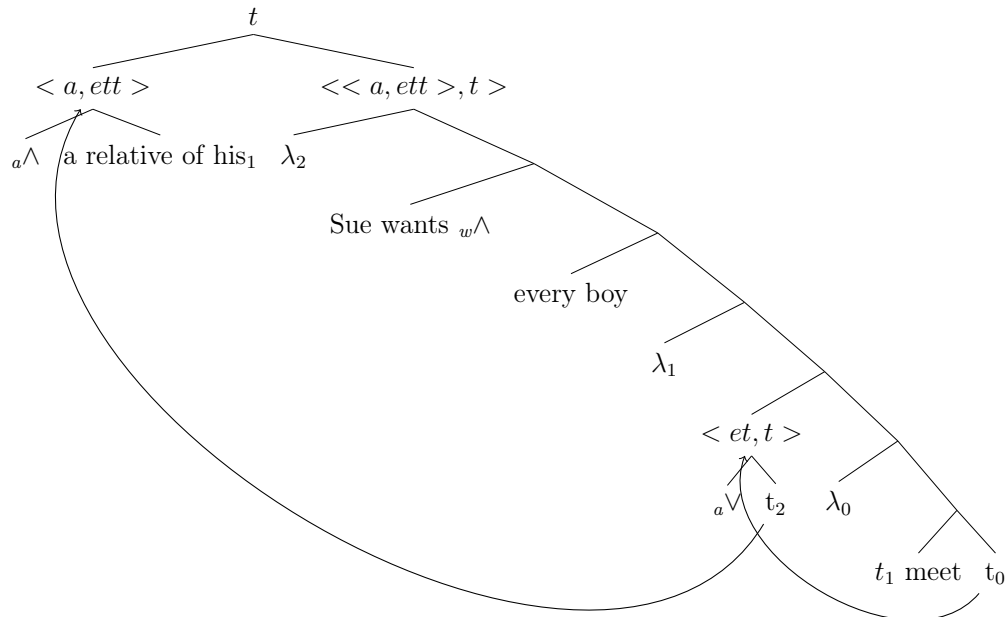
In the derivation above, when the constituent [$_a\wedge$ a relative of his] moves to the higher clause, it has to leave a trace of type $< a, ett >$. If it were to leave a trace of type $< a, e >$, there would be a type mismatch at the root node.[9] Hence, (21) holds.

(21)   **Binding-Scope Correlation in Semantic Reconstruction**
         Reconstruction for **binding** entails reconstruction for **scope**.

---

[7]Imagine a scenario where for each boy x, Sue points to a person y and says she wants x to meet with y. Unbeknownst to her, each y she points to is a relative of x.

[8]Of course, this criticism would apply to Keshet (2011), as well.

[9]That is, while [$_a\wedge$ a relative of his] is a function of type $< a, ett >$, its sister would be of type $<< a, e >, t >$.

However, as shown by the interpretability of the logical form above, a DP that undergoes binding reconstruction *can* be *de re*. That is, binding reconstruction is possible in the absence of opacity reconstruction.

(22)   **Binding-Opacity Correlation in Semantic Reconstruction**
       Reconstruction for **binding** does not entail reconstruction for **opacity**.

5.3   Application to pied-piping

Let us first observe that nothing changes in the way the pied-pipee semantically reconstructs for opacity. Instead of the composition rule IFA and EFA, we make use of the operators $_w\wedge$ and $_w\vee$.

(23)   Whose cat meowed?
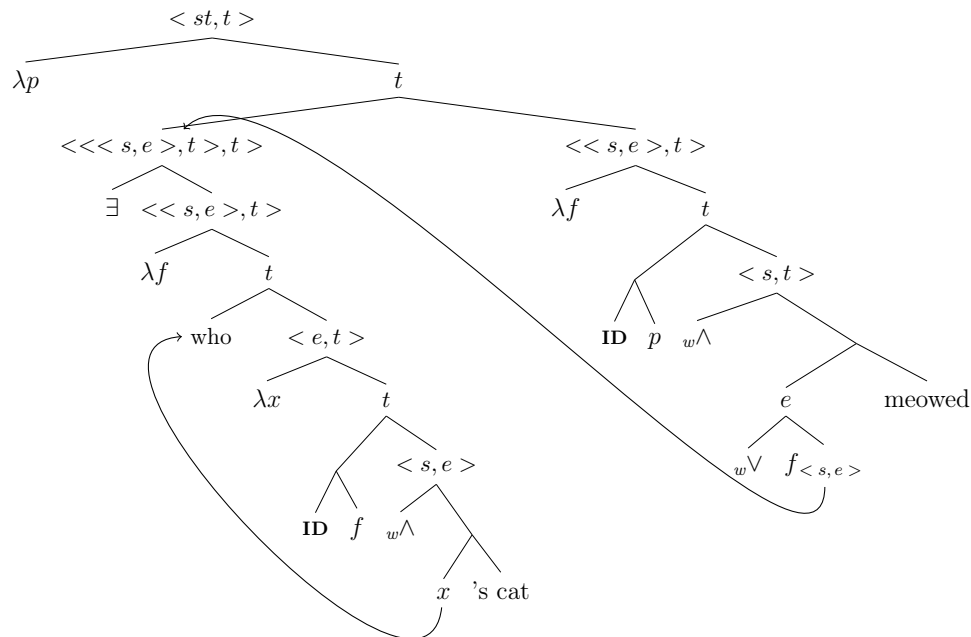
We will make use of the same logic for binding reconstruction of pied-pipee. As shown in (24), overt pied-piping in *wh*-questions can carry a pronoun to a position above its binder. As we pointed out while discussing Charlow's example, there is no option of undoing the movement, for that would not let us derive the relevant readings.[10]

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[10]Notably, a von Stechow derivation for pied-piping that involves sub-extraction and obligatory syntactic reconstruction would not face this problem. However, as we have discussed, under von Stechow's account, there is no independent motivation for obligatory reconstruction in cases that do not involve binding.

(24) **Which teacher's warning note to him$_1$** did no ill-behaved boy$_1$ bother
to read?
Relevant reading: which teacher x is such that no ill-behaved boy y bothered
to read x's warning note to y

Similarly, the same problematic configuration is derived in (25) under the assumption that the possessor indefinite [a teacher] cannot covertly move out stranding the possessee but instead pied-pipes the entire DP it is part of.

(25) No ill-behaved boy$_1$ bothered to read **a teacher's warning note to him$_1$**.
LF $\approx$ [a teacher$_2$ [t$_2$'s warning note to **him$_1$**]]$_0$

                                    no ill-behaved boy$_1$ bothered to read t$_0$
Relevant reading: There is a teacher x such that no ill-behaved boy y bothered
to read x's warning note to y

Assuming that the logical form for (25) has the pied-piping derivation shown below, the problem must be obvious. The constituent labelled DP undergoes movement as part of the constituent labelled QP. Crucially, the movement of QP targets a position that is outside the scope position of the λ-binder that is supposed to bind the pronoun **him** inside DP. This means that if nothing else is said, this logical form will be undefined. In simple terms, what we need to achieve here is to make it so that **him** is interpreted *as if* it is within the constituent labelled VP.

(26)

QP: $\exists$, λ_3, **a teacher**, λ_2, **DP**, ID, t_3, **t_2**, 's note to **him$_1$**

t ... λ_0, no boy, λ_1, **VP**, t_1, read t_0
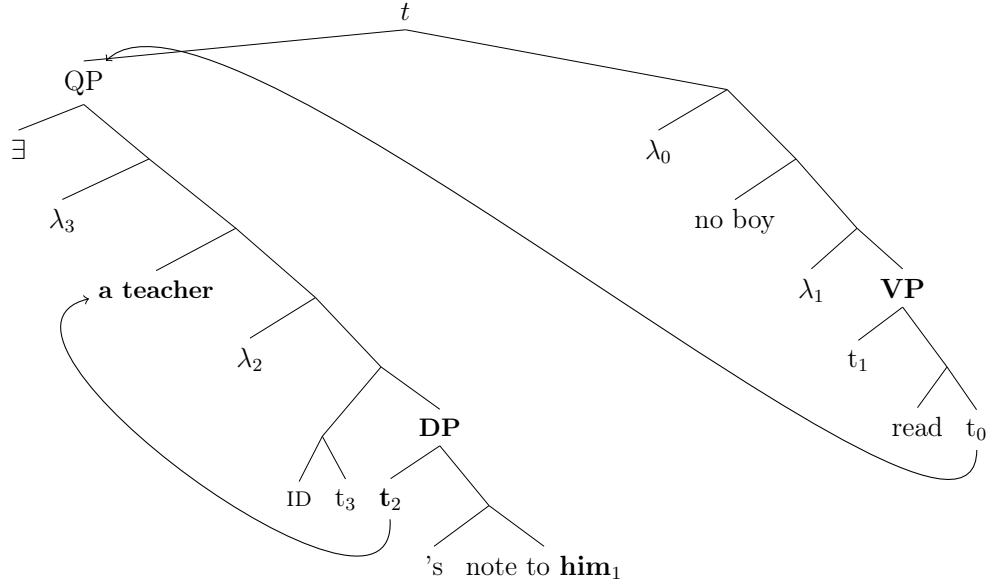
Given that undoing the movement is not an option under current assumptions on pied-piping, we need to semantically reconstruct the constituent labelled DP to its trace position, i.e. t_0, in a way that allows it to be interpreted with respect to an assignment g whose domain contains the index 1.

The logical form that will derive the desired reconstruction effect is given below. I entirely ignore intensionality here to simplify the discussion.[11] First observe that type-wise things work out. The abstractor $_a\wedge$ is merged above DP, giving us a function of type $< a, e >$ from assignments to individuals. When the standard derivation required for pied-piping takes place, the fronted QP (what moves above the subject) ends up denoting an existential quantifier over objects of type $< a, e >$. Hence, the trace of this quantifier can be type $< a, e >$. Crucially, the trace of the moved QP is complement to a $_a\vee$ that feeds the local assignment to its complement, as a result of which 'read' combines with a type e expression.

---

[11]Recall that the ID morpheme insists on composing with intensions.

(27)

```
                                    t
           ┌────────────────────────┴────────────────────────┐
    <<<a,e>,t>,t>                                      <<a,e>,t>
       ┌──┴──┐                                          ┌──┴──┐
       ∃   <<a,e>,t>                                   λ0     │
            │                                              no boy
            λ3                                              ┌──┴──┐
            │                                              λ1     │
         <<a,e>,t>                                          │     │
          ┌──┴──┐                                           t1   ┌┴─┐
      a teacher  │                                             read  e
                 λ2                                                 ┌┴─┐
               ┌─┴─┐                                               a∨  t0
          ID t3   <a,e>
                 ┌─┴──┐
               a∧    DP
                    ┌─┴──┐
                   t2  's note to him1
```
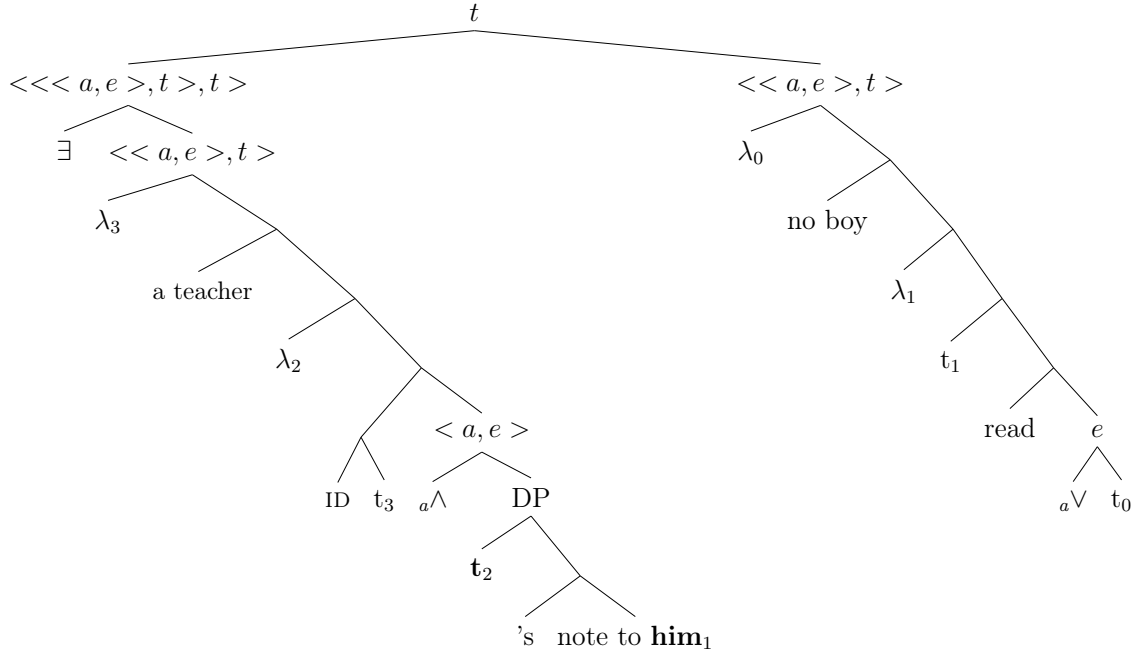
There is a crucial detail that needs to be fixed before we discuss this structure any further. While this detail was not relevant to the structures that we considered before, the constituent labelled DP in the LF above contains two distinct indexed expressions: the bound pronoun him_1, and the trace of [a teacher], i.e. t_2. The way I defined $_a\wedge$, repeated in (28), was sufficient for cases where it applied to a constituent in which the only assignment dependent expression was a pronoun that needed to be reconstructed. But here we have a trace that is interpretable if it does not reconstruct, in addition to a pronoun that is uninterpretable unless it reconstructs.

(28) $[\![_a\wedge\ \alpha]\!]^{w,\,g} = \lambda g'.\ [\![\alpha]\!]^{w,\,g'}$ (to be revised below)

How can we reconcile these contradictory requirements? Let us first observe that the problem arises simply because the operator in (28) in some sense 'gets rid of information', as illustrated in (29). While the constituent $[_a\wedge\ \ \alpha]$ is interpreted relative to an assignment that maps 5 to Bill. Once $_a\wedge$ abstracts over the assignment parameter, we lose that information. Hence, if α contains a pronoun with index 5, nothing guarantees that the pronoun will evaluated as Bill.

(29) $[\![_a\wedge\ \ \alpha]\!]^{\{5\rightarrow Bill\}} = \lambda g'.\ [\![\alpha]\!]^{g'}$

To ensure that abstraction over assignments does not result in loss of information, I propose the revised meaning for $_a\wedge$ below, where abstraction in some sense opens

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up a new slot for additional information rather than lose existing information.[12] This property of assignment abstraction is also implicit in the λ-abstraction rule in Heim and Kratzer (1998).[13]

(30) $\quad [\![_a\wedge \ \alpha]\!]^{\text{w, g}} = \lambda g'. \ [\![\alpha]\!]^{\text{w, g' } \cup \text{ g}}$ $\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (final)

With this revised definition for $_a\wedge$, let us go over the proof that the logical form derives the desired reading, starting from the left branch of the diagram, i.e. the entire pied-piped phrase.

(31)
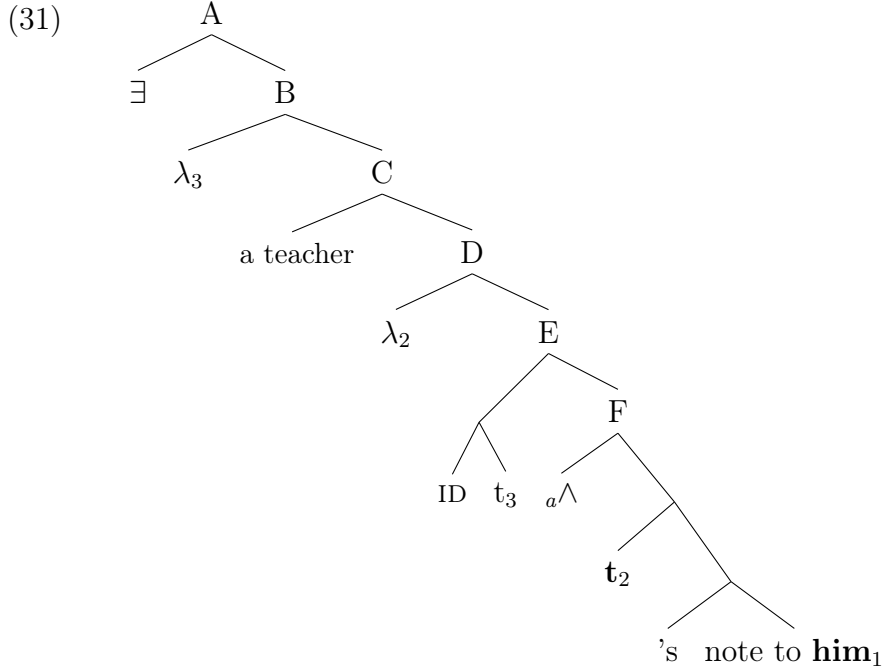
(32) $\quad [\![A]\!]^{\text{g}} =$

 a. $\quad \lambda Q. \ \exists f\colon Q(f){=}1 \ \& \ [\![B]\!]^{\text{g}}(f){=}1$ $\qquad\qquad\qquad\qquad\qquad\qquad$ =
 b. $\quad \lambda Q. \ \exists f\colon Q(f){=}1 \ \& \ [\lambda k. \ [\![C]\!]^{\text{g}[3\to k]}](f){=}1$ $\qquad\qquad\qquad\qquad$ =
 c. $\quad \lambda Q. \ \exists f\colon Q(f){=}1 \ \& \ [\![C]\!]^{\text{g}[3\to f]}{=}1$ $\qquad\qquad\qquad\qquad\qquad$ =
 d. $\quad \lambda Q. \ \exists f \ \exists x\colon [\![\text{teacher}]\!](x) \ \& \ Q(f){=}1 \ \& \ [\![D]\!]^{\text{g}[3\to f]}(x){=}1$ $\qquad$ =
 e. $\quad \lambda Q. \ \exists f \ \exists x\colon [\![\text{teacher}]\!](x) \ \& \ Q(f){=}1 \ \& \ [\lambda y. \ [\![E]\!]^{\text{g}[3\to f, \ 2\to y]}](x){=}1$ $\quad$ =
 f. $\quad \lambda Q. \ \exists f \ \exists x\colon [\![\text{teacher}]\!](x) \ \& \ Q(f){=}1 \ \& \ [\![E]\!]^{\text{g}[3\to f, \ 2\to x]}{=}1$ $\qquad\quad$ =
 g. $\quad \lambda Q. \ \exists f \ \exists x\colon [\![\text{teacher}]\!](x) \ \& \ Q(f){=}1 \ \& \ f{=} \ [\![F]\!]^{\text{g}[2\to x]}$ $\qquad\qquad$ =
 h. $\quad \lambda Q. \ \exists f \ \exists x\colon [\![\text{teacher}]\!](x) \ \& \ Q(f){=}1 \ \& \ f{=} \lambda g'. \ [\![t_2\text{'s note to him}_1]\!]^{\text{g' } \cup \text{g}[2\to x]}$

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[12]This revision does not have any effect on the cases we considered before the pied-piping examples.
[13]I thank Paul Marty for pointing out that this amendment might require further comments concerning the rules that would make the union of g and g' defined.

Let us now turn to the entire LF, where the meaning derived for the node A will be used.

(33)

```
              CP
           /      \
        [A]         G
                  /    \
                λ_0      H
                       /    \
                  no boy     I
                           /    \
                         λ_1      J
                          |      /  \
                         t_1  read
                                   /  \
                                 _a∨  t_0
```
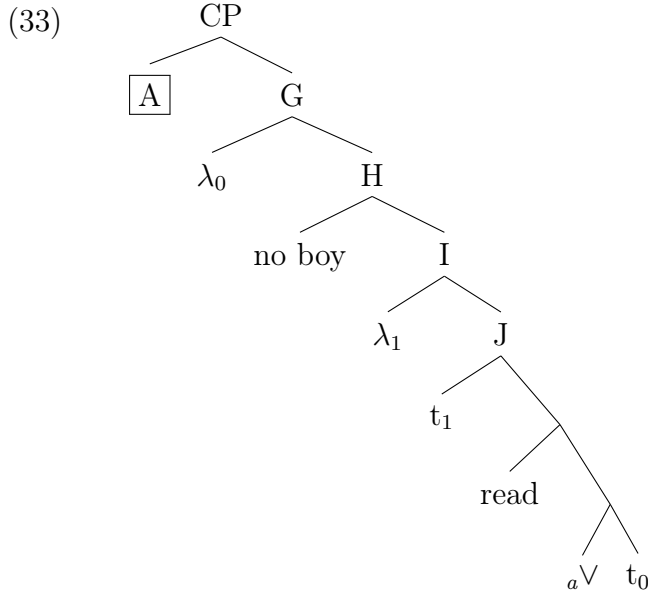
(34) $[\![CP]\!]^g = 1$ iff

a. $[\lambda Q.\ \exists f\ \exists x:\ [\![\text{teacher}]\!](x)\ \&\ Q(f){=}1\ \&\ f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}]([\![G]\!]^g)$
$= 1$ iff

b. $[\lambda Q.\ \exists f\ \exists x:\ [\![\text{teacher}]\!](x)\ \&\ Q(f){=}1\ \&\ f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}](\lambda k.$
$[\![H]\!]^{g[0\to k]}\ ) = 1$ iff

c. $\exists f\ \exists x:\ [\![\text{teacher}]\!](x)\ \&\ [\lambda k.\ [\![H]\!]^{g[0\to k]}](f){=}1\ \&$
$f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}{=}1$ iff

d. $\exists f\ \exists x:\ [\![\text{teacher}]\!](x)\ \&\ [\![H]\!]^{g[0\to f]}{=}1\ \&$
$f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}{=}1$ iff

e. $\exists f\ \exists x\ \neg\exists y\ [\![\text{teacher}]\!](x){=}1\ \&\ [\![\text{boy}]\!](y){=}1\ \&\ [\![I]\!]^{g[0\to f]}(y){=}1\ \&$
$f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}{=}1$ iff

f. $\exists f\ \exists x\ \neg\exists y\ [\![\text{teacher}]\!](x){=}1\ \&\ [\![\text{boy}]\!](y){=}1\ \&\ [\lambda z.[\![J]\!]^{g[0\to f,\ 1\to z]}](y){=}1\ \&$
$f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}{=}1$ iff

g. $\exists f\ \exists x\ \neg\exists y\ [\![\text{teacher}]\!](x){=}1\ \&\ [\![\text{boy}]\!](y){=}1\ \&\ [\![J]\!]^{g[0\to f,\ 1\to y]}{=}1\ \&$
$f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}{=}1$ iff

h. $\exists f\ \exists x\ \neg\exists y\ [\![\text{teacher}]\!](x){=}1\ \&\ [\![\text{boy}]\!](y){=}1\ \&\ [\![\text{read}]\!]([\![_a\vee t_0]\!]^{g[0\to f,\ 1\to y]})(y){=}1$
$\&\ f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}{=}1$ iff

i. $\exists f\ \exists x\ \neg\exists y\ [\![\text{teacher}]\!](x){=}1\ \&\ [\![\text{boy}]\!](y){=}1\ \&\ [\![\text{read}]\!](f(g^{[1\to y]}))(y){=}1\ \&$
$f{=}\lambda g'.\ [\![t_2\text{'s note to him}_1]\!]^{g'\ \cup g[2\to x]}$

Now, the derived conditions in (34i) require there to be a teacher x, a function f from assignments to individuals such that $f = \lambda g'$. $[\![t_2\text{'s note to him}_1]\!]^{g' \, \cup g[2 \to x]}$, and no boy y such that y read $f(g^{[1 \to y]})$. Crucially, when f is applied to its argument $g^{[1 \to y]}$, we get $[\![t_2\text{'s note to him}_1]\!]^{g[1 \to y] \cup g[2 \to x]}$, i.e. x's note to y. Hence, the derived truth conditions are equivalent to (35), as desired.

(35) $\exists x \, \neg \exists y$: x is a teacher and y is a boy and y read x's note to y.

Finally, for completeness sake, I provide below the logical form for the *wh*-question in (36). Notice that the trace of the QP is of type $< s, < a, e >>$, which determines the hierarchical order between $_w\vee$ and $_a\vee$ that applies to the trace. The reverse order would yield a type-mismatch. The internal composition of the QP is given next.

(36)   [$_{QP}$ **Which teacher's note to him$_1$**]$_0$ did no boy$_1$ read t$_0$?

(37)

The internal composition of the QP is given below. Given ID's meaning, the node identified with the complement of ID has to be an object of type $< s, \gamma >$, where γ is any type. Hence, the only possible merge order between $_w\wedge$ and $_a\wedge$ is as shown below.[14] Importantly, this merge order determines the type of the QP, which in turn determines the application order of $_w\vee$ and $_a\vee$ in trace posititon.

(38) $<<< s, < a, e >>, t >, t >$

$$\begin{array}{l}
\exists \quad << s, < a, e >>, t > \\
\quad\quad \lambda_3 \\
\quad\quad\quad \text{which teacher} \\
\quad\quad\quad\quad \lambda_2 \\
\quad\quad\quad\quad\quad\quad\quad < s, < a, e >> \\
\quad\quad\quad\quad\quad \text{ID} \quad t_3 \quad {}_w\wedge \quad < a, e > \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad {}_a\wedge \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad t_2 \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad \text{'s note to him}_1
\end{array}$$

To recap, under this system, the pied-pipee semantically reconstructs for scope, opacity, and binding. Scope reconstruction follows from the syntax of pied-piping, in particular the ID morpheme. Semantic reconstruction for opacity and binding is achieved thanks to morphemes that make reference to the parameters of the interpretation function w, g. These morphemes allow a grammar that has only two composition rules, Function Application and Predicate Modification, as they dispense with Intensional Functional Application and Extensionalizing Functional Application (and allow us to give a categorematic meaning to the λ-operator).[15] In what follows I discuss an important objection to semantic reconstruction and point to open questions.

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[14]This is not an inherent restriction but derives from of ID's meaning. In other environments, where semantic reconstruction for binding and opacity occurs at the same time, either merge order would work.

[15]I should add that while IFA and EFA encode FA in them, the output of $_w\wedge$ and $_w\vee$ can in principle compose with its sister via FA or PM, whichever is defined.

5.4 Limitations of semantic reconstruction

The idea that grammar makes semantic reconstruction via higher type traces possible is not free of challenges. Romero (1998); Fox (1999); Fox and Nissenbaum (2004) present empirical arguments against semantic reconstruction. Lechner (2018); Keine and Poole (2018), on the other hand, defend the view that grammar makes semantic reconstruction for scope available whereas reconstruction for opacity and binding always involves undoing the movement. The data that has been argued to constitute evidence that semantic reconstruction is unavailable or very limited bear on intricate binding theoretic facts, primarily involving Condition C (but also variable binding and anaphora). Although test cases may be complex, they arguably present an important challenge to theories that view semantic reconstruction as the only reconstruction mechanism available to grammar (Sharvit, 1998; Sternefeld, 2001b; Ruys, 2015; Jacobson, 2004). In this section, I discuss one of these challenges that have been brought up and mention some possible hypotheses, leaving an account of these facts to future work.

Noting some speaker variation, Fox (1999) reports the data below illustrating the interaction between A-movement and Condition C.[16] In (39a), the indefinite subject *a student of his* can be understood to have both the wide scope/*de re* construal and the narrow scope/*de dicto* construal when *his* is coreferent with *David*. However, in (39b), *a student of David's* is reported to disallow the narrow scope/*de dicto* construal but allow the wide scope/*de re* construal, when *him* is coreferent with *David*.

(39)   a.   [A student of his$_1$]$_2$ seems to David$_1$ $\mathbf{t}_2$ to be at the party.

                           ✓ *wide scope/de re*, ✓ *narrow scope/de dicto*

    b.   [A student of David's$_1$]$_2$ seems to him$_1$ $\mathbf{t}_2$ to be at the party.

                           ✓ *wide scope/de re*, * *narrow scope/de dicto*

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[16]The reported judgments in Fox (1999) seem to be for scope, rather than opacity. von Fintel and Heim (2011) report judgments for opacity. I combine these judgments in the presentation. I do not know whether the third reading (narrow scope/*de re*) is available for the indefinite subject. If it *is* available under the intended coreference, it would corroborate the claim in Keine and Poole (2018); Lechner (2018) that semantic reconstruction *is* available for scope reconstruction.

Fox's explanation of the contrast in the availability of the narrow scope/*de dicto* construal has two components:

(40)   a.   Condition C is evaluated (only) at LF.
         b.   Reconstruction is undoing the movement at LF.[17]

Observe that if the only way to obtain the narrow scope/*de dicto* construal for the indefinite is undoing the movement, a Condition C violation[18] (Chomsky, 1980, 1981; Lasnik, 1989; Chomsky and Lasnik, 1993, a.o.) is guaranteed at LF, as can be seen in the logical form below (assuming that the experiencer *him* c-commands *David* out the PP).

(41)   LF for the narrow scope/*de dicto* construal:
         seems to him$_1$ [**a student of David's**$_1$] to be at the party

Fox's argument is that if a semantic reconstruction mechanism were available, [**a student of David's**] would be above *seem* at LF, and we would be able to observe the obviation effect of A-movement under both readings of the indefinite, rather than just the wide scope/*de re* reading.

Given that there seems to be speaker variation as Fox notes, a possible counter-hypothesis on these facts is that semantic reconstruction is a dispreferred option whenever undoing the movement is available. Then, speakers who do not observe a contrast would be accessing the semantic reconstruction route to derive the narrow scope construal, under which the indefinite remains in its post-movement position at LF and a violation of Condition C is avoided. However, this hypothesis irrecoverably breaks once we take into consideration the received observation that Condition C is in fact *not* obviated by all movement operations.

Fox presents the sentences in (42) to illustrate that A' movement (which he takes *wh*-movement and QR to be instantiations of) generally[19] do not obviate Condition C[20], as illustrated in (42a) and (42b) whereas A-movement does, (42c).

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[17]This characterization is not entirely faithful to Fox but it should suffice in the present context.

[18]An informal definition from Sportiche (2006):

Condition C: A pronoun cannot corefer with a non-pronoun that it c-commands.

[19]Fox argues that Condition C *can* be obviated with A'-movement when the pre-movement position is forced to have a simple trace (as in Antecedent-Contained-Deletion) and when it is possible to late-merge material in the post-movement position (Lebeaux, 1990). See Fox (1999) and Sportiche (2006) for a comprehensive overview. I gloss over these intricate and interesting facts here, as I believe the basic data suffices to illustrate the challenge.

[20]There does not seem to be a consensus on Condition C effects with overt *wh*-movement. See Safir (1999); Jacobson (2004); Krifka (2018), a.o.

(42)   a. ??/*[Which argument that John$_1$ is a genius]$_2$ did he$_1$ believe t$_2$?

       b. *A different person told him$_1$ about [every argument that John$_1$ is a genius]

       c. [Every argument that John$_1$ is a genius]$_2$ seems to him$_1$ t$_2$ to be flawless.

                                                                    Fox (1999): 192

Taking up a suggestion in Chomsky (1993), Fox accounts for the contrast between A-movement and A'-movement by assuming that A' movement —unlike A movement— *"obligatorily leaves a copy that is converted to an operator-variable construction in accordance with economy considerations"*. Accordingly, the logical form for the *wh*-question in (42a) has to look (very roughly) like (43a) whereas the logical form for (42c) can look like (43b). Accordingly, the contrast between A-movement and A'-movement with respect to Condition C obviation is attributed to the difference in what each movement leaves behind. In (43a), *he* c-commands the lower occurrence of *John*, incurring a Condition C violation whereas in (43b) *him* does not c-command any occurrence of *John*, hence movement obviates Condition C.

(43)   a. [which argument that John$_1$ is a genius] λx

              he$_1$ believed

              $\boxed{\text{the argument that } \textbf{John}_1 \text{ is a genius} = x}$

       b. [every argument that John$_1$ is a genius] λx

                                         seems to **him**$_1$

                                         $\boxed{x}$ to be flawless

The semantic reconstruction approach is not readily compatible with this conception of what occupies the pre-movement position of A'-movement. In this system, the lower copy is converted into a definite description, hence it is an object of type *e*. Yet, the semantic reconstruction approach requires a variety of traces of higher types.[21] Therefore, it seems to me that if we want to maintain the assumption that

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[21]Danny Fox suggests that if we allow ourselves to existentially lift a quantifier (keeping ID entirely type-neutral), the lower copy *can* be construed as 'a quantificational trace' in some sense. For example, if [∃ [ID [every boy]]] QRs, its lower copy can be interpreted as 'the Q identical to [every boy]' (where Q is the variable of type $< et, t >$ that comes with λ-abstraction) by Trace Conversion and would be of type $< et, t >$. This essentially reconciles the possibility of leaving a higher type trace and the Copy Theory of Movement. However, as far as I can see, there will still be non-trivial problems in reconciling it with deriving a *de re* construal in that the lower copy will be evaluated in the local evaluation world, if nothing else is said. It is conceivable, however, the trace conversion procedure only introduces a weak presupposition on the intensional status of the expression in the lower copy, e.g. $[\![\text{THE}_n]\!]^w = \lambda P_{< s, \alpha >}: \exists w' \ P(w')(g(n)) = 1. \ g(n)$

Condition C is evaluated exclusively at LF (Fox, 1999; Sportiche, 2006, a.o.), telling a coherent story about these Condition C related effects is not straightforward under the semantic reconstruction approach.

There are other ideas about the nature of Condition C and where in grammar it is evaluated. One prominent semantic approach views Condition C effects to be derived from a preference for variable binding over coreference (Reinhart, 1983). Building on the ideas in Reinhart (1983), Jacobson (2004) and Krifka (2018) present an attempt to reinterpret basic Condition C effects under the view that what the interpretive component evaluates is strings rather than an abstract structure like LF. A pragmatic account that again builds on Reinhart (1983) is sketched in Schlenker (2005), where evaluation for Condition C is argued to be part of a left-to-right dynamic parsing procedure. In the same vein, Bruening (2014) argues that the relevant notion in evaluating Condition C makes reference to precedence, in addition to a relaxed notion of command, called phase-command. However, I believe these alternative models have not yet reached the level of sophistication that an LF based approach to Condition C as in Fox (1999) has. In particular, Condition C effects contingent on the interpretation assigned to a string (exemplified in (39b)) is a challenge that any linear parsing model needs to overcome. In particular, Sharvit (1998); Lechner (2018); Keine and Poole (2018) explicitly argue that that the obviation effect of movement on Condition C disappears in case of opacity reconstruction (as opposed to scope reconstruction).

Then, the challenge for the approach I have pursued is to reconcile the LF-based approach on Condition C and possibility of leaving higher type traces, which I leave as an important open question. On the other hand, something needs to be said about overt vs. covert scope shifting movement. While an overt scope-shifting movement (i.e. scrambling) in Turkish obviates Condition C as illustrated in (44), a covert scope-shifting movement (i.e. QR) typically does not, (42b).

(44)   a. *[$_{QP_1}$ bi öğretmen] **ona**$_3$ [$_{QP_2}$ her   **John**$_3$'a   sınavda kopya
             a teacher   3SG.DAT   every John.DAT on.exam copy
         verdiğim   dedikodusunu]   söylemiş.
         give.NMLZ.1SG rumor.3SG.POS.ACC   told.EVID
         Intended: 'A teacher told him$_3$ about every rumor that I let John$_3$ copy
         my answer on the exam.'

      b. ?[$_{QP_2}$ her   **John**$_3$'a   sınavda kopya verdiğim
             every John.DAT on.exam copy   give.NMLZ.1SG
         dedikodusunu]   [$_{QP_1}$ (farklı)   bi öğretmen] **ona**$_3$ t$_2$ söylemiş.
         rumor.3SG.POS.ACC   different a teacher   3SG.DAT   told.EVID
         'Every rumor that I let John copy my answers on the exam, a different

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teacher told him (about).'

An explanation of this contrast that makes reference to the pronunciation position, however, is not compatible with a purely-LF based account of Condition C effects.

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Chapter 6

Syntax of pied-piping and island-violating *wh*-scope

In deriving exceptional scope via pied-piping, both Charlow (2019) and its ∃-theory variant make crucial use of two types of movement: movement to the edge of an island and subsequent movement of the island. I have already mentioned in passing that both of these movements find cross-linguistic support in *wh*-questions, a point Charlow (2019) makes, as well. An important question, then, is whether the pied-piping approach to exceptional scope is also able to accommodate the attested variation. While I am not aware of cross-linguistic variability in the availability of island-violating scope for indefinites and *de re* readings inside islands, it is very well known that there is considerable variation in the availability of island-violating *wh*-scope across languages (see Bayer and Cheng (2017) for a recent review). In particular in single-*wh*-questions of *wh*-fronting languages, island violating *wh*-scope seems to be limited. While a language like Finnish is able to overtly pied-pipe an island that contains a *wh*-phrase as shown in (1a), many *wh*-fronting languages do not exhibit overt island pied-piping, as illustrated by the English example in (1b).

(1)   a.   [$_{island}$ **kenelle** kirjoitetun   kirjeen]$_1$ Pekka luki **t**$_1$?
                   who.ALL written.PTCP letter.ACC Pekka read
             'Who$_1$ is such that Pekka read the letter written to them$_1$?'
       b.   *[$_{island}$ the letter that was written to **whom**]$_1$ did Sue read **t**$_1$?

In this chapter, I investigate the nature of overt island pied-piping primarily in the light of Finnish data and argue that overt island pied-piping necessarily involves **string-vacuous *wh*-movement** internal to the pied-piped phrase. I take this to suggest that the availability of overt island pied-piping needs to make reference to the

linearization-related properties of what we call extraction islands (Fox and Pesetsky, 2004, 2005).

In the first part of this chapter, I discuss the baseline cross-linguistic evidence for the pied-piping approach to exceptional *wh*-scope, which consists in **internal *wh*-movement** (van Riemsdijk, 1985; Heck, 2009) and **island pied-piping** (Nishigauchi, 1990; Richards, 2000). In the discussion, I will only make reference to the ∃-theory but the discussion naturally applies to Charlow (2019), as well. Then, I turn to the issue of why overt island pied-piping seems to be restricted cross-linguistically. Finally, I briefly compare the current approach with an alternative proposal to limit island-violating *wh*-scope proposed in Cable (2010).

6.1   On edge requirement & internal *wh*-movement

How do languages deal with *wh*-phrases inside extraction islands? While island-violating *wh*-scope is cross-linguistically robust, it is typically[1] assumed that it is not obtained via *island-violating movement*.[2] This sort of movement is unavailable for overt *wh*-movement as illustrated in (2). Moreover, even languages like Turkish that permit long-distance scrambling disallow scrambling out of an extraction island, as illustrated in (3).

(2)   *What$_1$ did Sue kick [$_{island}$ the weird guy that brought t$_1$] out of her party?

(3)   a.   Sen [$_{island}$ Pelin'in   **kime**$_1$ verdiği   hediyeyi]   çöpe attın?
           you   Pelin.GEN who.DAT give.NOMLZ present.ACC trashed.2SG
           'Who$_1$ is s.t. you trashed the present that Pelin gave to them$_1$?'

      b. ***kime**$_1$ sen [$_{island}$ Pelin'in   t$_1$ verdiği   hediyeyi]   çöpe attın?
         who.DAT you   Pelin.GEN   give.NOMLZ present.ACC trashed.2SG

Setting aside generally barred or degraded instances of island violating movement like in (2), cross-linguistically, we find two ways of licensing island-violating *wh*-scope

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[1]This assumption is not shared by all. For example, von Stechow (1996) argues that island-violating *wh*-movement is legitimate at LF. See also Watanabe (1992) for a similar proposal.

[2] In particular, this is widely assumed to be the case in single-*wh*-questions. A more fine-grained characterization of the availability of island-violating *wh*-movement is advanced by Richards (1998) who argues that in binary *wh*-questions (or multiple *wh*-questions), island-violating *wh*-movement *can* occur. This instance of island-violating *wh*-movement is argued to be licensed on the condition that another *wh*-phrase satisfies the [+wh] feature of the interrogative complementizer via an instance of non-island-violating *wh*-movement. This is presented as a piece of empirical evidence for a general principle of grammar named Principle of Minimal Compliance (PMC). Richards shows that various domains outside of *wh*-questions converge on what PMC predicts.

in single-*wh*-questions.[3] First, as is well known, *wh*-in-situ typically licenses island-violating *wh*-scope, as illustrated in (3a). The —less studied— second way of licensing island-violating *wh*-scope is overt island pied-piping in overt *wh*-fronting languages.

I assume that grammar derives island-violating *wh*-scope in *wh*-fronting languages like Finnish and *wh*-in-situ languages like Turkish in the same way, i.e. via island pied-piping, as argued in Richards (2000). From this perspective, **overt island pied-piping** is a phenomenon that allows us to understand better what logical forms of island-violating *wh*-questions might look like. However, I should emphasize that the discussion that follows merely attempts to sketch an account of the seemingly restricted distribution of overt island pied-piping. I will leave an important question open, namely the question of what governs the distribution of overt vs. covert movement.

Overt island pied-piping has been reported in a (relatively small) number of languages. The most comprehensive study on island pied-piping comes from Huhmarniemi (2012) that investigates the syntactic properties of island pied-piping in Finnish. In addition to Finnish, languages that have been reported to have overt pied-piping of islands in *wh*-questions include Basque (Ortiz de Urbina, 1989; Raynaud, 2017), Haida (Enrico, 2003), and Tlingit (Cable, 2010).

Consider the Finnish data below which illustrates the phenomenon of overt island pied-piping.[4] As shown in (4a) the *wh*-phrase cannot be moved out of the DP island, leaving the island in-situ. However, the entire island DP containing the *wh*-phrase can be pied-piped, as shown in (4b).

(4)   Finnish   Huhmarniemi (2010)

    a. *__kenelle__$_1$ Pekka luki [$_{island}$ __t__$_1$ kirjoitetun   kirjeen]?
        who.ALL Pekka read   written.PTCP letter.ACC
        Intended: 'Which person x is such that Pekka read the letter written to x?'

    b. [$_{island}$ __kenelle__ kirjoitetun   kirjeen]$_1$ Pekka luki __t__$_1$?
            who.ALL written.PTCP letter.ACC Pekka read
        'Which person x is such that Pekka read the letter written to x?'

Examples of island pied-piping from Basque, Haida, and Tlingit are provided below. Note that both Tlingit (Cable, 2010) and Haida (Enrico, 2003) exhibit canonical *wh*-fronting like English. In Basque *wh*-questions, the *wh*-phrase does not have to

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[3]I set aside multiple *wh*-questions for reasons discussed in footnote 2 above.

[4]Finnish is SVO and an obligatory (single) *wh*-fronting language like English. See Huhmarniemi (2012) for baseline data.

be clause initial but there needs to be linear adjacency between the *wh*-phrase and the verbal complex. Under one analysis, this adjacency is taken to be created by canonical *wh*-movement to spec-CP and T-to-C head movement (Ortiz de Urbina, 1989). As the most detailed data is available for Finnish, I will focus on Finnish in discussing overt island pied-piping.

(5) Basque   Ortiz de Urbina (1989), pg. 252

 a. [$_{island}$ **nork** idatzi zuen   liburua]$_1$ irakurri du   Peruk t_1
          who   write AUX.COMP book   read   AUX Peru.ERG
      'Which person x is such that Peter has read the book x wrote?'

 b. ***nork**$_1$ irakurri du   Peruk   [$_{island}$ t_1 idatzi zuen   liburua]
          who   read   AUX Peru.ERG   write AUX.COMP book
      Intended: 'Which person x is such that Peter has read the book x wrote?'

(6) Haida (isolate)   Enrico (2003), pg. 634, 645

 a. ***giisd**-.uu$_1$ dang-ga [$_{island}$ t_1 kígs tla.àwhlaa-yaa] Mary giidaa-yaa?
      who-FOC you-to   cake make-EVID   Mary give-EVID
      Intended: 'Which person x is such that Mary gave you the cake x made?'

 b. [$_{island}$ **giisda** kígs tla.àwhlaa-yaa]-.uu dang dah-gaa?
          who   cake make-EVID-FOC   you buy-EVID
      'Which person x is such that you bought the cake x made?'

(7) Tlingit (Na-Dené)   Cable (2010), pg. 34, 42

 a. [$_{island}$ **goodáx̱**   ḵ'anáax̱án tlein] sáyá   du kát   satéen?
          where.from fence   big   Q.FOC its surface.to placed(?)
      Literally: 'A big fence from where was placed on it?'

 b. [$_{island}$ **wáa** kwligeyi   x̱áat] sá i   tuwáa   sigóo?
          how it.is.big.REL fish   Q your spirit.at it.is.glad
      Literally: A fish that is how big do you want?'

A crucial property of overt island pied-piping seems to be that the *wh*-phrase is always at the left edge of the pied-piped island. This empirical observation is explicitly made for Finnish by Huhmarniemi (2012), while the data reported for Basque, Haida and Tlingit do not appear to contradict this observation.

As shown in the Finnish example in (8a), when the genitive subject DP *pojan* in the relative clause precedes the *wh*-phrase, pied-piping is not possible. Note, however, that if the *wh*-phrase is the genitive subject as in (8b), it again becomes possible to pied-pipe the island. The ungrammatical example in (8a) only differs from the grammatical example (8c) in having a genitive DP that precedes the *wh*-phrase within the pied-piped island. A pressing interpretation of the facts below is a condition that requires **a *wh*-phrase to be at the left edge of the pied-piped island**.

(8)   Finnish   Huhmarniemi (2010), pg. 6; Huhmarniemi (2012), pg 170

   a. *[island pojan   **kenelle** kirjoittaman   kirjeen]   Pekka luki?
           boy.GEN who.ALL written.PTCP.ACC letter.ACC Pekka read
           'Which person x is s.t. Pekka read the letter written by the boy to x?'

   b. [island **kenen**   äidilleen   kirjoittaman kirjeen]   Pekka luki?
           who.GEN to.3SG.mother written.PTCP letter.ACC Pekka read
           'Which person x is s.t. Pekka read the letter written by x to x's mother?'

   c. [island **kenelle** kirjoitetun   kirjeen]   Pekka luki?
           who.ALL written.PTCP letter.ACC Pekka read
           'Which person x is such that Pekka read the letter written to x?'

The edge requirement observed in overt island pied-piping seems to fall under a generalization on pied-piping that Heck (2009) labels *Edge Generalization*, in (9).[5]

(9)   *Edge Generalization*
       If α pied-pipes β, then α must be at the edge of β Heck (2009), pg. 89

Edge Generalization was essentially formulated as a generalization on small scale pied-piping illustrated in (10).

(10)   a.   John wonders [**whose pictures**] you liked the most.
        b.   *John wonders [**pictures of whom**] you liked the most.

Both Heck (2009) and Cable (2010) note that what Heck names 'massive pied-piping' is available in some languages, where the *wh*-phrase can be deeply embedded in the fronted phrase. In English, this seems to be unavailable or only marginally available.

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[5]Richards (2000) formulates a similar condition on pied-piping that requires that *a wh-operator c-command its scope*. This relies on a relaxed interpretation of c-command where the edge position that hosts a *wh*-phrase is able to c-command the question nucleus.

(11)   a. ??[Pictures of **whom**] did John like?   Cable (2010), pg. 172
        b. *[Pictures of **whom**] do you think I should buy? Richards (2019), pg. 1

Massive pied-piping violates the *Edge Generalization* but is apparently limited to nonsubordinated environments (Heck, 2009; Cable, 2010).[6] Heck writes: "Massive pied-piping is a phenomenon that is to be distinguished from nonmassive pied-piping. It calls for a separate theoretical approach." (pg.77). Richards (2019), on the other hand, argues that the possibility of *wh*-in-situ within overtly pied-piped phrases correlates with the possibility of *wh*-in-situ in *wh*-questions, as illustrated by the French data below.

(12)   *optional matrix wh-in-situ → ✓ matrix massive pied-piping*

        a.   Tu fait **quoi** dans la   vie?
              you do   what in   the life
              'What do you do in life?'

        b.   [Des   photos de **qui**] as-tu   achetées?
              of.the photos of who   have-you bought
              '[Photos of who] did you buy?'

(13)   *no embedded wh-in-situ → × embedded massive pied-piping*

        a.   *Peter a   demandé [tu as   vu **qui**]
              Peter has asked   you have seen who
              Intended: Peter has asked who you have seen.

        b.   *Je ne sais   pas [des   photos de **qui**] elle as   acheté.
              I NE know not of.the photos of who   she has bought
              Intended: 'I don't know [pictures of whom] she bought.'

   Richards (2019), pg. 17-18

I set aside the important question of what licenses *wh*-in-situ in *wh*-questions and its potential connection with the question of which position(s) are available for *wh*-phrases in overtly fronted phrases. I follow Richards (2019) regarding massive pied-piping, and henceforth assume that *Edge Generalization* describes a general requirement that grammar imposes on pied-piping. What is more important for our purposes is that the available data on overt island pied-piping seems to be in line with the *Edge Generalization*.

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[6]Norvin Richards informs me that Zulu might be an exception to this.

Assuming that grammar imposes some form of edge requirement on pied-piping, there are two important questions regarding this requirement:

(14)   a.   What is the exact characterization of the notion of 'edge'?
       b.   How can languages satisfy the edge requirement on pied-piping?

As the reader may notice, from the perspective of the theory of pied-piping (and island-violating *wh*-scope) I proposed[7], it is not at all surprising that Heck's *Edge Generalization* seems to be right for overt island pied-piping, too. Remember that under the $\exists$-theory, pied-piped phrases (including pied-piped islands) in *wh*-questions are always existential quantifiers within which a *wh*-phrase takes scope. Crucially, the scope position within pied-piped phrases is always at the linear edge, as schematized in (15) (λ-binders not shown). As I have discussed at length, the proposed derivation not only derives the right meaning for *wh*-questions with pied-piping but also blocks an unattested interpretation for pied-piped phrases. In that sense, the proposed syntax is motivated by concerns on the set of meanings grammar generates for *wh*-questions, rather than concerns on the set of acceptable strings grammar generates for *wh*-questions. Yet, it also nicely fits in with Heck's *Edge Generalization*, which is purely motivated by concerns on the set of acceptable strings grammar generates. Of course, the Edge Generalization has more to do with what syntax can deliver to PF and how structures are linearized. Hence, I believe, that a particular semantics for pied-piping can *derive* or *explain* the edge generalization would be a bogus claim, and this is *not* my claim.

(15)

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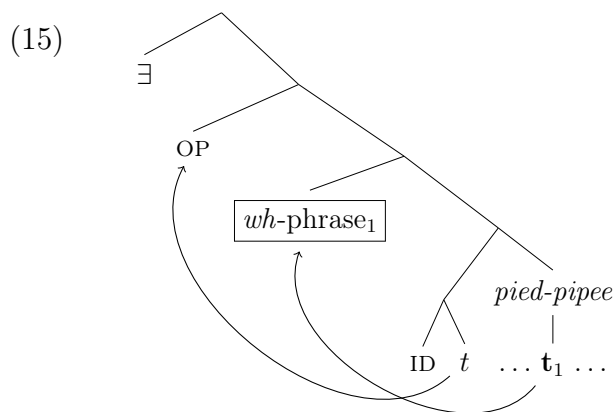
[7]Again, despite the differences, this discussion naturally applies to Charlow (2019), as well.

From the discussion above, it must be clear how I will answer the questions in (14). The edge position in a pied-piped phrase is a *scope position* for the *wh*-phrase above the pied-pipee. This position is derivationally created in syntax by merging an ID head. And the only legitimate way for a *wh*-phrase to occupy this position is movement. For the right meaning of *wh*-questions with pied-piping to be derived, it is crucial that the *wh*-phrase moves above the pied-pipee.[8]

(16)
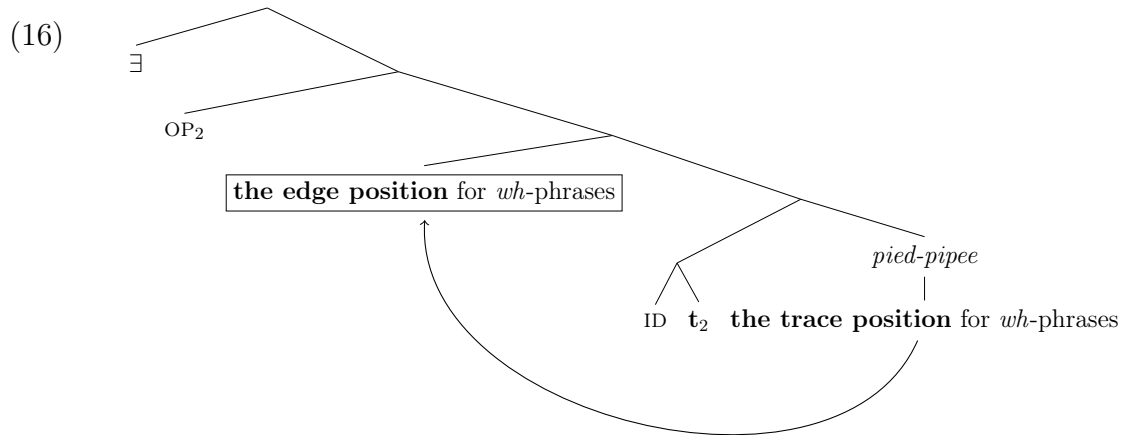
Heck (2009) notes that there is abundant evidence for *wh*-movement internal to pied-piped phrases, which he calls *secondary wh-movement*.[9] I call this movement **internal *wh*-movement**, following van Riemsdijk (1985); Richards (2000).

Perhaps one of the most well-known cases of internal *wh*-movement comes from Tzotzil. In Tzotzil, possssors are strictly postnominal as shown in (17) (Aissen, 1996).

(17)   Tzotzil (Mayan)   Heck (2009), pg. 89

    a.   s-p'in li   Maruch-e
          A3-pot the Maruch-ENC
          'Maruch's pot'

    b.   *Maruch s-p'in
          Maruch A3-pot

However, in *wh*-questions where the *wh*-phrase is a possessor, the *wh*-phrase strictly precedes the possessee, as shown in the examples below. From the perspective of the theory of pied-piping I proposed, the internal *wh*-movement that Tzotzil

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[8]Of course, this movement can, in theory, target a position outside the pied-piped phrase, above the ID in the clausal spine. This would yield the exact same denotation. Whether this option is actually attested is an open question.

[9]For Heck, secondary *wh*-movement also covers intermediate steps of successive cyclic *wh*-movement. He characterizes both movements as movements where a *wh*-phrase moves to a position that is not the scope position of that *wh*-phrase. In the theory of pied-piping I proposed (and Charlow's), *wh*-movement internal to a pied-piped phrase *is* movement to a scope position.

clearly exhibits is what the interpretive component of the grammar requires.[10] The *wh*-phrase *buch'u* is moving to its **scope** position above the pied-pipee, as schematized in (20) for the pied-piped phrase in (19b). One could argue that Tzotzil also supports the idea that this scope position is created by merging an ID head in that prenominal possessors do not seem to be available outside of *wh*-questions.[11]

(18) Tzotzil   Heck (2009), pg. 89

    a. [DP **Buch'u**$_1$ x-ch'amal **t**$_1$] i-cham
          who   A3-child   CP-died
        'Whose child died?'

    b. *x-ch'amal buch'u i-cham
        A3-child   who   CP-died

(19) Tzotzil   Heck (2009), pg. 95

    a. I-'ixtalaj [DP s-kayijonal y-osil   li   j-tot-e]
        CP-ruin   A3-firelane A3-land the A1-father-ENC
        'My father's land's firelane was ruined'

    b. [DP **buch'u**$_1$ s-kayijonal y-osil   **t**$_1$]$_2$ i-'ixtalaj **t**$_2$
          who   A3-firelane A3-land   CP-ruin
        'Whose land's firelane was ruined?'
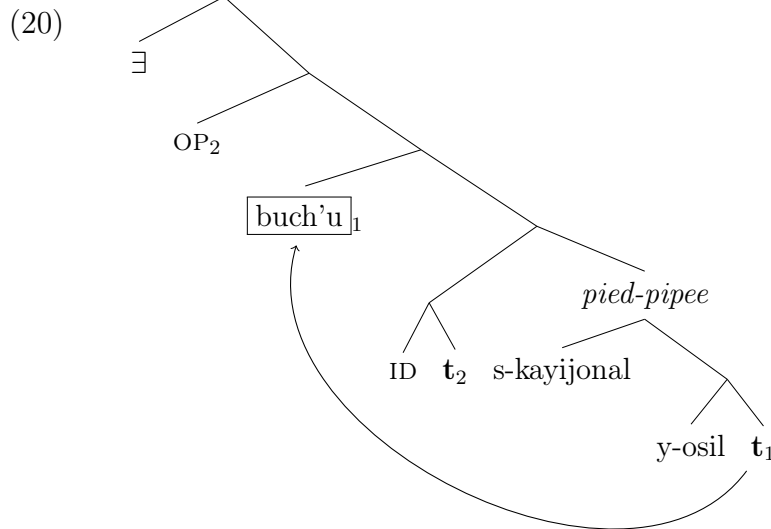
(20)

Another well-documented case of internal *wh*-movement occurs in pied-piped clauses, i.e. clausal complements of verbs (Ortiz de Urbina, 1989; Richards, 2000; Heck, 2008; Cable, 2010). Interestingly, languages that allow clausal pied-piping do not seem to *require* clausal pied-piping in that they also permit *wh*-extraction out of them.[12] See the Basque and Finnish examples below.

(21)   Basque   Duguine & Irurtzun (2014:2-3)

    a.   **Nork**$_1$ esan du   Jonek   [$_{CP}$ **t**$_1$ edan duela   ura]?
        who.ERG say   AUX Jon.ERG [drink AUX.COMP water.ABS]
        'Who did John say drank water?'

    b.   [$_{CP}$ **Nork**   edan duela   ura]$_1$ esan du   Jonek   **t**$_1$?
        [who.ERG drink AUX.COMP water.ABS] say   AUX Jon.ERG
        'Who did John say drank water?'

(22)   Finnish   Huhmarniemi (2010)

    a.   **Ketä**$_1$ Pekka halusi   lähteä [$_{InfP}$ auttamaan **t**$_1$]
        who   Pekka wanted leave   help.MA
        'Who did Pekka wanted to go to help?'

    b.   [$_{InfP}$ **Ketä**$_1$ auttamaan **t**$_1$]$_2$ Pekka halusi   lähteä **t**$_2$
        who   help.MA   Pekka wanted leave
        'Lit: To help who, did Pekka wanted to go?'

    c.   Pekka halusi   lähteä [$_{InfP}$ auttamaan kodittomia   koiria]
        Pekka wanted leave   help.MA   homeless.PAR dogs.PAR
        'Pekka wanted to go to help homeless dogs.'

Importantly, however, when clausal pied-piping *does* happen, the *wh*-phrase undergoes internal *wh*-movement to the edge of the pied-piped clause, indicated in (22b) (compare with the declarative sentence in (22c) where the infinitival clause exhibits the VO order). Consider also the data from Basque and Ancash Quechua below, which shows that internal *wh*-movement is required in clausal pied-piping.

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[12]This sort of optionality between pied-piping and sub-extraction is also attested in Tzotzil possessive constructions, where the *wh*-possessor can be extracted out of the possessive structure, stranding the possesee (Aissen, 1996; Heck, 2009). Under my proposal, both derivations would yield the same denotation. However, it is an interesting (and independent) question what governs the possibility of optionality across languages.

(23) Basque <space

>   Cable (2010), pg. 154

    a. [$_{CP}$ **nor**$_2$ joango dela **t**$_2$]$_1$ esan du   Jonek **t**$_1$
       who go   AUX   said AUX John
    Who did John say will go?

    b. *[$_{CP}$ joango dela **nor**]$_1$ esan du   Jonek **t**$_1$
       go   AUX who   said AUX John

(24) Ancash Quechua   Cable (2010), pg. 154

    a. [$_{CP}$ **imata**$_2$ wawa **t**$_2$ mikuchun]$_1$ Maria **t**$_1$ munan
       what   child   eat   Maria   want
    What does Maria want the child to eat?

    b. *[$_{CP}$ wawa **imata** mikuchun]$_1$ Maria **t**$_1$ munan
       child what   eat   Maria   want

The fact that internal *wh*-movement is a crucial component of clausal pied-piping follows from the ∃-theory of pied-piping. For the pied-piping structure to be inter-pretable at LF, a scope position for the *wh*-phrase needs to be created above the pied-pipee by merging an ID, which the *wh*-phrase has to move into, as schematized in (25) for (24a). Then, given that the internal *wh*-movement is what gives the embedded *wh*-phrase matrix scope, strings like (24b) are expected to be precluded, *assuming* that whatever determines the overtness of *wh*-movement proper also determines the overtness internal *wh*-movement (Richards, 2019). In other words, if a language were to require *wh*-movement proper to be **overt** but allowed internal *wh*-movement to be **covert**, strings like (24b) would be perfectly fine. This does not seem to be the case.

(25)

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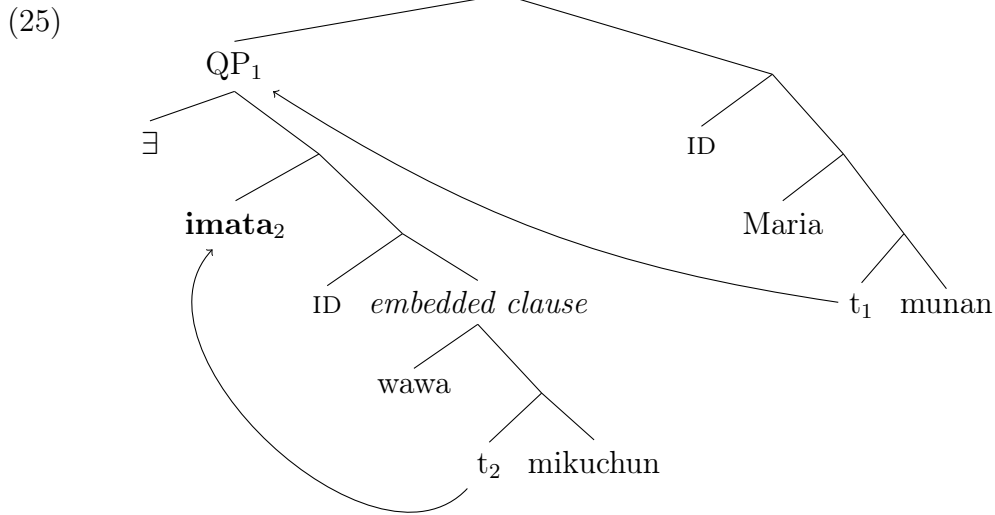
We have seen evidence in favor of edge requirement being satisfied via internal *wh*-movement. What does this imply for cases of overt island pied-piping? Remember that overt island pied-piping, too, respects the edge requirement on pied-piping. Then, the null hypothesis is that island pied-piping, too, involves internal *wh*-movement to the edge position.

Consider the Finnish data below which supports the idea that island pied-piping consists in internal *wh*-movement. As shown in (26), temporal adjunct clauses are islands for *wh*-extraction. The allative *wh*-phrase cannot be extracted out of a temporal adjunct island, leaving the island in-situ. However, the same kind of island that contains an allative *wh*-phrase can be overtly pied-piped as shown in (27b). Crucially, the VO order inside the island in the baseline example (27a) changes into OV order in the pied-piping example in (27b). As argued by Huhmarniemi (2012), this is a case of *internal wh-movement* for island pied-piping, as a result of which the edge requirement on pied-piping is satisfied.

(26)   Finnish   Huhmarniemi (2012), pg. 182

    a.   Pekka   kompastui [$_{\text{island}}$ laittaessaan   ruokaa
          Pekka.NOM fell   cook.ESSA.PRS.PX.3SG food.PAR
          Merjalle]
          Merja.ALL
          'Pekka fell when he was cooking for Merja.'

    b.   *$\textbf{Kenelle}_1$ Pekka   kompastui [$_{\text{island}}$ laittaessaan
          who.ALL Pekka.NOM fell   cook.ESSA.PRS.PX.3SG
          ruokaa $\textbf{t}_1$]
          food.PAR
          'Which person x is such that Pekka fell when he was cooking for x?'

(27)   Finnish   Huhmarniemi (2012), pg. 184

    a.   Pekka   katkaisi puhelun [$_{\text{island}}$ soittaessaan   **Merjalle**]
          Pekka.NOM cut   call.ACC   call.ESSA.PRS.PX.3SG Merja.ALL
          'Pekka disconnected when he was calling Merja.'

    b.   [$_{\text{island}}$ $\textbf{Kenelle}_2$ soittaessaan $\textbf{t}_2$]$_1$ Pekka   katkaisi
              who.ALL call.ESSA.PRS.PX.3SG   Pekka.NOM cut
          puhelun $\textbf{t}_1$
          call.ACC
          'Which person x is s.t. Pekka disconnected when he was calling x?'

Under my account, the internal *wh*-movement that occurs in (27b) for interpretative purposes should target a position right above the temporal clause island, as schematized in (28).

(28)
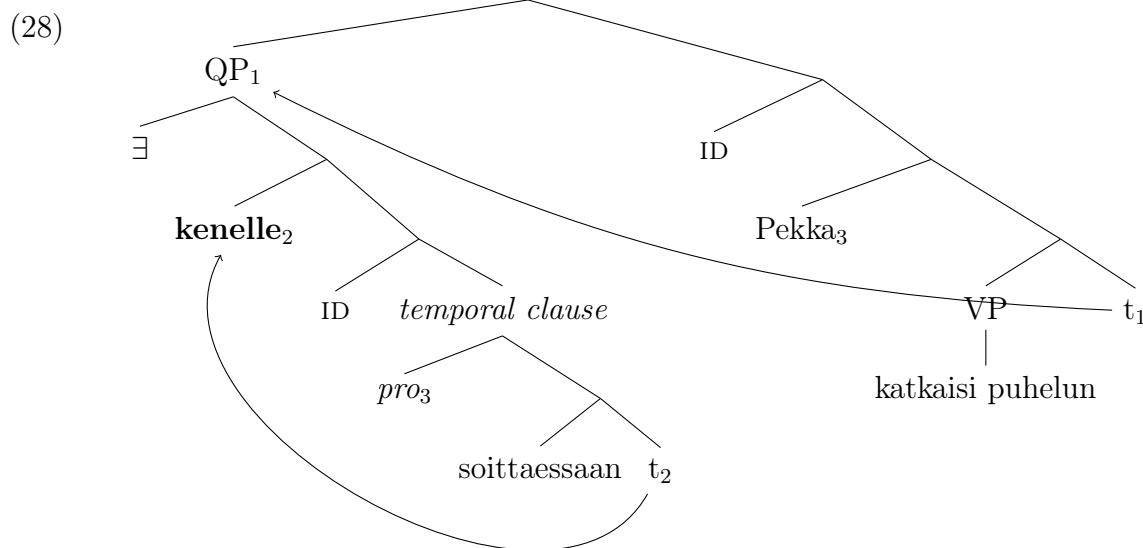
To recap, I have presented the cross-linguistic evidence suggesting that *internal wh-movement* in pied-piping is a robust phenomenon and showed that there is also evidence for the hypothesized internal *wh*-movement in cases of overt island pied-piping. Then the obvious question is why overt island pied-piping is not observed in all *wh*-fronting languages. In the next subsection, I provide a preliminary investigation of why island-violating *wh*-scope is not unconstrained, in particular laying out an important restriction on internal *wh*-movement that carries a *wh*-phrase to its scope position within the pied-piped phrase.

6.2 What restricts overt island pied-piping

In the previous section, we have seen that *wh*-fronting languages like Finnish are able to derive island violating *wh*-scope by pied-piping islands. In this section, I investigate why this is not an option in every *wh*-fronting language.

First, we can argue that ungrammatical overt island pied-piping examples like in (29) should be ruled out because they violate the edge requirement, i.e. the *wh*-phrase is not in its scope position within the pied-piped phrase.

(29)   *[the book that Mary gave **who**] did you steal?   (Cable, 2010: p.197)

Then, the follow-up question is what rules out instances of overt internal *wh*-

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movement that would move the *wh*-phrase to the edge of the island (where it can scope above the island), as in (30).[13]

(30)   *[$_{DP}$ who$_1$ [the book [$_{RC}$ that Mary gave t$_1$]]]$_0$ did you steal t$_0$

We learned from Finnish that overt island pied-piping exhibits the two important properties in (31)— stated in somewhat theory-neutral terms.

(31)   a.   overt island pied-piping is possible iff the *wh*-phrase is linearly the left-most phrase in the island
        b.   a *wh*-phrase can 'become' the linearly leftmost phrase in the island **via displacement**

What we have not yet seen is that Finnish also provides evidence that (31b) is **not** unconstrained. Consider the data below. The ungrammatical example in (32a) shows that when the allative *wh*-phrase inside the relative clause is preceded by the genitive subject of the relative clause, pied-piping is ungrammatical due to a violation of the edge requirement. (32b) shows that when there is no genitive subject, pied-piping is grammatical.

(32)   a.   *[$_{island}$ pojan   **kenelle** kirjoittaman   kirjeen]   Pekka luki?
                    boy.GEN who.ALL written.PTCP.ACC letter.ACC Pekka read
                    'Which person x is s.t. Pekka read the letter written by the boy to x?'

        b.   [$_{island}$ **kenelle** kirjoitetun   kirjeen]   Pekka luki?
                    who.ALL written.PTCP letter.ACC Pekka read
                    'Which person x is such that Pekka read the letter written to x?'

        c.   *[$_{island}$ **kenelle**$_1$ pojan   **t**$_1$ kirjoittaman   kirjeen]   Pekka luki?
                    who.ALL boy.GEN   written.PTCP.ACC letter.ACC Pekka read
                    'Which person x is s.t. Pekka read the letter written by the boy to x?'

Given the possibility of internal *wh*-movement to the island edge, we could expect that the ungrammaticality of (32a) could be fixed if the allative *wh*-phrase is moved to the left of the genitive subject. Yet, crucially, this movement does not improve the sentence, as shown in (32c). It is fair to argue that this data might be showing us

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[13]Or, if we —more realistically— take the relative clause to be an island (i.e. not just the DP that contains it), the expected structure would have to involve roll-up pied-piping:
[$_{DP}$ [who$_1$ [$_{RC}$ that Mary gave t$_1$]]$_2$ the book t$_2$]$_0$ did you steal t$_0$

that internal *wh*-movement is not unconstrained.[14]

Let us consider another set of data that exhibits the same contrast in a way that gives us important clues on what the nature of the restriction on internal *wh*-movement is.

Consider the baseline example with a temporal adjunct clause island in (33a), where the subject of the temporal clause can be an overt genitive DP or a null *pro*, both triggering phi-agreement on the nominalized verb. The ungrammatical example in (33b) shows that when the genitive subject of a temporal adjunct is an overt genitive DP, pied-piping by a *wh*-phrase generated below the subject (i.e. the allative *wh*-phrase **kenelle**) is impossible. Interestingly however, in a minimally different sentence where the genitive subject is a null *pro*[15] rather than an overt DP, pied-piping by a *wh*-phrase generated below it becomes possible again, as shown in (33c).

(33)   Finnish   Huhmarniemi (2012), pg. 184, 185

    a. Pekka   katkaisi puhelun [$_\text{island}$ **(hänen)** soittaessaan
        Pekka.NOM cut   call.ACC   3SG.GEN call.ESSA.PRS.PX.<u>3SG</u>
        Merjalle]
        Merja.ALL
        'Pekka disconnected when s/he was calling Merja.'

    b. ?*[$_\text{island}$ **Kenelle$_2$ hänen**   soittaessaan   **t$_2$**]$_1$ Pekka
             who.ALL 3SG.GEN call.ESSA.PRS.PX.<u>3SG</u>   Pekka.NOM
        katkaisi puhelun **t$_1$**
        cut   call.ACC
        'Which person x is s.t. Pekka disconnected when s/he was calling x?'

    c. [$_\text{island}$ **Kenelle$_2$** *pro*   soittaessaan   **t$_2$**]$_1$ Pekka
             who.ALL 3SG.GEN call.ESSA.PRS.PX.<u>3SG</u>   Pekka.NOM
        katkaisi puhelun **t$_1$**
        cut   call.ACC
   'Which person x is s.t. Pekka disconnected when s/he was calling x?'

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[14]We can discard a potential explanation for the ungrammaticality of (32c) that would go as follows: "For the allative *wh*-phrase to gain the edge position in structural terms it has to be extracted out of a relative clause island. This extraction is possible in (32b) because the passive participial relative clauses are not islands for extraction but the ones with a genitive subject are islands." This explanation, however, is at odds with the impossibility of *wh*-extraction from passive participial relative clauses. As was shown in in (4a), passive participial relative clauses, too, *are* islands for *wh*-extraction.

[15]Huhmarniemi (2012) notes that the null *pro*-subjects in nominalized temporal adjuncts can refer to individuals outside the sentence (pg.181).
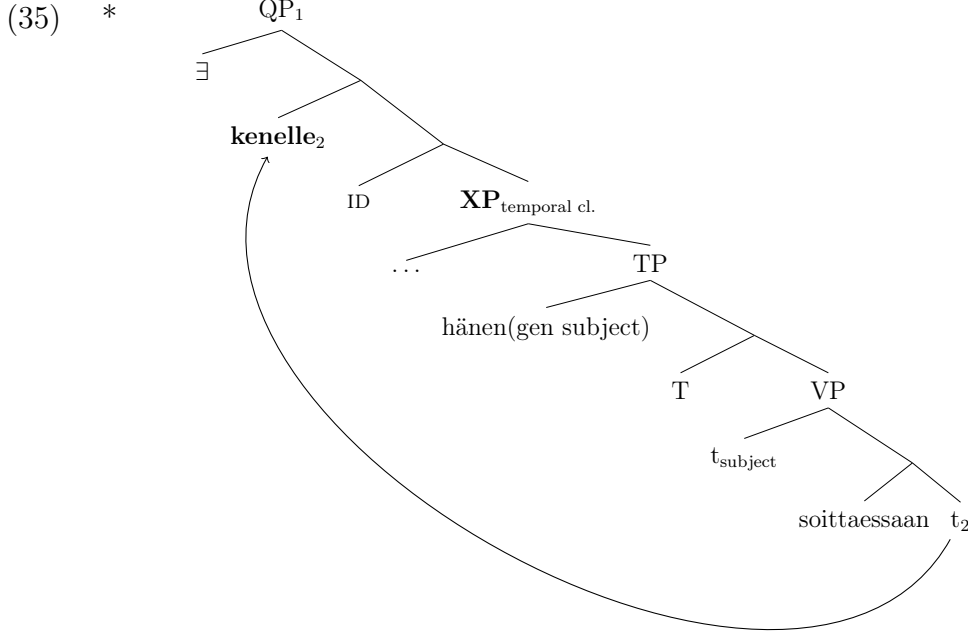
How does the contrast above relate to restrictions on internal *wh*-movement? Descriptively speaking, in both the grammatical variant and the ungrammatical variant, the allative *wh*-phrase moves from inside the VP to a higher position, linearly crossing the verb. Yet, it appears that this movement *cannot* cross a genitive DP while it can cross a null *pro*. Hence, while (33c) shows that internal *wh*-movement can happen, (33b) shows that there are restrictions on internal *wh*-movement.

The explanation that Huhmarniemi (2012) offers is as follows: the edge position that the *wh*-phrase targets is spec-TP and this position is only available when the subject is a null *pro* that can remain in vP/VP rather than an overt genitive DP (which occupies spec-TP).

I take this account of the contrast to be on the right track. Yet, there is something missing in this account. Under my proposal for deriving island violating *wh*-scope, if the *wh*-phrase *remains* in spec-TP, the derived meaning will not be the meaning of a *wh*-question. That is, for the *wh*-question interpretation to be derived, there needs to be an additional movement step that carries the *wh*-phrase to its scope position inside the pied-piped phrase, i.e. above an ID head right above the island, as schematized below.

(34)
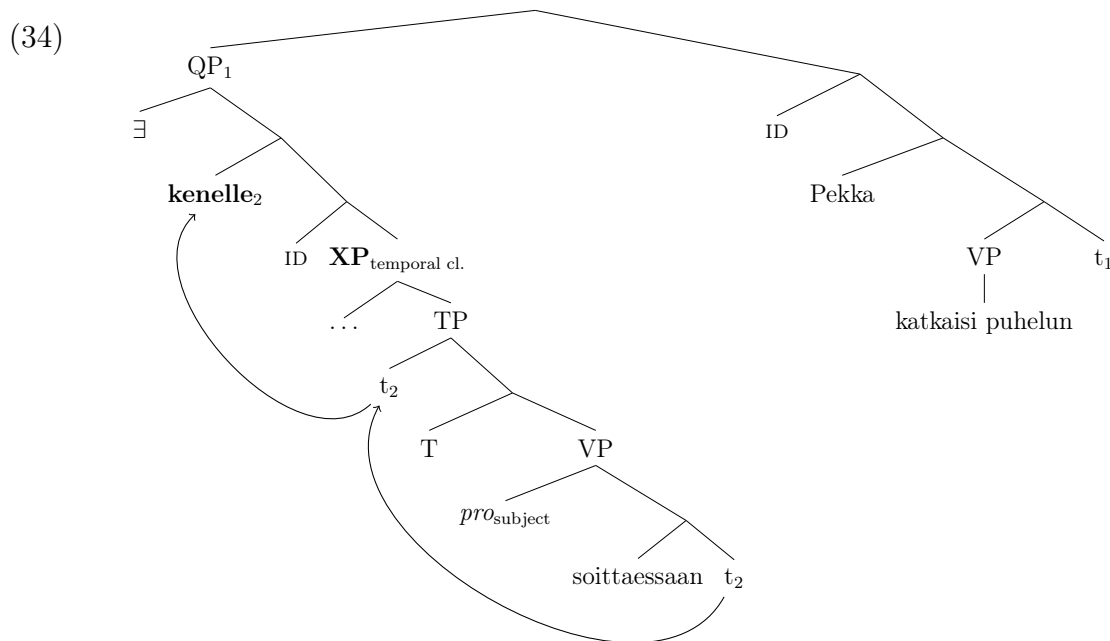
If this additional short movement of **kenelle** to spec-ID is permitted, what is it that blocks the derivation in (35)? (only the derivation of the pied-piped island shown)

(35)   *

```
                    QP₁
              ∃
           kenelle₂
                  ID      XP_temporal cl.
                       ...        TP
                           hänen(gen subject)
                                      T      VP
                                          t_subject
                                              soittaessaan  t₂
```

In simple terms, one way to describe the difference between the two derivations is as follows: Let XP be the extraction island here.[16] The ungrammatical derivation in (35) (representing (33b)) involves a long movement step that linearly crosses the material inside XP. The grammatical derivation in (34) (representing (33c)), on the other hand, involves two movement steps: the first movement step targets spec-TP inside XP while the second movement is a **string vacuous movement** that carries the *wh*-phrase to its scope position right above the island XP. In other words, it seems that there is no punishment for a movement step that carries a *wh*-phrase out of an extraction island to its scope position right above the island if and only if this movement is **string vacuous**.

I believe that the description that the 'good movement' is **string-vacuous** reflects the right intuition for developing an account of the observed restriction on internal *wh*-movement for island pied-piping. In what follows, I will sketch how we could capture this intuition in reference to linearization.

As a first step, let us try to define what islands are in terms of syntax-PF mapping, i.e. in particular their *linearization* properties. Regardless of what semantic property might correlate with islandhood, it intuitively seems right for a description like (36) to be true of what we typically call extraction islands.[17]

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[16]Huhmarniemi (2012) represents nominalized temporal adjunct clauses as bare TPs. Given that they are nominalized clauses, it is unlikely for temporal adjunct clauses to be bare TPs, in my opinion. Hence, I am representing the island as an XP projection, which is presumably a DP projection.

[17]Obviously, the characterization 'X triggers Linearization and X does not have an edge/specifier'

(36)   If XP is a domain of spell-out such that XP necessarily immediately domi-
         nates X (and X's sister YP), then these hold:

         a.   merging X triggers **Linearize**
         b.   X does not have an edge/specifier position

                                                (adapted from (Fox and Pesetsky, 2004))

Under the theory of linearization and successive cyclic movement proposed in
Fox and Pesetsky (2004), this characterization predicts the islandhood of XP. To
summarize their proposal in naive terms[18], it could be said that once syntax builds
an island, the operation **Linearize** (Fox and Pesetsky, 2004) applies to it and takes a
'screenshot' of its linearization. Grammar, in some sense, requires that that screenshot
be part of the string assigned to the entire structure that contains the island. From
this perspective, it is easy to see why an island-violating *wh*-movement like in (37) is
bad. Given the cyclic bottom-up nature of derivations, the *wh*-phrase **kenelle** was
already linearized inside the island. If the linearization procedure generates the string
"laittaessaan ruokaa kenelle" for the island, this needs to be a substring in the output.
But this is not the case in (37).

(37)   *$\textbf{Kenelle}_1$ Pekka   kompastui [$_\text{island}$ laittaessaan   ruokaa $\textbf{t}_1$]
       who.ALL   Pekka.NOM fell   cook.ESSA.PRS.PX.3SG food.PAR
       'Which person x is such that Pekka fell when he was cooking for x?'

Then, it is equally easy to see why string-vacuous movement out of extraction
islands may not pose a linearization problem. This is exactly what Fox and Pesetsky
(2004) mention in a footnote "*…a prediction of our proposals not shared by most other
theories: string-vacuous movement should not require successive-cyclicity, and thus
be immune to certain islands.*" (fn.9)

Characterizing islandhood in term of linearization correctly predicts that the only
way for a *wh*-fronting language to carry a *wh*-phrase α inside an island XP to the
scope position for α is to pied-pipe XP. As we have seen, even pied-piping is not
sufficient. Besides pied-piping of XP, the internal *wh*-movement that targets a scope
position right above XP has to be string-vacuous. The hypothesized generalization is
given in (38).

---

is a restatement of the islandhood of XP. But it surely provides more insight into what it means to
be an extraction island, than a mere labelling like 'XP is an extraction island.'

    [18]Their proposal relies on generating linerization statements cyclically at each spell-out domain.
Hence, an island-violating movement will typically yield *contradictory linearization statements*. See
Fox and Pesetsky (2004) for formal details.

(38)   string-vacuous internal *wh*-movement requirement in overt island pied-piping
        If a node α is a spell-out domain without an edge position (i.e. extraction
        island), overt *wh*-movement out of α has to be string vacuous.

This view of extraction islands and overt island pied-piping allows us to see why overt island pied-piping might not be a frequently attested phenomenon. For overt island pied-piping to be possible, the *wh*-phrase must be in a position/movable to a position within the island which could allow it to undergo a string-vacuous movement to its scope position within the pied-piped phrase (containing the island).[19] For example, in English, (39) would be out as the *wh*-phrase fails to reach its scope position whereas (40) would be out because the indicated internal *wh*-movement is not string-vacuous.

(39)   *[the book that Mary gave **who**] did you steal?   (Cable, 2010: p.197)

(40)   *[$_{DP}$ **who**$_1$ [the book [$_{RC}$ that Mary gave t_1]]]$_0$ did you steal t_0

It seems that typical extraction islands in English do not exhibit the conditions necessary for string-vacuous internal *wh*-movement. It is useful to notice here that small scale pied-piping cases like in (42) *do* provide the baseline structures necessary for string-vacuous internal *wh*-movement.[20]

(41)   *Mary wonders [**which linguist**$_1$ [if we invite t_1 to the party]] grad students
        will be very happy.

(42)   [**who**$_1$ [t_1's father's friend's uncle]] did you meet at the party?

                                                                    Cable (2010), pg. 156

To recap, we have seen why overt island pied-piping may not be available in all *wh*-fronting languages. I believe that a theory of island pied-piping that makes reference to linearization-related properties of extraction islands seems to be a promising avenue for further research on both the phenomenon of islands and overt island pied-piping. However, there are some remaining questions. The most pressing one is the status of

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[19]As was discussed in Chapter 2 and 3, to generate the right meaning for *wh*-questions with pied-piping, the pied-pipee needs to be reconstructed. The structure I proposed for pied-piped phrases is designed to address this issue without assuming syntactic reconstruction.

[20]It is very much possible that in English string-vacuous movement requirement holds for small-scale pied-piping, as well. But as we have seen in Tzotzil, internal *wh*-movement can be non-string-vacuous in small-scale pied-piping. Notably, Tzotzil presents optionality between possessee stranding and pied-piping (Aissen, 1996), which suggests that what is pied-piped is not an island in the first place.

covert movement (and covert pied-piping) from the linearization perspective. If what makes a domain an extraction island is only characterized in reference to linearization, one could argue that covert movement out of in-situ islands should be on a par with string-vacuous (overt) movement out of a pied-piped island (as in Finnish). In other words, there would be no motivation for covert pied-piping of islands. This is at odds with my assumption that island pied-piping (whether it is required to be overt or not) is the only way to scope out of islands.[21] Hence, in order for a more complete story to be told, (i) we need to be explicit about what covert movement means from a linearization perspective, and obviously (ii) there needs to be an independent (perhaps semantic) characterization of what makes a domain an island.[22] These remain as open questions.

In the following section, I will compare the current approach with the theory of pied-piping proposed in Cable (2010), as it is a rare example of a study that not only provides a compositional semantics for pied-piping but also puts special emphasis on cross-linguistic empirical coverage.

6.3   A brief comparison with Cable (2010)

Cable (2010) provides a general theory that promises to reduce the phenomenon of pied-piping in *wh*-questions into QP-movement, where Q is a head whose complement is whatever appears to be pied-piped, as schematized in (43).

(43)
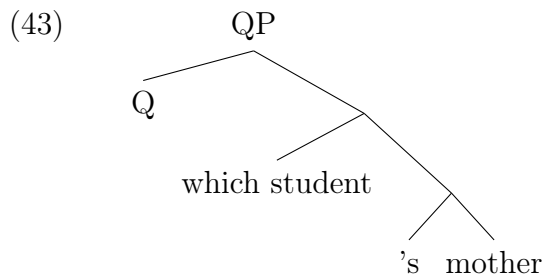
Under this view of pied-piping, there is no direct relationship between a *wh*-phrase and an interrogative complementizer. Rather, the interrogative complementizer is in a syntactic relationship with a QP projection (that contains a *wh*-phrase). An

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[21]For example, the pied-piping requirement is what allowed us to block universal quantifiers scoping out of extraction islands. If covert movement out of in-situ islands were just fine, we would lose the explanation for *semantic* restrictions on exceptional scope.

[22]Recall that the characterization from the linearization perspective is not explaining the island-hood of any domain *per se*. Rather, it delivers diacritic/lexical information ($\approx$ X has no edge position, X triggers Linearize) to the PF interface.

important parameter in Cable's system is whether a Q particle is in an agreement relationship with the *wh*-phrase(s) it c-commands. Cable makes use of this parameter to account for cross-linguistic variability in the availability of island-violating *wh*-scope and derive edge-related effects in pied-piping. To appreciate this proposal, we need to briefly go over its basic components.

Cable argues that the semantics of *wh*-questions makes use of both choice functions (Reinhart, 1997) and Alternative Semantics (Beck, 2006). As far as I can see, the reason why Cable exploits more semantic machinery than what is required is to be able to say something about the cross-linguistic variation. Notably, both of these tools independently allow for the denotation of a *wh*-question to be derived without any movement, as they rely on in-situ 'scope' mechanisms of binding and pointwise composition, respectively.[23] Hence, in Cable's system *wh*-movement is not scope-taking and is not semantically required.

Under Cable's proposal, the composition of a single-*wh*-question like the one in (44) requires three pieces: a *wh*-phrase, a Q particle, and an interrogative C_Q head. Grossly simplifying, these pieces work together as follows: the *wh-phrase* denotes a set of alternatives— in (44) {x: x is a student}— and is the complement of a Q particle. This set of alternatives is "captured" by the Q particle (which is a focus sensitive operator (Beck, 2006)). While the Q particle denotes a *choice function variable*, its complement denotes the set it "chooses from". In turn, the C_Q head existentially binds the choice function variable (i.e. the Q particle) and returns a proposition set. This is illustrated in (44).[24]

(44)   Which student did Sue praise?[25]

    a.   LF: C_Q [$_{QP}$ Q which student] λ_1 Sue praised t_1

    b. $\lambda p.$ $\exists f$: f is a *choice function* & $p = \lambda w.$ Sue praised $f(\{x$: x is a student in $w\})$ in w

Cable's answer to the question what constrains island-violating *wh*-scope is still syntactic in nature. He argues that some languages require that a Q particle agree with the *wh*-phrase in its complement and assumes that islands constitute a barrier

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[23]Though, see Chapter 2 for some complications on the representation of intensionality in this system.

[24]Notably, equivalent results would be obtained if Q particles did not exist and C_Q simply returned the denotation of its complement as the denotation of its mother (Beck, 2006; Kotek, 2016).

[25]The C_Q is a binder for Q particles. Therefore, if a QP moves to the left periphery, it cannot move into the specifier of C_Q or above it but has to move to a position below it. For Cable, this is a Focus projection —not shown in the given LF sketch, as it does not contribute to the interpretation.

for this **Q-*wh* agreement**. Accordingly, the Q particle in a language like English, which cannot pied-pipe islands, requires **Q-*wh* agreement** whereas the Q particle in a language like Tlingit, which overtly pied-pipes islands, does not require **Q-*wh* agreement**, as illustrated by the contrast below. In other words, both *wh*-questions below are interpretable at LF but English, syntactically (or whatever component of grammar is responsible for checking Q-*wh* agreement), bars (45a).

(45)   a. *[$_{QP}$ Q$_{[agr+]}$ [$_{island}$ the book that Mary gave **who**]] did you steal?

   b. [$_{QP}$ [$_{island}$ **wáa** kwligeyi   x̱áat] sá]   i   tuwáa   sigóo?
              how it.is.big.REL fish   Q$_{[agr-]}$ your spirit.at it.is.glad
        Literally: A fish that is how big do you want?'

(Cable, 2010: p.42,197)

Additionally, for Cable, Q-*wh* agreement is what derives the edge-related effects in overt pied-piping. He assumes that lexical projections also intervene for Q-*wh* agreement, explaining the badness of cases like (46).

(46)   *John wonders [Q$_{[agr+]}$ [pictures of whom]] you liked the most.

Remember that I attributed the badness of cases like (46) to the fact that the *wh*-phrase is not in its scope position (which means that a question denotation is not derived).[26] For Cable, however, *wh*-phrases are not scope takers in the first place (i.e. they compose in-situ). Therefore, for Cable, the edge-effect is not a by-product of interpretive requirements but a language particular parameter that derives from Q-*wh* agreement.

While the Q-*wh* agreement theory allows us to state the variability in island-sensitivity in simple terms, it predicts a language like Finnish will not exist. As we have discussed in the previous section, the edge requirement seems to hold for overt island pied-piping, as well. However, under Cable's proposal, precisely the opposite pattern is expected. If a language allows overt island pied-piping, it should not care if the *wh*-phrase is linearly to the left of the island. Let us illustrate this with an example from Finnish. Given that Finnish can overtly pied-pipe islands (47a), Cable would have to assume that Finnish does not require Q-*wh* agreement, just like Tlingit. However, if edge-related effects arise a result of Q-*wh* agreement, why (47b) is bad is not accounted for.

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[26]This assumes that internal *wh*-movement within a pied-piped phrase is necessarily overt in English.

(47)   a.   [_{island} **kenelle** kirjoitetun   kirjeen]   Pekka luki?
              who.ALL written.PTCP letter.ACC Pekka read
              'Which person x is such that Pekka read the letter written to x?'

       b.   *[_{island} pojan   **kenelle** kirjoittaman   kirjeen]   Pekka luki?
              boy.GEN who.ALL written.PTCP.ACC letter.ACC Pekka read
              'Which person x is s.t. Pekka read the letter written by the boy to x?'

To recap, Cable makes the prediction that if a *wh*-fronting language lacks Q-*wh* agreement, it can overtly pied-pipe islands in which the *wh*-phrase is in-situ. Hence, a scopal theory of pied-piping (i.e. Charlow's and its ∃-theory variant) and Cable's proposal make very different predictions on what overt island pied-piping will look like. Cable predicts that overt island pied-piping can occur in a language only when pied-piping in that language is immune to edge-related effects. This seems to be the exact opposite of what the available data on overt island pied-piping suggests.

Another departure from Cable's system is that whether a language will have overt island pied-piping is not an issue of parametric variation. In Cable's system overt island pied-piping is contingent on a parameter, i.e. Q-*wh* agreement. In the theory advocated here, if nothing else is said, overt island pied-piping is expected to be obligatory whenever the conditions that license it are met. Crucially, these conditions are independently observable phenomena: (i) is a language *wh*-fronting? if yes, (ii) does its extraction islands provide the base structures that would allow short string-vacuous *wh*-movement to the edge of an island? When both of these conditions are met, we expect to see overt island pied-piping. Needless to say, this claim is based on an extremely limited sample and may easily turn out to be false. However, I see its falsifiability as an advantage.[27]

Finally, I should note that the Q-theory makes interesting predictions on variability in *superiority effects*[28] (Pesetsky, 1987) and *intervention effects* (Beck, 2006), and their interaction (Pesetsky, 2000). I unfortunately have put aside these phenomena. However, I believe there are reasons to reject Beck's (2006) proposal for *intervention effects*, which Cable incorporates into his proposal. I will briefly address *intervention effects* in the following chapter.

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[27]Thanks to Sabine Iatridou for insisting that I be less equivocal on the claim made here.

[28]I believe the Q-theory's perspective on superiority could be adopted into my proposal without committing to what Cable assumes Q particles semantically do. As far as I can see, Q particles can also be seen as semantically vacuous morphemes that introduce the formal feature that interacts with the interrogative complementizer.

Chapter 7

Further questions

This chapter presents sketches of analyses for some further questions or speculations on some challenges. The topics that I will very briefly address are morphological distinctness of *wh*-phrases and indefinites, nested *wh*-questions (Elliott, 2015; Sudo, 2017, a.o.), *de dicto which*-phrases (Rullmann and Beck, 1998; Sharvit, 2002; Sharvit and Guerzoni, 2003; Heim, 2012, a.o.), functional *which*-phrases (Engdahl, 1986; Heim, 2012), compatibility with more fine-grained theories of *de re* (Percus and Sauerland, 2003; Charlow and Sharvit, 2014, a.o), and intervention effects (Beck, 2006), in the given order.

7.1 Distinctness of *wh*-phrases and indefinites

While not all languages have distinct forms for *wh*-phrases and indefinites, many languages do. Any theory that takes *wh*-phrases and indefinites to have identical denotations has to say something about their morphological distinctness.[1]

Under a scopal account of *wh*-questions (Karttunen, 1977; von Stechow, 1996, a.o.), a Hamblin set is derived thanks to an existential quantifier occupying a special scope position at LF, as can be easily seen on the denotation for (1).

(1)   which girl hugged a puppy

$$\lambda p.\ \boxed{\exists x\ [\![\text{girl}]\!]^{\text{w}}(x)}\ \&\ p = \lambda w'.\ \boxed{\exists y\colon [\![\text{puppy}]\!]^{\text{w'}}(y)}\ \&\ [\![\text{hugged}]\!]^{\text{w'}}(y)(x)$$
$$\underbrace{\qquad\qquad}_{\textbf{which girl}}\qquad\qquad\quad \underbrace{\qquad\qquad}_{\textbf{a puppy}}$$

Given that the logical form of (1) is as in (2), we could attribute the morphological

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[1]For example, under an Alternative Semantics/Hamblin Semantics view on exceptional scope, a long distance checking/agreement relation with closure operators needs to be postulated (Kratzer and Shimoyama, 2002; Cable, 2010, e.g.).

distinctness of *wh*-phrases and indefinites to their LF positions.

(2)
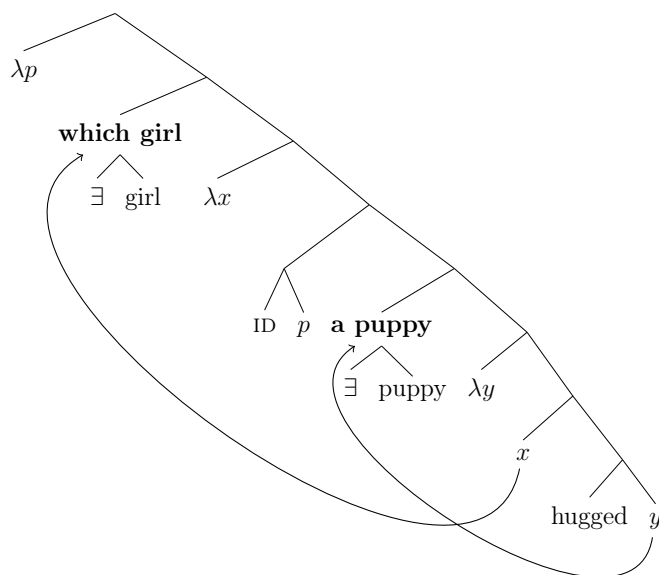
A preliminary attempt to achieve this is in (3).

(3)   *Morphological distinctness of wh-phrases and indefinites* (version 1 of 3)
        An existential quantifier is spelled-out as a *wh*-phrase iff it is a specifier of an
        ID head. Otherwise it is spelled-out as an indefinite.[2]

Unfortunately, under the $\exists$-theory, we need something much more complex because (i) there are null $\exists$ morphemes (ii) indefinites, too, can end up being a specifier of an ID head (e.g. when they need to scope out of an island). The discussion that follows is an attempt to characterize what needs to be said. Needless to say, this is going to be a challenging exercise.

To block spelling out null $\exists$ morphemes, I assume (4).[3] What this does is illustrated in (5).

(4)   If a head α denotes $\exists$, α has overt pronunciation if and only if
        α's sister is of type $< e, t >$.

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[2]An issue that I am setting aside is the predicative use of indefinites, in examples like *Mary is a professor.*

[3]This is hard (perhaps impossible) to justify for *wh*-phrases like *why* but I will gloss over this.

(5) **Ø which girl's cat**

∃ $<se, t>$

λf

which girl

∃ $<e, t>$ λx

|

girl

ID f x 's cat
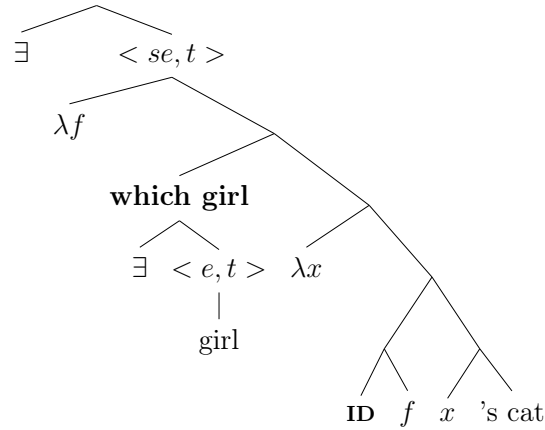
Next comes the more tricky task of differentiating overtly pronounced ∃ heads. Recall that an indefinite that scopes out of an island is a specifier of an ID, as well. To see the structural difference between indefinites and *wh*-phrases more transparently, let us consider the Turkish examples below along with their simplified syntactic structures. As these structures involve an island within an island, to improve readability, I only indicate movements via indices.

(6) [island [island **hangi adaya**   verilen   çoğu oyun]
                which candidate.DAT give.PASS.REL most vote.GEN
      çalındığı   dedikodusunu] herkes   duymuş?
      steal.PST.NOMLZ rumor.ACC   everybody heard
      ⇒ Which candidate x is s.t. everybody heard the rumor that most votes cast for x got stolen?

QP$_2$

∃

ID everybody heard t$_2$

QP$_1$

∃

ID the rumor that t_1 got stolen

QP$_0$

∃ candidate **ID** most votes cast for t$_0$

157
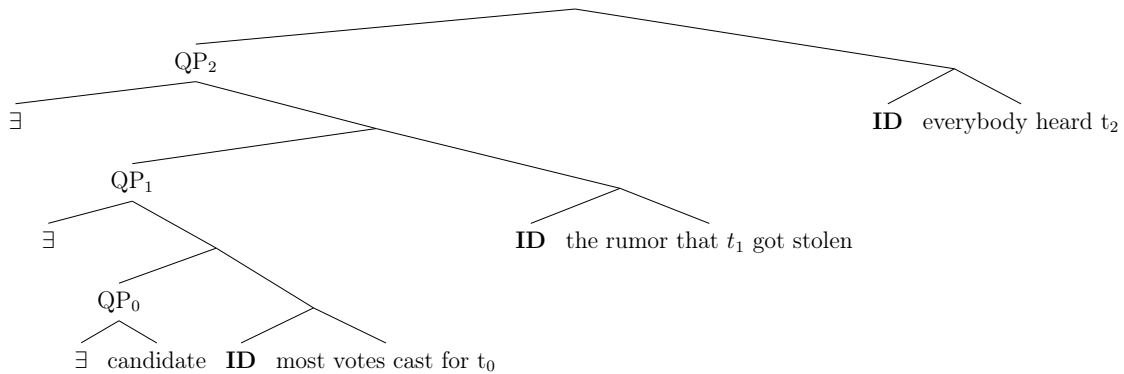
(7) [island [island **bi adaya**   verilen   çoğu oyun]   çalındığı
                    a candidate.DAT give.PASS.REL most vote.GEN steal.PST.NOMLZ

dedikodusunu] herkes   duymuş.
rumor.ACC   everybody heard

⇒ There is a candidate x: everybody heard the rumor that most votes cast

for x got stolen.
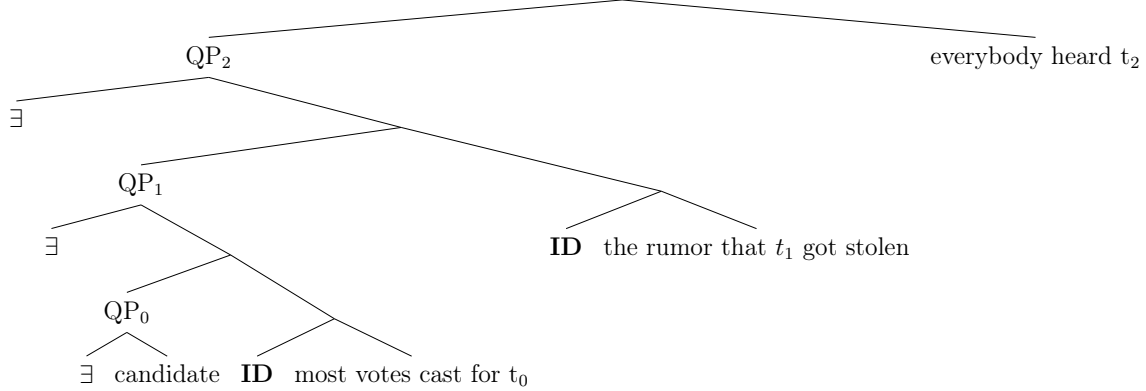
The only difference between these structures is that the complex quantificational phrase labelled QP_2 is a specifier of an ID head in the structure for the *wh*-question in (6), but not in the structure for the declarative sentence in (7). Given that an indefinite or a *wh*-phrase can be embedded within multiple islands, we need to characterize what counts as a *wh*-phrase recursively, i.e. with reference to any dominating existential quantifier projections. The added condition in (8a-ii) tries to achieve that.

(8)   If a head α denotes $\exists$ and α's sister is of type $< e, t >$,   (version 2 of 3)

   a. αP is spelled-out as a *wh*-phrase iff
       (i) αP is a specifier of an ID head
       (ii)   the maximal projection βP of any $\exists$-head β that c-commands α is also a specifier of an ID head.
   b.   Otherwise αP is spelled-out as an indefinite

There is still something missing in this characterization in that a c-commanding $\exists$ head can be infinitely distant. Given that operations that establish syntactic relationships (e.g. agreement) as well as spell-out mechanisms responsible for exponent selection (e.g. allomorph selection)[4] obey fairly strict locality conditions, we natu-

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[4]As a matter of fact, under my assumptions regarding the output of syntactic derivations for *wh*-questions, it is a real challenge to license *wh*-morphology by whatever mechanism governs allomorphy, as the "search space" for the selection of an exponent at PF is very local (in fact, typically contingent on adjacency).

rally expect *wh*-pronunciation to be determined in a sufficiently local domain. In fact, there is empirical evidence for such a locality restriction. Consider the simplified logical form of the sentence below for the reading where the indefinite within the *wh*-question is interpreted above the embedded question.

(9)   Sue asked me which director shot **a movie that we saw last night.**
         $\exists x$: x is a movie we saw last night & Sue asked me which director shot x.

(10)
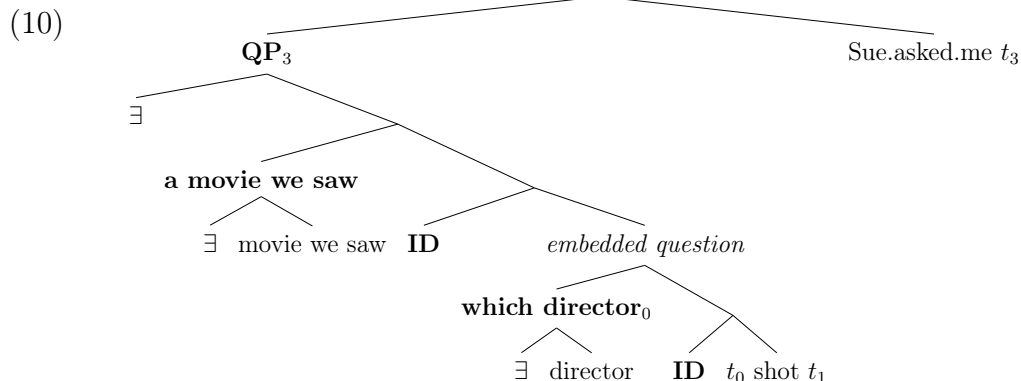
As is clear in the simplified logical form above, the characterization of the distinctness of *wh*-phrases given above cannot capture the fact that [$\exists$ director] is spelled out as *which director* if we assume that PF can see the entire derivation and operate on it. However, if we assume that PF operates on the output of syntax in cycles (let us say "phases") (Chomsky, 2001), it will be possible to restrict the "search space" for whatever is responsible for morphological distinctness (be it agreement or allomorphy). For example, if the embedded question is such a locality domain, there will be no $\exists$ head that c-commands [$\exists$ director] within that domain. Hence, [$\exists$ director], being a specifier of an ID head, will get pronounced as a *wh*-phrase.

The final piece of nonelegant addition to the characterization of morphological distinctness of indefinites and *wh*-phrases is required to block the *wh*-pronunciation for an indefinite that moves to a "*wh*-position" but does so leaving a higher type trace (to receive a *de re* construal).[5] To prevent an indefinite which has higher type trace from receiving a *wh*-pronunciation, I add the condition that the sister of a *wh*-phrase has to be of type $< e, t >$. The final version is given in (11). It is surely formidable yet it is what needs to be said under this system, unless we find a way to state morphological distinctness that does not make reference to structure or makes

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[5]I am not entirely convinced that this situation would arise. But I add the condition just in case it potentially could.

reference to (additional) structure that I did not include in my representations.[6]

(11)   *Morphological distinctness of wh-phrases and indefinites* (version 3 of 3)

    a.   If a head α denotes $\exists$ and α's sister is not of type $< e, t >$, α does not have overt pronunciation

    b.   If a head α denotes $\exists$ and α's sister is of type $< e, t >$,

        (i) αP is spelled-out as a *wh*-phrase iff

                αP's sister is of type $< e, t >$,

                αP is a specifier of an ID head,

                the maximal projection βP of any $\exists$-head β that c-commands α in a local domain/phase is also a specifier of an ID head.

        (ii)   otherwise αP is spelled-out as an indefinite

Notice that the characterization above makes the assumption that all ID heads are one and the same. If we want to give a special status to an interrogative complementizer (whose meaning is ID's meaning), there might be ways to simplify (11).[7] I do not undertake this task here. In the next section, I discuss nested *which*-questions, where the morphological distinctness of *wh*-phrases and indefinites will be important.

7.2   Nested *which*-phrases

In a recent snippet, Sudo (2017) identifies a challenge concerning the interpretation of nested-*which*-questions (also called Russian-doll questions (Richards, 2004)). To see what the problem is, consider his examples in the given context.

(12)   Context: I reserve a part of my bookshelf for Russian novels, and my son doesn't know what kind of books they are or who wrote them, but knows which ones I haven't opened (e.g., because they are clean).

    a.   ✓ My son knows **which novels by Russian authors** I haven't opened.

    b.   # My son knows **which novels by which Russian authors** I haven't opened.

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[6]I thank Norvin Richards for helping me with the neverending process of trying out many different versions of this 'algorithm'.

[7]It seems to me that distinguishing 'interrogative' ID heads by diacritic information (let's say '*wh*-features') is independently needed in that *wh*-movement can exhibit superiority effects, which does not follow from interpretive requirements. Moreover, many languages require overt *wh*-movement, which sets *wh*-movement apart from (typically covert) scope-shifting movement of other quantifiers.

In the given context, the sentence embedding a single-*which* question in (12a) has a true reading where *which novels by Russian authors* has a *de re* construal. Under this reading, (12a) simply asserts that the speaker's son knows which members of a particular set of objects in the actual world the speaker has not opened. In other words, for (12a) to be true, the son does not have to know that this particular set of objects are novels by Russian authors. Sudo goes on to observe that (12b) is not true in the same context, which suggests that **which novels by which Russian authors** cannot have the ('completely') *de re* interpretation. In other words, the son cannot be completely unopinionated (or have false beliefs) about what sort of objects it is that his dad hasn't opened.

To characterize the problem formally, let us consider the context below.

(13)   *w: There are only two cats, Rory's cat Ragu and Mary's cat Moku. Ragu is pregnant, Billy knows this but has the false belief that Ragu is Mary's cat.*

    a.   Billy knows **which cat** is pregnant.   *true*

    b.   Billy knows **which cat owned by which human** is pregnant   *false*

Remember that if the embedded question in (13a) has the denotation in (14), we correctly predict that (13a) will be true because Billy indeed knows that Ragu is pregnant (although he is mistaken about which human owns Ragu).

(14) $\lambda p. \exists x \; [x \in \{\text{Ragu, Moku}\} \; \& \; p = \lambda w'. \; x \text{ is pregnant in } w']$

What Sudo calls the complete *de re* reading of the embedded question in (13b) is where the entire pied-piped phrase is interpreted in the evaluation world w. This would be represented as in (15). Crucially, given that the set of cats owned by some human in w is {Ragu, Moku}, (15) is identical to (14).

(15) $\lambda p. \; \exists x \; \exists y \; [\![\text{cat}]\!]^w(x) \; \& \; [\![\text{human}]\!]^w(y) \; \& \; [\![\text{own}]\!]^w(y)(x) \; \& \; p = \lambda w'. [\![\text{pregnant}]\!]^{w'}(x)$

As Sudo points out, this reading (i.e. 'complete' *de re*) is **absent** in nested-*which*-questions, as also evidenced by the fact that (13b) is false while (13a) is true in w. If these two embedded *wh*-questions picked the same set of propositions, we would predict that they are both true. Therefore, we somehow have to block the completely *de re* readings of nested-*which*-questions.

Let us see how Sudo's problem arises under a von Stechow derivation. Consider the reasonable logical form[8] in (16) for the *wh*-question below.

(16)   Which cat owned by which human is pregnant?
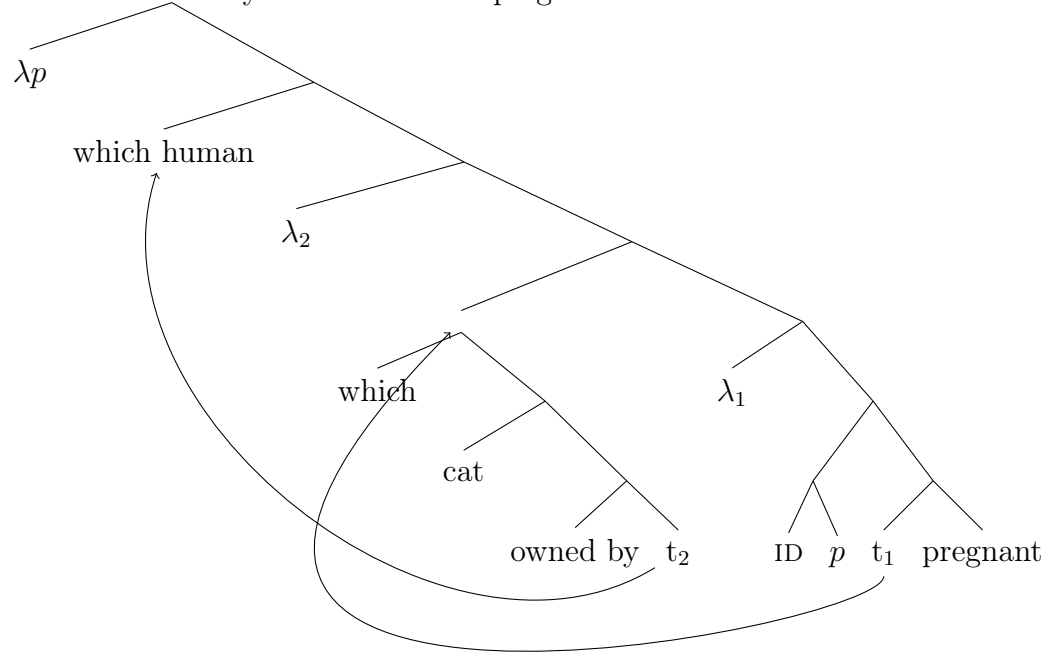
This is a legitimate logical form under von Stechow's assumptions. There is nothing to reconstruct, either. Both *wh*-phrases are above the ID head. Moreover, it also satisfies the morphological rule that I formulated in the previous section.

However, both *which human* and *which cat owned by t*, being above the interrogative complementizer, are interpreted *de re*. Therefore, the meaning derived from this LF is (17), which as we have seen is the wrong meaning for this *wh*-question. Rather (17) is the meaning for *which (human-owned) cat is pregnant?*.

(17) $\lambda p.\ \exists x\, \exists y\, [\![\text{cat}]\!]^{\text{w}}(x)\ \&\ [\![\text{human}]\!]^{\text{w}}(y)\ \&\ [\![\text{own}]\!]^{\text{w}}(y)(x)\ \&\ p=\lambda w'.[\![\text{pregnant}]\!]^{\text{w'}}(x)$

Then, the crucial question is <u>what blocks the LF in (16)</u>. One potential answer is that it involves *wh*-extraction out of an island but not in the legitimate way. I have argued that whenever *wh*-extraction out of an island needs to happen, an ID head needs to be merged, creating a scope position for the *wh*-phrase at the edge of the island. This is not what we see in (16). Let us then observe what happens when we adjust the LF in accordance with the assumption that [∃ cat owned by ∃ human] is

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[8]Another logical form which is fully interpretable would be where *which human* QRs within the relative clause. In that LF, there would be no extraction out of the pied-piped phrase. Notably, this LF, too, generates the same truth conditions, i.e. the unattested completely *de re* reading.

an extraction island. The LF given below (under the assumptions of the $\exists$-theory), does satisfy (17) and only involves a movement that I have argued to be legitimate. But it still does not return the intended meaning. What it returns is the meaning for the *wh*-question '**which human** *is such that* **a cat owned by that human** *is pregnant?*'. That is, the node labelled DP reconstructs for scope and opacity and is interpreted as an **indefinite**.

(18)

λp

$\exists$

λ_3

$\exists$ human

λ_2

$< s, ett >$

ID $\quad$ t$_3$ $\quad$ $_w\wedge$ $\quad$ DP

$\exists$

cat $\quad$ owned by $\mathbf{t}_2$

λ_0

ID $\quad$ p $\quad$ $_w\wedge$

$< et, t >$ $\quad$ pregnant

$_w\vee$ $\quad$ $\mathbf{t}_0$
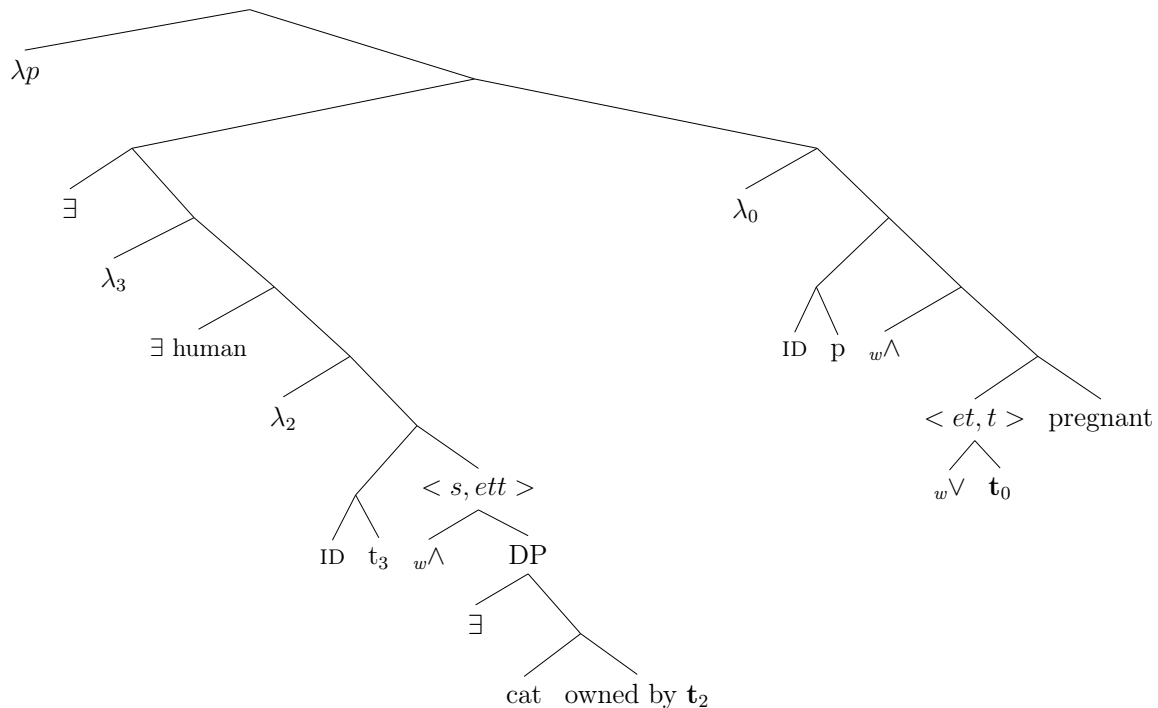
This is not all bad news. If our characterization of *wh*-phrases in the previous section, in (11), is correct, the node labelled DP is **not** a *wh*-phrase but an indefinite (because it is not a specifier of an ID). Then, I argue that while the LF is (16) is filtered out because it involves an island-violating movement, the LF in (18) is legitimate but **cannot** be pronounced by the string '**which cat owned by which human is pregnant?**'.[9]

So the question is: how do we get the right meaning?

Sudo characterizes the problem he identified with nested *which*-questions as follows: the embedded *which*-phrase has to contribute to a *wh*-question as *wh*-phrases normally do. This point can be understood better by comparing the following pair of *wh*-questions. Just like there is a contrast between the two questions in (19), there

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[9]It could have been pronounced by '*a cat owned by which human is pregnant?*' if English allowed overt island pied-piping.

has to be a contrast between the two sentences in (20).

(19) a. Which girl hugged **a puppy**?
      b. Which girl hugged **which puppy**?

(20) a. Which book by **which female author** are you looking for?
      b. Which book by **a female author** are you looking for?

I take this to suggest that in nested *which*-phrases, more than one *wh*-phrase independently takes scope within the pied-piped phrase. In turn, this implies that nested *which*-phrases only *appear* to be nested.[10] In what follows, I develop an analysis that revises the assumed structure for (what appear to be) nested *which*-phrases.

It is instructive to observe that the question why the completely *de re* reading is absent in nested *which*-questions seems equivalent to the question what could be an answer to a nested which-question, as also pointed out in Elliott (2015).[11] Observe the contrast between the two short answers to the following nested-*which*-questions.

(21) Which novel by which Russian author did you read for this class?

      a. # War and Peace
      b. ✓ War and Peace by Tolstoy

I believe that an important clue on the structure of nested *which*-phrases hides in the structure of short answers to them. A reasonable hypothesis is that **which novel by which Russian author** and **War and Peace by Tolstoy** share the same internal structure. What is the internal structure of **War and Peace by Tolstoy**? A naive and clearly wrong attempt is in (23), in analogy to (22).

(22) ✓ a book by Tolstoy

$$<< e, t >, t >$$

a $< e, t >$

$< e, t >$ $< e, t >$

book by Tolstoy

(23) × W&P by Tolstoy

t

e $< e, t >$

W&P by Tolstoy

---

[10]This is also the conclusion that Sternefeld (2001a) reaches who provides an analysis in terms of choice functions. Thanks to Simon Charlow for pointing out this work to me.

[11]Elliott (2015) proposes a compositional semantics for nested *which*-phrases using Charlow's theory of pied-piping. As he himself acknowledges, the meaning he ends up deriving is the complete *de re* reading and hence is not right.

I propose that when a string like **War and Peace by Tolstoy** can be shown to be a constituent, it will have the following structure, where **e-ident** has the denotation in (25).

(24) ιy: by-Tolstoy(y) and $y = $ W&P   (25) $[\![$e-ident$]\!]^{\mathrm{w}} =$
    $\lambda x.\ \lambda P.\ \iota y$: $P(y) \wedge x = y$

$$
\begin{array}{c}
\diagup\ \diagdown \\
\langle et, e \rangle \qquad \langle e, t \rangle \\
\diagup\ \diagdown \qquad \diagup\ \diagdown \\
\textbf{e-ident}\quad \text{W\&P}\quad \text{by}\quad \text{Tolstoy}
\end{array}
$$

Given our hypothesis that nested *which*-phrases have the same internal structure as their corresponding short answers, the base structure of **which novel by which Russian author** will be like (26a), rather than (26b). What is crucial about this revised structure is the leftmost **which** is not semantically functioning as the determiner of the entire structure. Hence, what appear to be nested *which*-phrases are *not* nested. (Since the surface strings appear to map a nested structure, I continue using the terms nested *which*-questions/phrases.)

(26)   a.   ✓

e-ident   which novel   by   which Russian author

    b.   ✗

which

novel

by   which Russian author
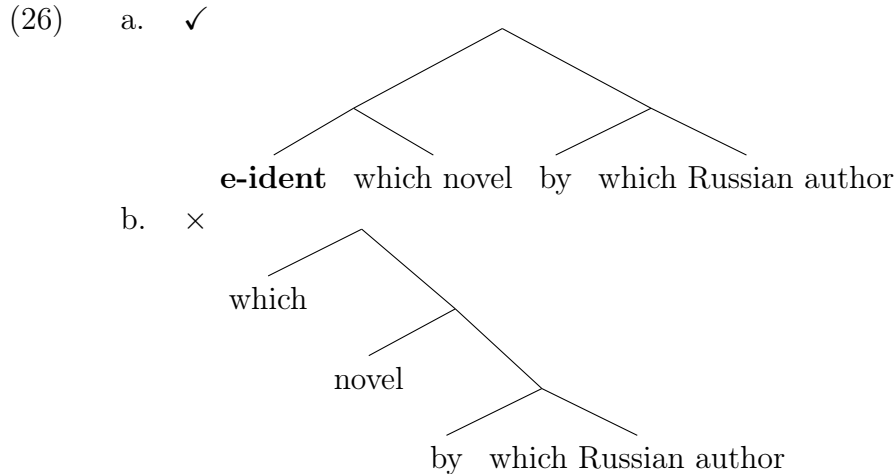
Given this revised structure for nested *which*-phrases, the syntactic derivation of the *wh*-question below will be roughly as in (27) (omitting irrelevant nodes).

(27)   Which novel by which Russian author did you read?
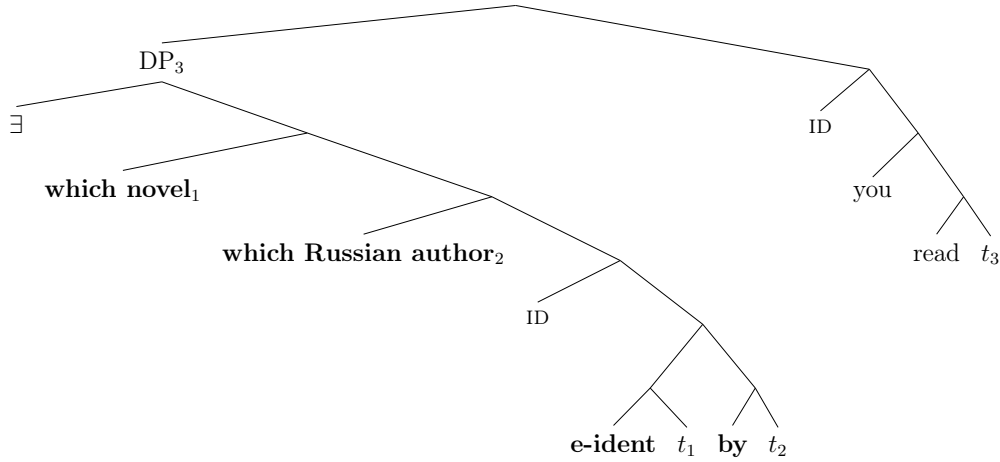
What is noteworthy in this derivation is that both *which novel* and *which Russian author* meet the structural definition of what counts as a *wh*-phrase, being specifiers of ID. Then, the only difference between what appear to be nested *which*-phrases and simple pied-piped phrases like *which boy's mother* is that in the former there is more than one *wh*-phrase that undergoes internal *wh*-movement within the pied-piped phrase (i.e. take scope above the ID within the pied-piped phrase).[12]

The logical form for the pied-piped phrase will be as in (28) and the denotation of the pied-piped phrase that we derive from this logical form is in (29).

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[12]If we adopt these structures to the original account of von Stechow (1996) (where there is no ID within the pied-piped phrase), both *wh*-phrases would have to move out of the pied-piped phrase (i.e. into matrix spec-ID). The remnant, that is the pied-pipee [[e-ident t][by t], would obligatorily reconstruct at LF. This means that nested structures would have to be unnested, which potentially overgenerates in that unnesting incorrectly predicts pair-list readings to be available with nested *which*-questions. (See Elliott (2015) for an argument against this.) The current account does not have to suffer from this potential overgeneration problem in that the entire pied-piped phrase *can* be interpreted without unnesting thanks to the scope positions within pied-piped phrases.

(28)

$<<<s,e>,t>,t>$

∃ $<<s,e>,t>$

λf t

which novel

∃ novel λ_1

which R author

∃ R author λ_2 t

$<s,e>$

ID f $_w\wedge$

e-ident t_1 by t_2
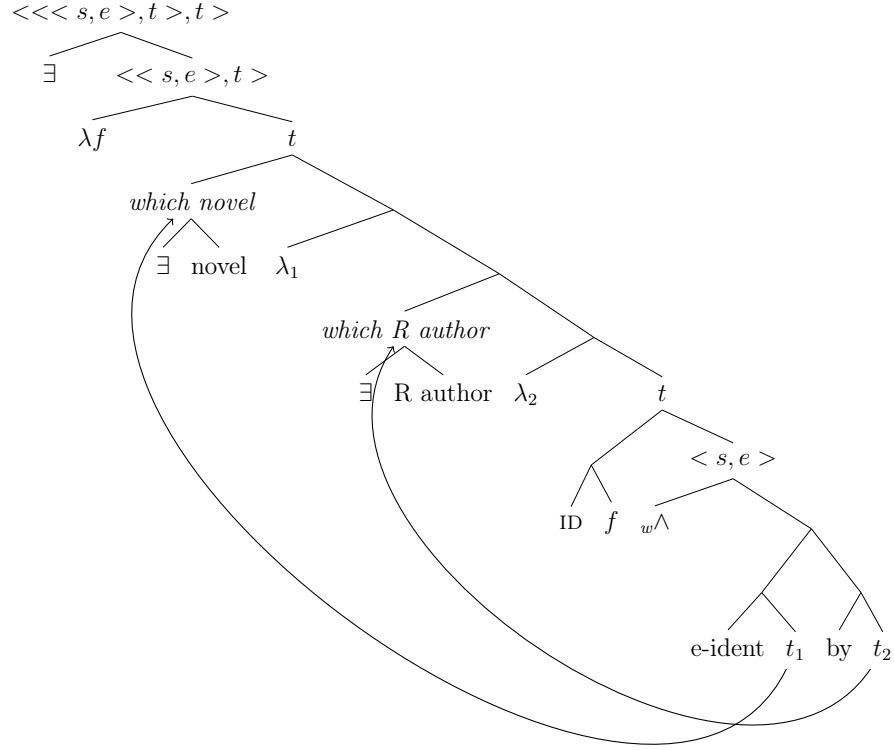
(29)   ⟦which novel by which Russian author⟧^{w} =
$\lambda R_{<se,t>}$. ∃f ∃x ∃y ⟦novel⟧$^w(x)$ & ⟦Russian author⟧$^w(y)$ & $R(f)$ &
$[f = \lambda w'.\ \iota z\colon x = z$ & ⟦by⟧$^{w'}(z)(y)]$

From the denotation above, we can already see that the pied-piped phrase will
not lead to the problem Sudo identified in nested *which*-questions in that it does not
receive the completely *de re* interpretation (which we have seen to be absent).

As shown below, this pied-piped phrase combines with the rest of the logical form just like *whose mother* does.

(30) $[\![$which novel by which Russian author you read$]\!]^{\mathrm{w}} =$
        $\lambda p.\ \exists f\ \exists x\ \exists y\colon [\![$novel$]\!]^{\mathrm{w}}(x)\ \&\ [\![$Russian author$]\!]^{\mathrm{w}}(y)\ \&$
        $p = \lambda w'.\ [\![$read$]\!]^{\mathrm{w'}}(f(w'))(you)$
        $\&\ [f = \lambda w'.\ \iota z\colon x = z\ \&\ [\![by]\!]^{\mathrm{w'}}(z)(y)]$

```
                        < st, t >
                   λp              t
                        <<< s,e >,t >,t >        << s,e >,t >
                               |                λ₀            t
        which novel by which Russian author              < st,t >     < s,t >
                                                         ID    p      w∧
                                                                          you
                                                                      read      e
                                                                             w∨   t₀
```
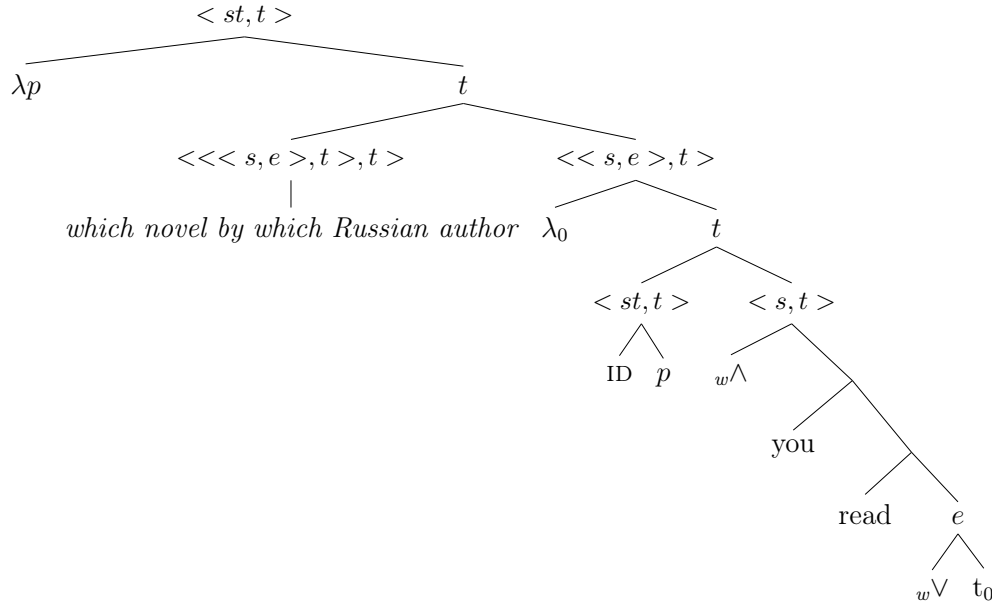
I hope to have shown that there is no way to avoid completely *de re* readings for nested *which*-phrases unless we revise our assumptions about their structure (see also Sternefeld (2001b); Heim (2012)). I have argued that the problem with nested *which*-phrases is that their surface structure is deceiving: the leftmost *which* is never the determiner for the whole structure. What is special about them is that they always contain more than one *wh*-phrase independently taking scope within the pied-piped phrase.

I have argued that there is both theory-internal and possibly empirical motivation for this revision. The theory-internal motivation is that unless we revise their structure, we can never generate an LF that will have the pronunciation of a nested-*which* question. Notably, for this argument to go through, we need the assumption that ID is a crucial ingredient in scope-taking out of islands. I have also shown that this revision finds some empirical support, if we assume that nested *which*-phrases have the same internal structure as short answers to *wh*-questions that feature nested *which*-phrases.

7.3 *de dicto* which phrases

So far, we have been talking about the *de re* reading of *which*-questions. In a context where (31) is felicitous, the *which* phrase has a *de re* construal. Under that reading, (31) asserts that the 2 year old knows which member of a particular set of entities it is not ok to play with. These entities happen to be souvenirs that the speaker of (31) brought from Norway (as she describes it) but for (31) to be true, the 2 year old does **not** need to know that those entities are souvenirs her mom brought from Norway.

(31)   My 2 year old knows
        which souvenir I brought from Norway it is not ok to play with.

While within appropriate contexts *de re* readings of *which*-phrases are available, the more salient reading of *which*-phrases is the *de dicto* reading. Under that reading, (31) asserts that the 2 year old not only knows which member of a particular set of entities it is not ok to play with but also knows that those entities are souvenirs her mom brought from Norway. The salience of the *de dicto* reading explains why it takes some effort to access a true reading for (31). Given that 2 year old babies typically don't know countries or souvenirs, (31) is felt to be false under the *de dicto* reading of the *which*-phrase.

I am aware of two approaches on the *de re* vs. *de dicto* construals of *which*-phrases. One is due to Sharvit (2002); Sharvit and Guerzoni (2003), building on Heim (1994) and Groenendijk and Stokhof (1982, 1984). Under this account, when a *wh*-question like (32) is embedded under a predicate like *know*, the reading where the *which*-phrase has a *de dicto* construal is derived — thanks to the meaning given to *know*.[13] This means that the *de re* construal for the *which*-phrase requires evaluating the *which*-phrase outside the intensional context created by *know*. To implement this under STI's assumptions, the *which*-phrase has to move above *know* (possibly by pied-piping the embedded clause with it), crucially leaving a higher type trace.[14]

(32) $[\![\text{which student left}]\!]^{\text{w}} = \lambda p.\ \exists x\ [\![\text{student}]\!]^{\text{w}}(x)\ \&\ p = \lambda w'.\ [\![\text{left}]\!]^{\text{w'}}(x)$

---

[13] $[\![\text{Jane knows which student left}]\!]^{@} = 1$ iff
$\text{BEL}(J)(@) \subseteq \{w: \cap\{p: \exists x\ [\![\text{student}]\!]^{\text{w}}(x)\ \&\ p = \lambda w'.\ [\![\text{left}]\!]^{\text{w'}}(x)\ \&\ w \in p\} = \cap\{p: \exists x\ [\![\text{student}]\!]^{@}(x)\ \&\ p = \lambda w'.\ [\![\text{left}]\!]^{\text{w'}}(x)\ \&\ @ \in p\}\ \}$

[14] This creates a complication in the spell-out of *wh*-phrases. The morphology rule would have to be defined in a way that allows *wh*-pronunciation to be preserved once an existential quantifier satisfies it. The effect of further movement has to be blocked.

Another view on the *de dicto* vs. *de re* construals of *which*-phrases is due to Rullmann and Beck (1998), further refined in Heim (2012, 2018). Under this approach, the *de dicto* construal of the *which*-phrase requires evaluating it in the intensional context created by the interrogative complementizer, i.e. in the question nucleus. Notably, to get the right meaning for *wh*-questions, we need to assume that the *de dicto which*-phrase is a definite description[15] (Rullmann and Beck, 1998).[16]

(33) $[\![\text{which student left}]\!]^{\text{w}} = \lambda p.\ \exists x:\ p = \lambda w'.\ [\![\text{left}]\!]^{\text{w'}}(\iota y:\ [\![\text{student}]\!]^{\text{w'}}(y)\ \&\ y{=}x)$

One piece of evidence that Rullmann and Beck (1998) discuss comes from cases like (34). They claim that *wh*-questions like (34a) and (34b), in an appropriate context, allow a reading where the speaker does not presuppose that unicorns exist. This is easily accounted for if (33) is a possible representation for *wh*-questions, as shown in (35) for (34a).

(34)   Bill thought he saw two unicorns, a green one and a blue one.

     a.   Which unicorn did Bill want to catch?

     b.   Which unicorn did Bill think he caught?

(35) $\lambda p.\ \exists x:\ p = \lambda w'.\ [\![\text{want}]\!]^{\text{w'}}(\lambda w''.[\![\text{catch}]\!]^{\text{w''}}(\iota y:\ [\![\text{unicorn}]\!]^{\text{w''}}(y)\ \&\ y{=}x)(b))(b)$
        'what x is such that Bill wanted to catch the unicorn (in Bill's belief worlds) identical to x?'

Assuming that this is a legitimate way of representing *de dicto which*-phrases, I sketch a way to implement this under the ∃-theory.

From Heim (2012, 2018) I adapt the idea that *which* can come in an unrestricted variety. I propose that *de dicto which*-phrases involve pied-piping. The base structure of a *de dicto which*-phrase will be like (36), using the morpheme *e-ident* that I proposed in the previous section.

(36)

            which unicorn

                       unicorn

        e-ident   ∃ R

---
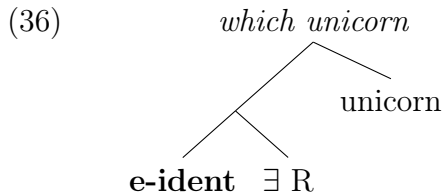
[15]Under their analysis, both *de dicto* and *de re which*-phrases are definite descriptions (with variables in them). However, as far as I can see, there is no reason to assume that *de re which*-phrases are definite descriptions. See also Heim (2012).

[16]Otherwise, the *wh*-question *'which student didn't come?'* could be understood as *'what is not a student or didn't come?'*.

To to keep the meaning I gave to $\exists$, I assume that $\exists$ can a have semantically vacuous restrictor.[17] A *dicto which*-phrase like *which unicorn* will have the internal structure given in (37) and the denotation in (38). Notice that a *de dicto which*-phrase is exactly like a pied-piped phrase *whose mother*, denoting an existential quantifier over individual concepts. Hence, when it QRs, it will leave an intensional trace of type $< s, e >$. I do not illustrate this, as it must be clear by now. The denotation of the *wh*-question '*which unicorn does Bill want to catch?*' using this meaning for *which unicorn* is given in (39).[18]

(37)
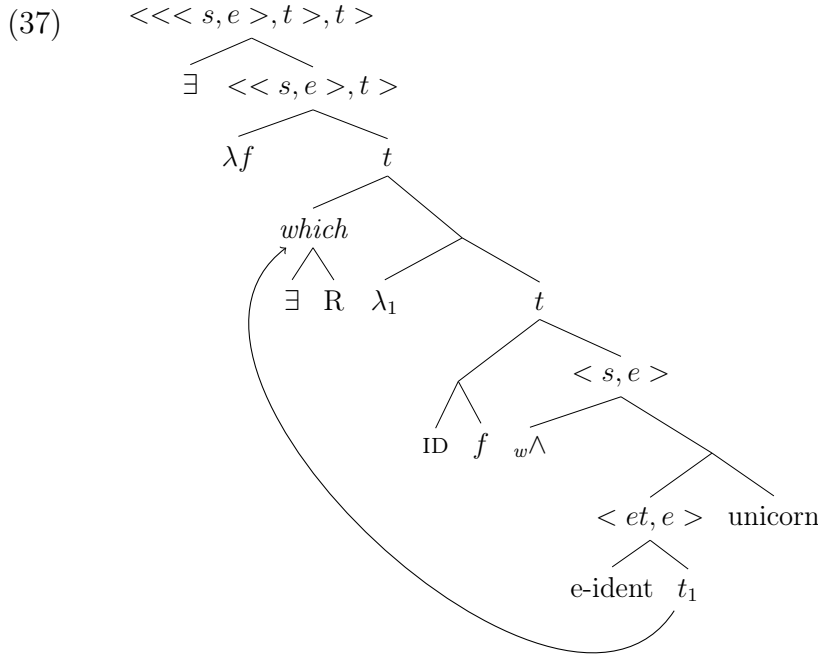
(38) $\quad \lambda K_{<< s,e >,t >}.\ \exists f\ \exists x:\ K(f)\ \&\ f = \lambda w'.\ \iota y:\ [\![\text{unicorn}]\!]^{\text{w'}}(y)\ \&\ y{=}x$

(39) $\quad \lambda p.\ \exists f\ \exists x:\ p = \lambda w'.\ [\![\text{want}]\!]^{\text{w'}}(\lambda w''.[\![\text{catch}]\!]^{\text{w''}}(f(w''))(\text{Bill}))(\text{Bill})\ \&$
$\qquad\qquad f = \lambda w'.\ \iota y:\ [\![\text{unicorn}]\!]^{\text{w'}}(y)\ \&\ y{=}x$

---

[17]This semantically vacuous restrictor can be $[\lambda m.\ m = m]$, or the restrictor might as well be contentful and stand for the covert contextual restriction on the domain of the quantifier (whatever it might be).

[18]Notice that this representation assumes that there are non-actual individuals (that correspond to unicorns in Bill's belief worlds), as pointed out by Rullmann and Beck (1998). They propose an alternative where the question is closer to '*what property P is such that Bill wants to catch the individual with P that is a unicorn in his belief worlds.*' This, too, could be represented under the pied-piping story if allow the domain of the QRing $\exists$ phrase to be properties.

One piece of syntactic evidence in favor of allowing (what appears to be) the "*wh-determiner*" move as an independent constituent comes from Left Branch Extraction, as illustrated by the Russian example below. From the pied-piping perspective on *de dicto which*-phrases, the string in (40) could be the result of stranding the DP whose internal structure is [e-ident t book].

(40)   Ja sprosil [**kakuju**   ty   cital [t_1 knigu]]
       I   asked what.kind.of you read   book
       'I asked what kind of book you read.'   Russian - Cable (2010); pg. 108

Assuming that strings that illustrate NP-stranding transparently reflect what the logical forms of these sentences are[19], we predict that a stranded NP will not accept a *de re* construal. This seems to be borne out, as shown by the contrast below. Parallel data is reported in Fox (1999) and Sportiche (2006) for *how many* questions in French, where the stranding the NP is possible.

(41)   Russian   (Tanya Bondarenko, pers. comm.)

       a.   Prezident ne   pomnit, **kotorogo shpiona** on vchera   vstretil.
            president NEG remember which   spy   he yesterday met
            'The president doesn't remember which spy he met yesterday.'   ✓ *de re*

       b.   Prezident ne   pomnit, **kotorogo** on vchera   vstretil **shpiona**.
            president NEG remember which   he yesterday met   spy
            'The president doesn't remember which spy he met yesterday.'   ?? *de re*

7.4   Functional questions

In this section, I will sketch a way to implement Heim's (2012) proposal for functional questions under the pied-piping approach. Engdahl (1986) argues that *wh*-questions like (42) are asking the addressee to identify a *function*, rather than an individual. In this particular example, the paraphrase of the question is as in (42b). Accordingly, a functional question like (42) accepts short answers of the form 'her undergraduate phonology paper'.

(42)   a.   Which paper she$_1$ wrote did no girl$_1$ publish?
       b.   Which function f from girls to papers they wrote is such that
            no girl x published what f maps to x

---

[19]If there is subsequent covert movement of the strandee, or the discontinuous strings are the result of "scattered deletion" (Davis and Bondarenko, 2019), this argument does not go through.

What is special about functional questions like the one above is that the restrictor of *which* contains a pronoun that appears to be bound in a position that is outside the scope of its binder. Recall that we dealt with a similar case in Chapter 5 where a pronoun ended up above its binder as a result of pied-piping, as illustrated by the example repeated in (43). We will make use of the same method of binding reconstruction in functional questions.

(43)   Which teacher's warning note to him$_1$ did no ill-behaved boy$_1$ bother to read?

It is useful to observe that functional questions pose a challenge to the pied-piping analysis I have pursued. This is because semantic reconstruction for binding entails scope reconstruction, as we have discussed in Chapter 5. There is, however, a way to remedy this if we allow ourselves to the *de dicto* structures I have proposed in the previous section.[20] In what follows, I illustrate how this can be achieved under the pied-piping approach we have been developing.

From Heim, I borrow the crucial idea that a covert individual denoting pronoun can be inserted to yield quantification over functions. Moreover, I assume that the restrictor of $\exists$ is again semantically vacuous.[21] For concreteness, I assume that R has the denotation in (45a).

The base structure of *which paper she wrote* in its functional construal will be as in (44). Notice that the only addition to the *de dicto* structure is a pronoun merged as the sister of the existential quantifier (boxed below). This pronoun bears the same index as the overt pronoun.

(44)
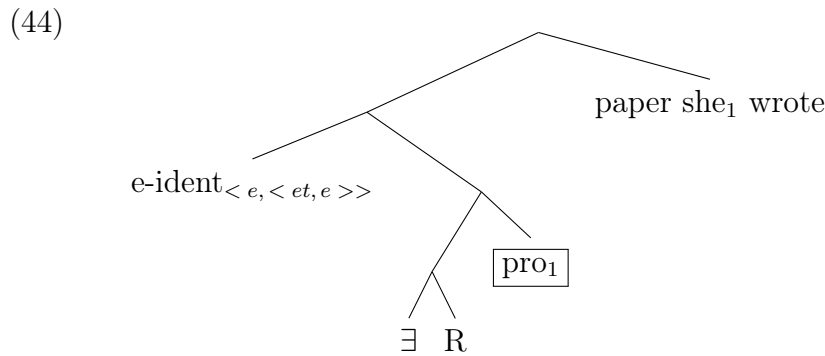
(45)   a. $[\![R]\!] = \lambda m_\alpha.\ m = m$ where α is any type
         b. $[\![\text{e-ident}]\!]^{\text{w}} = \lambda x.\ \lambda P.\ \iota y\colon P(y) \land x = y$ (repeated from before)

---

[20]In a similar vein, Heim's analysis relies on interpreting the restrictor of *which*, within the question nucleus. I refer the reader to Heim (2012) for a her particular implementation, which I heavily borrow from.

[21]Heim's meaning for $[\![\text{which}]\!]$ is unrestricted: $\lambda P.\ \exists m\colon P(m)$.

Let us now see what the structure of the pied-piped phrase will be. Notice that the only possible type for t_2 is $< e, e >$, which entails that the λ-abstract created is a function of type $<< e, e >, t >$.[22] This is thanks to the fact that pro_1 is merged as a sister to the quantifier that QRs within the pied-piped phrase. The presence of the pronoun gives us a quantifier that ranges over functions of type $< e, e >$, as desired. This is the crucial insight borrowed from Heim (2012).

(46)
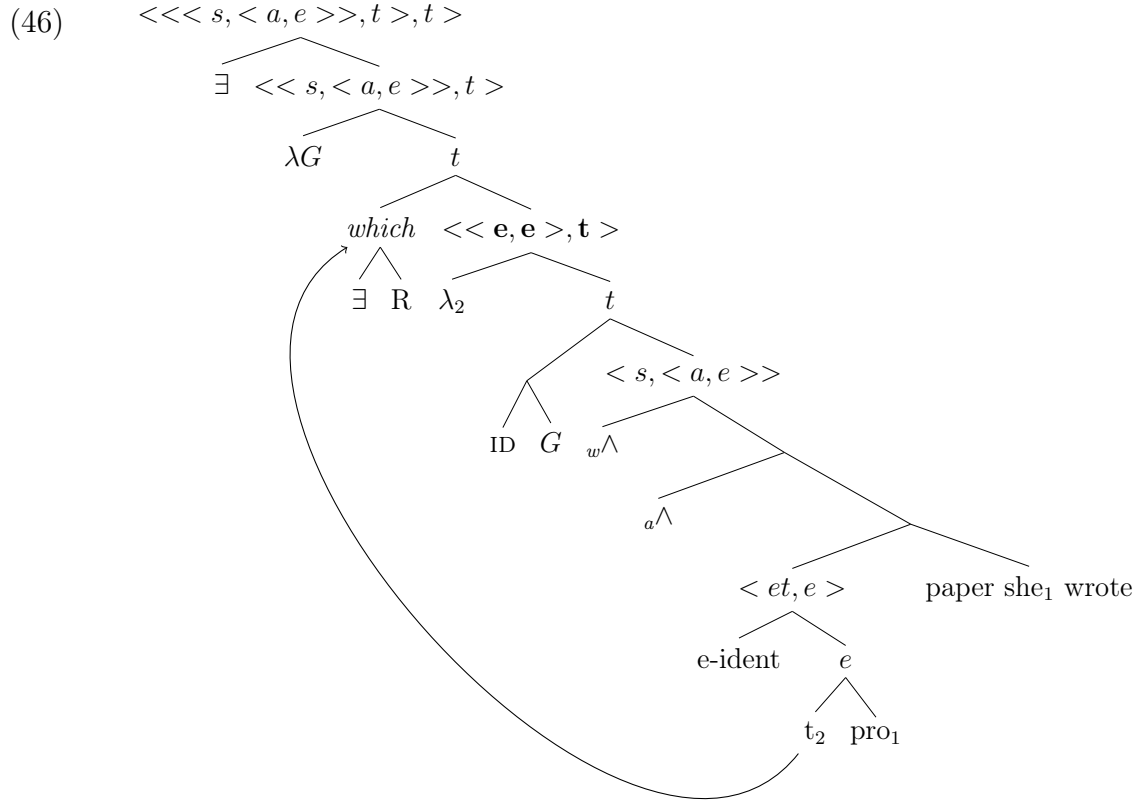
The meaning of this complex quantifier (the entire pied-piped phrase) is given below.

(47) $[\![(46)]\!]^{\text{w, g}} = \lambda K_{<< s, < a, e >>, t >}.\ \exists G_{< s, < a, e >>}\ \exists f_{< e, e >}:\ K(G)\ \&$
$G = \lambda w'.\ \lambda g'.\ \iota x:\ x = [\![t_2]\!]^{\text{w', g'} \cup \text{g}[2 \rightarrow \text{f}]}([\![\text{pro}_1]\!]^{\text{w', g'} \cup \text{g}[2 \rightarrow \text{f}]}) \wedge$
$[\![\text{paper she}_1\ \text{wrote}]\!]^{\text{w', g'} \cup \text{g}[2 \rightarrow \text{f}]}\ (x)$

---

[22]This means that the 'morphology rule' for *wh*-phrases has to accommodate this. I gloss over this.

In (48) is the rest of the logical form for the *wh*-question below.

(48)   Which paper she$_1$ wrote did no girl$_1$ publish?
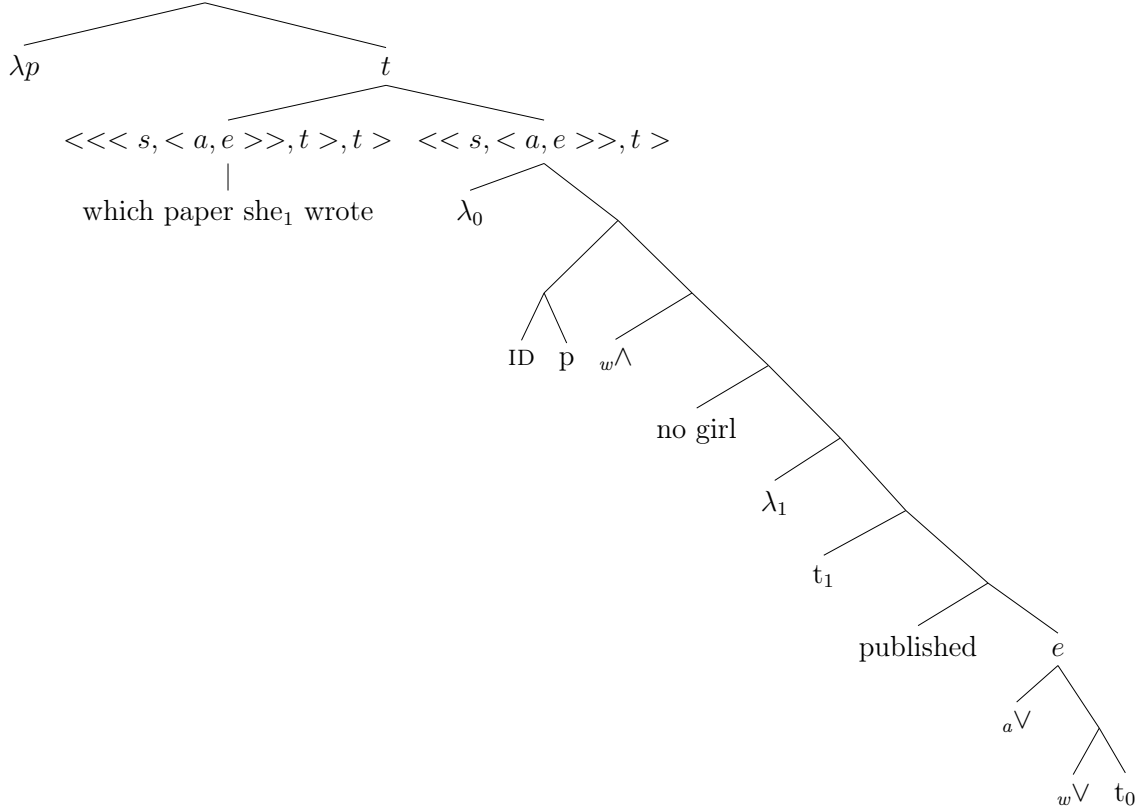
(49) $\lambda p.\ \exists G_{< s, < a, e >>}\ \exists f_{< e, e >}$:
$p = \lambda w'.\ \neg\exists y$: $[\![$girl$]\!]^{w'}(y)$ & $[\![$published$]\!](G(w')(g[1\rightarrow y]))(y)$
$G = \lambda w'.\ \lambda g'.\ \iota x$: $x = f([\![$pro$_1]\!]^{w',\ g'\ \cup\ g[2\rightarrow f]})\ \wedge$
$[\![$paper she$_1$ wrote$]\!]^{w',\ g'\ \cup\ g[2\rightarrow f]}(x)$

In the derived function, the object of *published* is G(w')(g[1→y]). Given what G equals to, G(w')(g[1→y]) = ιx: $x = f(y)$ & $[\![$paper$]\!]^{w'}(x)$ & $[\![$wrote$]\!]^{w'}(x)(y)$. Therefore, the derived function is identical to the function in (50), as desired.

(50) $\lambda p.\ \exists f_{< e, e >}$: $p = \lambda w'.\ \neg\exists y$: $[\![$girl$]\!]^{w'}(y)$ & $[\![$published$]\!]^{w'}(\iota x$: $x = f(y)$ & $[\![$paper$]\!]^{w'}(x)$ & $[\![$wrote$]\!]^{w'}(x)(y))(y)$
'which function f is such that no girl y published the unique x such that x is a paper y wrote and x is what f maps to y'

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7.5 Fine-grained theories of *de re* attitudes

In this section, I address compatibility issues with proposals that present more fine-grained views of *de re* ascription. Recall that a sentence like (51) is a true attitude report in a context where the 2 year old points to a guy that she sees on TV, who happens to be the US president, and says '*his hair is funny*'. Under the true reading of (51), the definite description *the US president* has a *de re* construal, assuming that the 2 year old does not know the guy she saw on TV is the US president.

(51)   My 2 year old thinks that the US president has funny hair.

Thus far, we have been representing the truth conditions of *de re* attitude ascriptions like the one above, as shown below.

(52)   ⟦my 2 year old thinks that the US president has funny hair⟧ = 1 iff
        $[\lambda x.$⟦my 2 year old thinks⟧$^{\text{w}}(\lambda w'.$ ⟦has funny hair⟧$^{\text{w'}}(\underline{x}))]$ (⟦the US president⟧$^{\text{w}}$)

Notice that the reported attitude above is of the form 'x has funny hair', where the speaker identifies x as the actual US president. To put it in simple terms, under this representation, the 2 year old's attitude looks like it is about "a variable". Conceptual issues aside, Quine identifies an empirical problem with this kind representation of *de re* ascription. The argument comes from his famous example in (53). Quine argues that under a multiple-guise scenario, where Ralph sees the man named Ortcutt in two different situations but fails to recognize that the men he sees are the same individual (i.e. Ortcutt), (53) can have a non-contradictory reading. However, the representation of *de re* ascription that we have been using, illustrated in (52), can only express the contradictory reading.

(53)   Ralph believes that **Ortcutt** is a spy and, at the same time, he believes that
        Ortcutt is not a spy.

                                        (Quine, 1956; Charlow and Sharvit, 2014)

There are various proposals that address this problem with *de re* attitudes (Lewis, 1979; Cresswell and von Stechow, 1982; Sauerland, 2014; Percus and Sauerland, 2003; Cable, 2018a). Here I will very briefly discuss the solution offered in Percus and Sauerland (2003), and further defended in Charlow and Sharvit (2014).

Under the theory of *de re* attitudes in Percus and Sauerland (2003), an attitude report that contains a *de re* DP can only be true if the attitude holder has a "concept"

corresponding to what that *de re* DP denotes in the utterance world. Their proposal relies on a device called *concept generators*. Under the 'Concept Generators' theory of *de re*, attitude verbs have enriched (and type flexible) meanings that allow them to existentially quantify over concept generators of type $< e, < s, e >>$. A *de re* DP or its trace is sister to a concept generator variable G of type $< e, < s, e >>$ that maps the DP to a concept of type $< s, e >$ (that the speaker thinks the attitude holder might have in her mind) for what that DP denotes at the utterance world. How *de re* ascription works under this system is illustrated below (somewhat simplified). As can be seen below, the derived truth conditions require Sue to have a concept that corresponds to the individual that the speaker describes as "the US president".
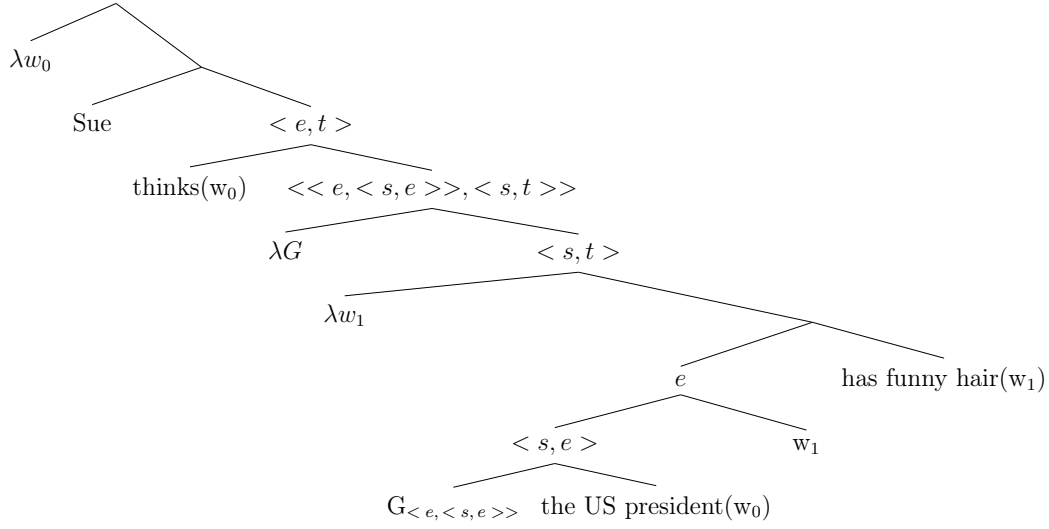
(54)   ⟦Sue thinks that the US president has funny hair⟧$^\mathrm{w}$ = 1 iff ⟦Sue thinks⟧$^\mathrm{w}(\lambda G.$
$\lambda w'.$ ⟦has funny hair⟧$^{w'}$(G(⟦the US president⟧$^{\mathbf{w}}$)(w')) = 1 iff
$\exists G$ for Sue at w such that
$\mathrm{DOX}_{\mathrm{sue, w}} \subseteq$ {w': G(the US pres. in w)(w') has funny hair in w'}

Given that in Quine's multiple guise scenario, Ralph has two distinct concepts for Ortcutt, contradiction is avoided, as shown below.

(55)   a.   ⟦Ralph believes that Ortcutt is a spy⟧$^\mathrm{w}$ = 1 iff
$\exists G$ for Ralph at w: $\mathrm{DOX}_{\mathrm{ralph, w}} \subseteq$ {w': G(Ortcutt)(w') is a spy w'}
        b.   ⟦Ralph believes that Ortcutt is not a spy⟧$^\mathrm{w}$ = 1 iff
$\exists G$ for Ralph at w: $\mathrm{DOX}_{\mathrm{ralph, w}} \subseteq$ {w': G(Ortcutt)(w') is not a spy w'}

In what follows, I sketch how this theory of *de re* ascription can be implemented under STI. First it is useful to go over the logical form for the sentence below under BTI's assumptions. Notice that the *de re* DP is sister to a concept generator variable G of type $< e, < s, e >>$. This variable is abstracted at the root node of the embedded clause. Therefore, the type of the embedded clause depends on how many distinct concept generator variables there need to be (accordingly, the embedding verb needs to have a type-flexible meaning).

(56)   Sue thinks that the US president has funny hair

λw_0

Sue $< e,t >$

thinks(w$_0$) $<< e, < s,e >>, < s,t >>$

λG $< s,t >$

λw_1

e has funny hair(w$_1$)

$< s,e >$ w$_1$

G$_{< e, < s,e >>}$ the US president(w$_0$)

What is relevant for our purposes is that in this logical form the sister of G is evaluated in the utterance world *in-situ*. Of course, under STI's assumptions, this is not possible. Therefore, to demonstrate the compatibility of the Concept Generator theory of *de re* ascription with STI, we need to show that the *de re* DP can be evaluated in the utterance world *ex situ*, i.e. above *think*. Since this is fairly straightforward to achieve in this particular case, I will demonstrate this on a fairly involved example that I have assumed requires pied-piping. The sentence I demonstrate this on is given below.
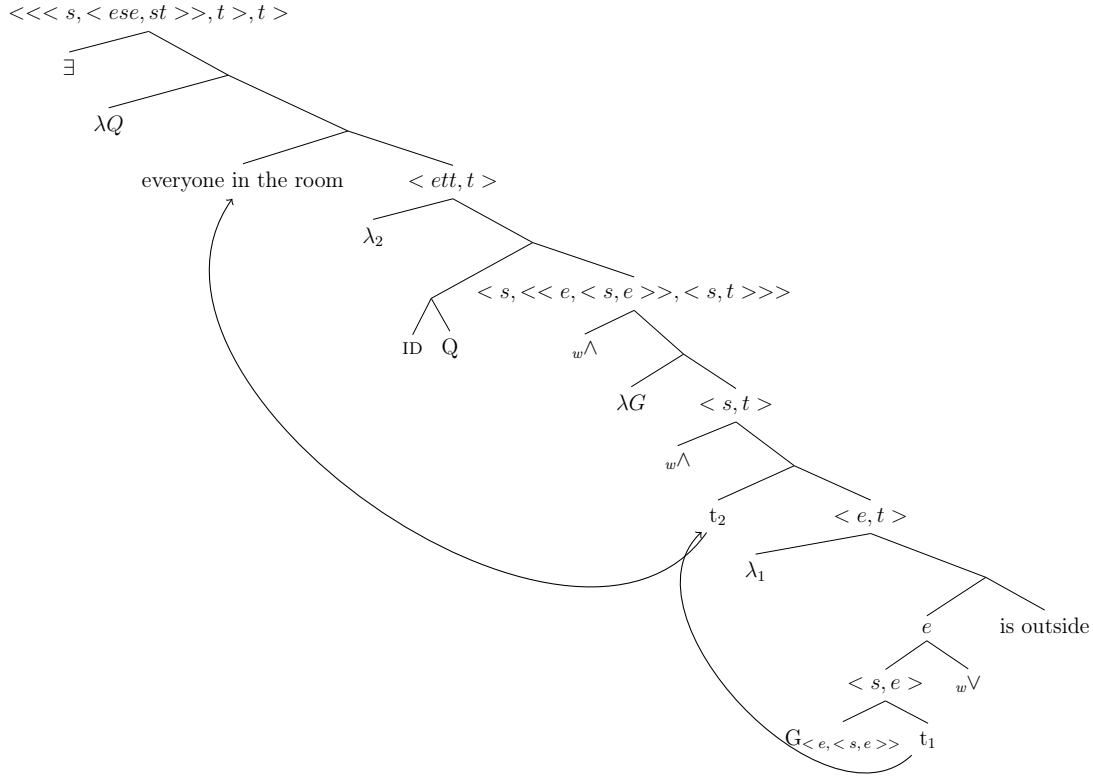
(57)   Sue thinks that everyone in the room is outside.

For illustration purposes, I assume that everyone in the room cannot QR out of the tense clause and pied-pipes the entire embedded clause, as shown below.

(58)

everyone in the room is outside

λ_0

Sue thinks

$_w\lor$ t$_0$
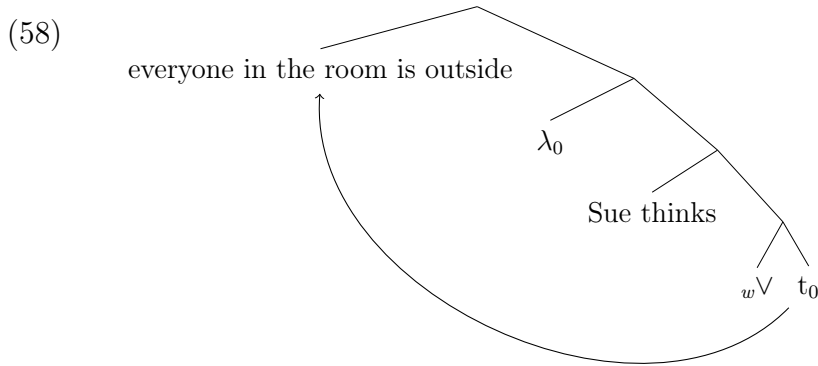
Below is the internal derivation of the pied-piped clause.

(59) everyone in the room is outside

$<<< s, < ese, st >>, t >, t >$

∃

λQ

everyone in the room $< ett, t >$

λ_2

$< s, << e, < s, e >>, < s, t >>>$

ID Q $_w\wedge$

λG $< s, t >$

$_w\wedge$

t_2 $< e, t >$

λ_1

e is outside

$< s, e >$ $_w\vee$

$G_{< e, < s, e >>}$ t_1

While implementation under BTI would require QRing *everyone in the room* from its base position for type-reasons (G is looking for an individual argument), under STI's assumptions, assuming we do not allow universal quantifiers to move out of a tensed clause, the derivation schematized above seems necessary. Even though the pied-piping derivation arguably looks much more complex, it employs the exact same logic we have used so far to allow a narrow scope DP to be evaluated above an intensional operator.[23] My conclusion based on this demonstration is that a more 'complete' theory of *de re* may not be fundamentally incompatible with the representation of intensionality I have been assuming.

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[23]Another more involved case will be where a *de re* DP is within an island. In that case, pied-piping will carry the concept generator variable G that the DP is associated with, above G's λ-binder. However, given that the pied-piping theory I spelled out is able to achieve binding reconstruction semantically, this does not create an impasse.

7.6 Intervention Effects

As I have mentioned in Chapter 6, there is a well-acknowledged account of *intervention effects* in *wh*-questions due to Beck (2006). Beck's theory of *wh*-questions and intervention phenomena adopted (with variations) by Cable (2010) and later by Kotek (2016). Both authors use Beck's theory to demonstrate impressive empirical coverage, making fine-grained predictions on intervention phenomena and its interaction with superiority (Pesetsky, 1987, 2000). This line of work, albeit interesting and sophisticated, is unfortunately incompatible with the theory advocated here in that it relies on Beck's adaptation of Rooth's Focus Semantics (Rooth, 1985, 1992).

However, I will argue that this may not be bad news because Beck's theory in fact fails to account for the core intervention phenomena it started with. I will have some preliminary remarks on an alternative account of intervention effects in terms of **scope rigidity** in languages like Turkish. Interestingly, a similar claim is made for Japanese in Erlewine and Kotek (2017). However, the explanation offered here will have a very different nature.[24]

The core intervention phenomenon in *wh*-questions is illustrated by the Turkish sentences below. Under Beck's theory, *only* ('sadece' in Turkish) is a focus sensitive operator that needs to access the ordinary semantic value of its prejacent (as well as its focus semantic value). Recall that Beck assumes that *wh*-phrases do not have an ordinary semantic value (see Chapter 2) and can only pointwise compose (in the focus dimension). Therefore, the ungrammaticality of (60a) is explained as follows: given that the *wh*-phrase 'kimle' is in the scope of the focus sensitive operator 'sadece', the prejacent of 'sadece' will not have an ordinary semantic value (it will be undefined). Given that 'sadece' *needs* the ordinary semantic value of its sister, the entire logical form is undefined.

(60)   Turkish

    a. *<u>Sadece</u> Selin kim-le   konuştu
        only   Selin who-with talked
        'Intended: who$_1$ is such that only Selin talked to them$_1$?'

    b. Kim-le$_1$ <u>sadece</u> Selin t$_1$ konuştu
        who-with only   Selin   talked
        ✓'Who$_1$ is such that only Selin talked to them$_1$?'

---

[24]Their explanation is making reference to the difficulties with λ-abstraction in pointwise composition (Shan, 2004). In particular, they argue that whenever there needs to be a λ-binder in the domain of 'alternative computation', there will be intervention. It is not clear, however, what they assume for the representation of intensionality and relativization, both of which are likely to require abstraction.

This theory also correctly predicts that (60b) is well-formed because the *wh*-phrase is no longer in the scope of *only*, after it moves out.

Beck's theory fails in baseline cases like (61), which has been overlooked, with the exception of Li and Law (2014) who present parallel data from Mandarin and propose an alternative theory.

(61) Turkish

    a. Selin <u>sadece</u> kim-le   konuştu
       Selin only   who-with talked
       'Who$_1$ is such that Selin talked to ONLY them$_1$?'=
       Who is the only person that Selin talked to?

    b. <u>Sadece</u> kim-le   Selin konuştu
       only   who-with Selin talked
       'Who$_1$ is such that Selin talked to ONLY them$_1$?'=
       Who is the only person that Selin talked to?

Beck's theory of intervention relies on the assumption that in the intervention configuration, *wh*-phrases cannot covertly escape the scope of *only*. Only by this assumption, an account of the ungrammatical case in (60a) becomes possible. One could argue that we could make an exception and assume that covert movement is allowed in (61a), which would derive the intended meaning. However, the real problem is cases like (62), where an entire island that contains a *wh*-phrase can be in the scope of *only*. Except for the fact that they have presuppositions that need accommodation, these sentences are perfectly grammatical. For example, (62) is a felicitous question in a context where the speaker presupposes that the addressee liked exactly one of the gifts that came to the addressee.

(62) <u>Sadece</u> [$_{island}$ **kim-den** gelen   hediyeyi] beğendin?
     only   who-from come.REL gift.ACC you.liked
     'Which person x is such that you only liked [the gift that came from x]$_F$?'

(63) <u>Sadece</u> [$_{island}$ **nereye** gidersek] bizimle gelirsin?
     only   where if.we.go with.us you.come
     'Which place x is such that you would only come with us [if we went to x]$_F$?'

Again these sentences would be predicted to be fine, if a *wh*-phrase could covertly move out of the island that contains it. This movement would derive the intended readings. However, allowing this movement entirely defeats the purpose of having pointwise composition in the first place. Therefore, I argue that Beck's theory of in-

tervention is not a suitable theory of intervention phenomena —at least for languages like Turkish.

In what follows, I sketch an alternative account of the data presented above. For the purposes of illustration, I assume the meaning for *sadece* 'only' in Turkish given in (64). This semantics for 'sadece' assumes that 'sadece' phrases are scope-takers[25], as we will see below.

(64) $[\![\text{sadece}]\!]^{\text{w, g}} = \lambda x.\ \lambda P_{<e,t>}.\ \{y\colon \mathrm{P}(y)\} = \{x\}$ Charlow (2015)

In a simple sentence like (65), the 'sadece' phrase takes scope by moving covertly, as illustrated in (66). Accordingly, the truth conditions that we derive from the LF in (66) will be as in (67).

(65)   Selin [sadece Ali-yi] seviyor
   Selin only   Ali.ACC likes
        'Selin only likes Ali.'

(66)
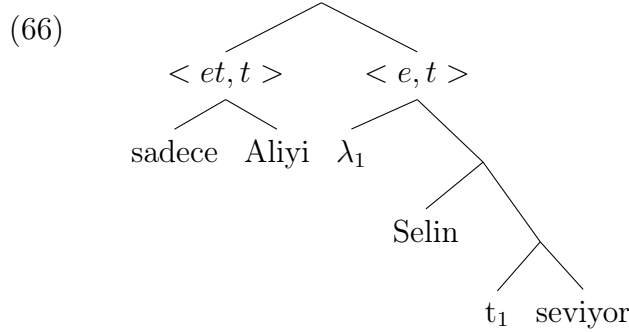
(67) $[\![(66)]\!]^{\text{w}} = 1$ iff $\{\text{Ali}\} = \{y\colon \text{Selin likes } y \text{ in } w\}$
        'The set of things Selin likes only contains Ali.'

Next is an illustration of 'sadece' combining with a *wh*-phrase. In (69) is the logical form for the *wh*-question in (68). The function that we compute from this logical form is given in (70).

(68)   Selin [sadece kimi]   seviyor
        Selin only   who.ACC likes
        'Who is the only person Selin likes?'

---

[25] See also Krifka (1991); Geurts and van der Sandt (2004); Sauerland (2018)

(69)
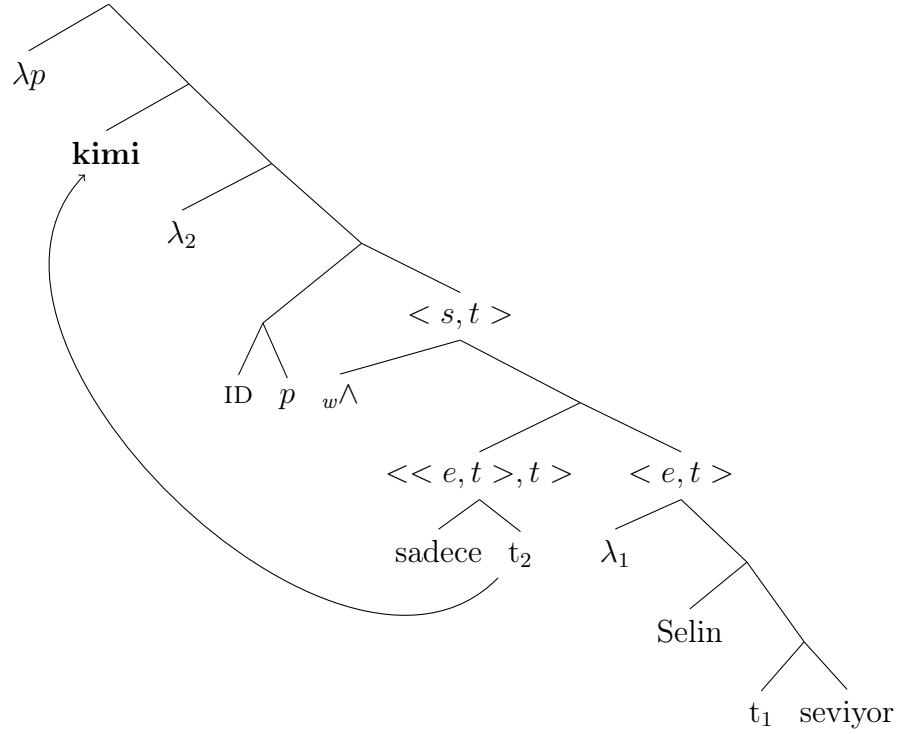
(70) $[\![(69)]\!]^{w} = \lambda p.\ \exists x\!: [\![\text{human}]\!]^{w}(x)\ \&\ p = \lambda w'.\ [\{x\} = \{y\!: [\![\text{likes}]\!]^{w'}(y)(\text{Selin})\}]$
'which human x is such that x is the only thing that Selin likes?'

Given that under the ∃-theory, pied-piped islands are existential quantifiers, there is no difficulty in interpreting a sentence like (71) where 'sadece' combines with an island containing a *wh*-phrase. I do not present the internal composition of the island, as we have seen it numerous times. The only thing to remember here is that 'sadece' expects an argument of type e but the trace of the pied-piped island will be of type $< s, e >$. Hence, $_{w}\vee$ will apply to the trace and return an individual. The derived function is given in (73).

(71) Selin <u>sadece</u> [island **kim-den** gelen   hediyeyi] beğendi?
Selin only   who-from come.REL gift.ACC liked
'Which person x is such that the only thing Selin liked liked is [the gift that came from x]F?

(72)

λp

kimden gelen hediyeyi $<<s,e>,t>$

λ_2

$<s,t>$

ID p $_w\wedge$

$<<e,t>,t>$ $<e,t>$

sadece e λ_1

$_w\vee$ t$_2$ Selin

t$_1$ beğendi
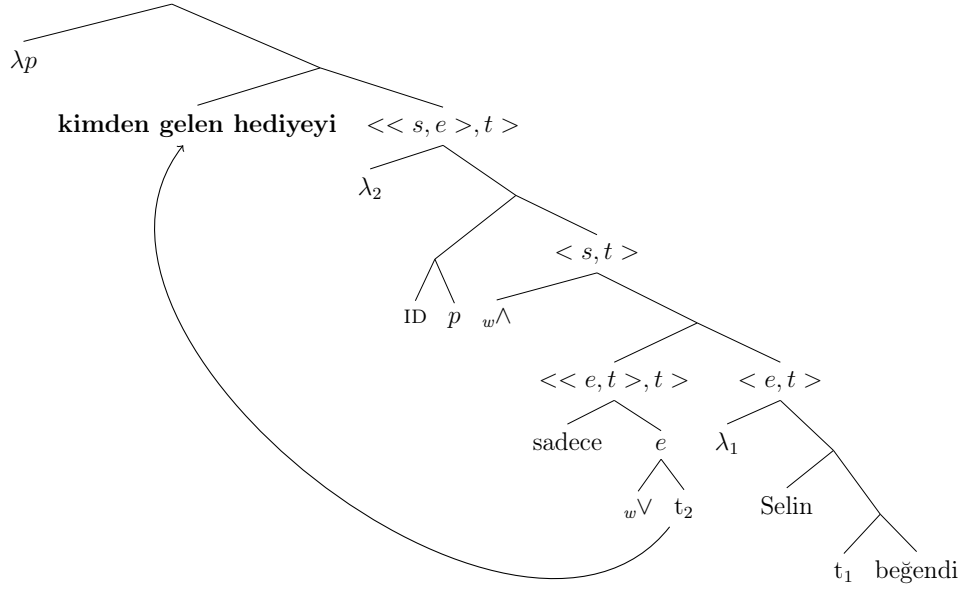
(73) $[\![(72)]\!]^{\text{w}} =$

$\lambda p.\ \exists f\ \exists x: [\![\text{human}]\!]^{\text{w}}(x)\ \&\ p = \lambda w'.\ [\{f(w')\} = \{y: [\![\text{liked}]\!]^{\text{w'}}(y)(\text{Selin})\}]$

$f = \lambda w'.\ \iota z: [\![\text{gift}]\!]^{\text{w'}}(z)\ \&\ [\![\text{came from}]\!]^{\text{w'}}(x)(z)$

'which person x is such that the only thing that Selin liked is the gift that came from x?'

Assuming that a scopal account of 'sadece' is on the right track, we can now look at the intervention phenomena. Recall that a *wh*-question like (74) is ungrammatical. I hypothesize that this is merely the result of **scope rigidity** in Turkish (Kelepir, 2001; Özyıldız, 2017, e.g.), (see also Bobaljik and Wurmbrand (2012)).

(74)   *[Sadece Selin] kimi   seviyor
        only   Selin who.ACC likes
        Intended: 'Who is it that only Selin likes?'

The scope rigidity is illustrated by the data below, repeated from Chapter 1. (75) informs us that the linear order between scope-taking expressions determine their relative scope in Turkish.

(75)   Turkish

    a.   [$_{QP_1}$ bi çocuk] [$_{QP_2}$ her   elma-yı]   ye-di
            a   child   every apple-ACC eat-PST.3SG
            'A child ate every apple.'

            <u>false</u> if every apple was eaten by a different child.

    b.   [$_{QP_2}$ **her   elma-yı**]   [$_{QP_1}$ bi çocuk] **t**$_{QP_2}$ ye-di
            every apple-ACC   a child   eat-PST.3SG
            <u>true</u> if every apple was eaten by a different child.

Crucially, DPs headed by 'sadece' are subject to scope rigidity effects.

(76)   a.   Hiçkimse   [<u>sadece</u> Selin-i]   sev-m-iyor
            nobody.NOM only   Selin-ACC like-NEG-IMPF
            <u>Unavailable:</u> 'Selin is the only person that nobody likes.'

    b.   [<u>sadece</u> Selin-i]$_1$ hiçkimse   t$_1$ sev-m-iyor
            only   Selin-ACC nobody.NOM   like-NEG-IMPF
            <u>Available:</u> 'Selin is the only person that nobody likes.'

Of course, if Turkish is scope rigid and 'sadece' phrases are scope takers, (77a) will converge as gibberish. The only interpretable LF is where the *wh*-phrase scopes above all other scope-takers, including 'sadece' phrases. The obligatoriness of the movement in (77b), then, is a result of the requirement that the linear order reflect the relative scope of scope-taking DPs.

(77)   a. *[<u>Sadece</u> Selin] kimi   seviyor?
            only   Selin who.ACC likes
            Intended: 'Who is it that only Selin likes?'

    b. kimi$_1$ [<u>Sadece</u> Selin] t$_1$ seviyor?
        who.ACC only   Selin   likes
        'Who is it that only Selin likes?'

The same kind of scope rigidity effects can be observed with quantifiers like no-body/anybody, which also have been taken by some authors to be intervention configurations. This is illustrated below.

(78)   a. *Hiçkimse   [kim-i]   sev-m-iyor
            nobody.NOM who-ACC like-NEG-IMPF
            Unavailable: 'Who is such that nobody likes them?'

        b. [kim-i]$_1$ hiçkimse   t$_1$ sev-m-iyor
            who-ACC nobody.NOM   like-NEG-IMPF
            Available: 'Who is such that nobody likes them?'

Surely, this perspective on intervention effects makes further predictions and raises many important questions, which I hope to study more carefully in the future. However, I believe that a line of research on intervention phenomena that assumes a scopal treatment of the core intervener 'only' seems promising.[26]

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[26]See also Elliot and Sauerland (2019) on intervention by negation.

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