

Abstract:

In this article, I argue that a treatment of pied-piping in terms of feature percolation is problematic under minimalist assumptions. I propose an alternative approach based on Agree. *Wh*-movement and restrictions on pied-piping are argued to follow from the interaction of the theory of phases and a violable constraint that forces *wh*-feature checking under Agree to be as local as possible. The theory derives three observations that are attested in different languages: Pied-piping is recursive, the *wh*-phrase seeks to be at the edge of the pied-piped phrase, and pied-piping is a last resort.

1. Introduction and Overview

In this article I provide a new analysis for a certain subclass of pied-piping constructions. Pied-piping (see Ross (1967, 1986)) is theoretically problematic because it undermines the descriptive generalization that *wh*-movement can only affect categories that bear the feature [wh] (see section 2.1.). Work within the Principles-and-Parameters framework of the eighties and early nineties usually approached this problem by assuming a process of *wh*-feature percolation (see section 2.2.). My starting point is that an approach to pied-piping within the minimalist program should dispense with feature percolation provided that (i) feature percolation cannot be reduced to one of the standard construals Move and Merge and (ii) an alternative analysis of pied-piping without feature percolation is available. Consequently, one aim of the article is to illustrate that a percolation-free analysis can be offered (section 3.1.). Moreover, I present three observations that every theory of pied-piping should account for, and I show how they are derived by the alternative theory proposed here (see sections 3.2.-3.4.).

Central to my proposal is the assumption that *wh*-feature checking should be subsumed under the operation of Agree (see Chomsky (2001)). In particular, I suggest that a local application of Agree is preferred over a remote one. This is derived by a violable constraint, dubbed LOCAL AGREE (LA; see 3.1.). It turns out that LA also offers a handle to solve the problem of successive cyclic *wh*-movement. The remainder of section 3. addresses three cross-linguistic properties of pied-piping. I suggest that they can be captured by the interaction of LA, the notion of a phase, and a recursive accessibility condition that holds between probe and goal. Cross-linguistic variation in pied-piping is argued to result from independent differences between languages. Throughout this paper, I presuppose a derivational approach to syntax (see Chomsky (2000, 2001)). In appendix 1 I explicitly discuss the question whether a reduction of feature percolation to Merge or Move is possible. There, I sketch what a reductionist theory that accounts for the three pied-piping properties could look like. The conclusion is that such a theory can account for the same range of empirical observations, but it has to resort to additional and unattractive assumptions in order to do so.

[‡]For comments, suggestions, and helpful criticism I am grateful to Petr Biskup, Joanna Blaszczak, Sandra Chung, Gisbert Fanselow, Jochen Geilfuß-Wolfgang, Andrew McIntyre, Gereon Müller, Marga Reis, Marc Richards, Uli Sauerland, Violaine Schneider, Peter Sells, Peter Staudacher, Arnim von Stechow, Wolfgang Sternefeld, Jochen Trommer, Malte Zimmermann, and to two anonymous *LI* reviewers.

A caveat is due before I move on. In this article, I do not address the phenomenon dubbed *massive* or *heavy* pied-piping (see Safir (1986) or Vries (2005), respectively). The constitutive property of massive pied-piping is that it allows for an unusual amount of structure to be pied-piped. The distinction between massive and ordinary (non-massive) pied-piping becomes obvious in a language that lacks massive pied-piping. German seems to be a case in point.¹ Consider the contrast in (1).

- (1) a. *ein Problem, die Lösung von dem wir haben
 a problem the solution of which we have
 ‘a problem whose solution we have’
 b. ein Problem, von dem wir die Lösung haben
 a problem of which we the solution have

Pied-piping of a DP is impossible in German if the pied-piper (the relative pronoun *dem* in (1-a)) is buried on the complement side of the N-head; this is an instance of massive pied-piping. In contrast, extraction of the *wh*-phrase out of the DP, minimally pied-piping a preposition, is grammatical (see (1-b)).

Crucially, there are languages where massive pied-piping of the type (1-a) is grammatical, albeit only under certain circumstances. A particularly instructive example is Italian, which, according to Cinque (1982), not only restricts the application of massive pied-piping to the context of appositive relative clauses (as opposed to restrictive relatives), but also shows a morphological reflex of the distinction between massive and non-massive pied-piping. The former is only possible with relative pronouns of the *il quale*-type but not with *cui*, see (2-a) vs. (2-b).

- (2) a. *L'uomo la figlia di cui fuma è contrario
 the-man the daughter of who smokes is against
 ‘the man whose daughter smokes is against it’
 b. Giorgio, la figlia del quale fuma, è contrario
 Giorgio the daughter of-the who smokes is against
 ‘Giorgio, whose daughter smokes, is against it’

According to Cinque (1982, 275ff.), parallel facts hold for French (which also exhibits two types of relative pronouns).² In fact, it has often been claimed that in English, too, massive pied-piping is only grammatical in appositive relative clauses, although there is no variation in the form of the relative pronoun in English (see Nanni and Stillings (1978), Sells (1985), Safir (1986), Fabb (1990), Grimshaw (1991, 2000), and Borsley (1992), among many others).³

¹See Webelhuth (1992, 128ff.), who claims that massive pied-piping in Germanic is restricted to English; but cf. Vries (2005) for a different view.

²See also Kayne (1976), Cowper (1987, 328ff.), and Moritz and Valois (1994, 701) for some relevant judgments. Counterexamples to the claim that massive pied-piping in French is subject to the above-mentioned restrictions can be found in Kayne (1975, 112, footnote 57) and Hirschbühler (1978, 110).

³Again, judgements are not uniform. See, for instance, Ross (1986, 121ff.), who judges massive pied-piping in restrictive relative clauses as grammatical. I assume that speakers that accept massive pied-piping in restrictive relatives can resort to some mechanism that for other speakers is only available in appositive relatives. As far as I know there are no speakers who accept massive pied-piping in restrictive but reject it in appositive relative clauses.

I therefore assume that massive pied-piping is a phenomenon that is to be distinguished from non-massive pied-piping. It calls for a separate theoretical approach, which I will not provide here. Finally note that I shall also ignore special properties of pied-piping as they occur in the context of *wh*-exclamatives, free relative clauses, and zero-operators, which, I believe, can be reduced to independent factors.⁴

2. *Wh*-Movement, Locality, and Feature Percolation

2.1. The Problem of Pied-Piping

Many languages form interrogative and relative clauses by fronting of a *wh*-element. The correspondence between morphological shape and the fronting of *wh*-elements has often been derived by a constraint that makes reference to a relation between two *wh*-features: One on the *wh*-element and another on the C-head of the interrogative or relative clause. Following Chomsky (2001), I call these features goal and probe, respectively. Different variants of the constraint have been proposed, for instance the *wh*-CRITERION (see Aoun et al. (1981), Kayne (1983), Lasnik and Saito (1992), Rizzi (1996)) or a locality condition on feature checking (see the notion of “minimal residue” in Chomsky (1995)). Crucially, they all require that the relation be local, with no phrase boundary intervening between probe and goal. A formulation of the constraint in terms of feature checking that focuses on this property is given in (3).

(3) *Condition on wh-Feature Checking*

A *wh*-checking relation must be local.

Empirically, however, (3) is not always met. As Ross (1967, 1986) observed, there are cases where the category that occupies SpecC of the interrogative or relative clause is not a *wh*-element but rather contains a *wh*-element: pied-piping.⁵ (4) illustrates pied-piping of a DP by the prenominal genitive *wh*-element *whose* in English:

(4) a man [_{DP} whose deckchair]₂ you spilled coffee on t₂

Provided that the morpho-syntactic features of a head project up to the phrase of this head but not beyond (see Lieber (1980), di Sciullo & Williams 1987) and under the assumption that *whose* in (4) occupies SpecD of the DP *whose deckchair* (see Abney (1986)), it follows that *whose* cannot project its *wh*-feature up to the DP *whose deckchair*. If so, then the relation between the *wh*-feature on the C-head of the relative clause (the probe) in (4) and the *wh*-feature on *whose* (the goal) is not local, due to the intervening DP-projection. Thus, given (3), the question arises why (4) is well-formed.

⁴The issues are briefly addressed in Heck (2004), which also contains an approach to massive pied-piping that is compatible with the analysis offered in the present article.

⁵Obviously, (3) is generally not met in *wh*-in-situ languages. That *wh*-in-situ not to be treated on a par with pied-piping is suggested by the facts that the locality conditions that govern the two phenomena are different and that they differ with respect to the application of overt *wh*-movement to begin with.

2.2. The Standard Approach

One solution to the problem described in section 2.1. is to say that, despite superficial appearances, the probe-goal relation in (4) actually is local. The assumption is that alongside feature projection there exists a process called feature percolation, which is not subject to the same locality restriction as projection; see (5).

(5) *The Feature Percolation Hypothesis*

There is a mechanism of feature percolation that enables features to spread across phrase boundaries.

The idea that it is *wh*-feature percolation that bridges the gap in locality in the context of pied-piping was introduced by Chomsky (1973). It has become the standard view (see, e.g., Cowper (1987), Grimshaw (1991, 2000), Webelhuth (1992), among many others).⁶ Of course, feature percolation is a powerful concept. If there were no restrictions on it, then one would expect any category that contains a *wh*-element to be able to undergo pied-piping, contrary to fact; see (6).⁷

- (6) a. *a man [_{DP} a deckchair of whom]₂ you spilled coffee on t₂
b. *a man [_{AP} fond of whom]₂ she found herself t₂
c. *a man [_{VP} to address whom]₂ she hesitated t₂
d. *a man [_{CP} that we trust whom]₂ you should not believe t₂

The main problem for percolation-based approaches to pied-piping is thus to find the right restrictions on percolation.⁸ This, however, is not my concern here.

Rather, I will first illustrate that a theory of pied-piping can be formulated that dispenses with the concept of feature percolation and that is based on the independently motivated operation Agree. I take this to be an interesting fact in itself. Moreover, in appendix 1 I illustrate that this result is also conceptually desirable.

3. An Agree-Based Approach

I suggest that (3) should be abandoned. This follows if feature checking is performed by the operation Agree, as proposed by Chomsky (2000, 2001)). Crucially, Agree is not subject to the locality restriction on checking that was still assumed in Chomsky (1995). Rather, Agree can apply in a remote fashion, crossing phrase boundaries, as long as the goal is c-commanded by the probe (modulo minimality); see (7).

⁶There are exceptions, see Sells (1985), Cinque (1982), Kayne (1994), Lutz and Trissler (1997), and, most recently, Cable (2006).

⁷As pointed out in footnote 3, there are speakers of English who judge examples like those in (6-a)-(6-c) as grammatical, even if they occur in restrictive relative clauses. As before, I assume that these speakers resort to a mechanism not available in other dialects of English.

⁸It has been proposed to restrict percolation to types of categories (see, e.g., Grosu (1994), following ideas of Grimshaw (1991, 2000)), to make it dependent on (the absence of certain) non-categorial features (see Cowper (1987)), Webelhuth (1992) or to restrict it to certain structural configurations (see Cowper (1987), Grimshaw (1991, 2000), Webelhuth (1992) Moritz and Valois (1994), Aissen (1996)).

(7) *Agree*

Probe β can establish Agree with goal γ iff a. and b. hold.

- a. β c-commands γ .
- b. There is no goal α such that β c-commands α and α c-commands γ .

Abandoning (3) and adopting Agree instead answers the question (posed in section 2.1.) how pied-piping can be possible. But it raises at least two other questions. First, why is there *wh*-movement in the first place? Given that remote Agree between *wh*-probe and *wh*-goal is possible, there is a priori no reason why the goal should move towards the probe. Second, what is the nature of the restrictions that block ungrammatical instances of pied-piping? I will now develop an Agree-based approach that answers these questions.

3.1. The Core Theory

To begin with, I adopt the STRICT CYCLE CONDITION (SCC, adapted from Chomsky (1973)), a version of which is given in (8).

(8) STRICT CYCLE CONDITION

No operation can apply to a cyclic domain α in such a way as to affect solely a proper sub-domain of α that is also cyclic.

I also adopt the claim that non-complements are islands for movement (see Cattell (1976), Huang (1982), Chomsky (1986), and Cinque (1990)). The idea is made explicit in (9), which is a version of Huang's (1982) CONDITION ON EXTRACTION DOMAINS (CED).

(9) CONDITION ON EXTRACTION DOMAINS

- a. Movement must not cross an island.
- b. A phrase is an island iff it is not a complement.

I next turn to the theory of Move. Chomsky (1995, 228) assumed that all movement must be driven by the need to check certain features (the probes of Chomsky (2001)). This was ensured by the interaction of a constraint that requires elimination of a probe via checking by some matching goal (FEATURE CONDITION, FC), a constraint that blocked unmotivated movement (LAST RESORT, LR; Chomsky 1995, 128), and a requirement on feature-checking stating that the goal be in the minimal residue of the probe. See (10) and (11), respectively, for the variants of LR and FC that I adopt here. For the rest of this paper, Σ shall denote the current phrase marker of the derivation.

(10) FEATURE CONDITION

If β is a probe in Σ , then β must be checked on the Σ -cycle.

(11) LAST RESORT

If γ moves within Σ , then γ must check some probe on the Σ -cycle.

As mentioned above, in later work Chomsky detached movement from feature checking by introducing Agree and abandoning the notion of minimal residue. Movement in general, and in particular *wh*-movement, was then conceived of as being triggered by the need to fill a specifier position, expressed by the presence of a generalized EPP-feature on the specifier's

head.⁹ In what follows, I will depart from this assumption.

3.1.1. *Short Wh-Movement without Pied-Piping*

Instead, I would like to contend that movement may depend on checking a morpho-syntactic feature other than [EPP] (like, for instance, [wh]) and at the same time adopt an Agree-based checking theory. I propose the violable constraint in (12), which minimizes the distance between probe and goal in terms of intervening phrase boundaries and therefore typically (but not necessarily) forces movement of a goal towards the probe.¹⁰

(12) LOCAL AGREE (LA)

If goal γ in Σ matches active probe β , then no XP dominates γ but not β .

(13) *Active Probe*

A probe β is active iff a. or b. hold.

a. β is part of Σ .

b. β is a single in the numeration.

Some comments are in order. First, the very existence of grammatical pied-piping suggests that LA must be violable because pied-piping by definition involves a configuration where (at least) one XP-border intervenes between *wh*-probe and *wh*-goal. Note that LA is a gradient constraint, i.e., each XP in the sense of (12) incurs an LA-violation. Violability of LA may be implemented in an optimality theoretic manner (see Prince and Smolensky (2004)). In particular, I assume here (following Heck and Müller (2003)) that each time Σ is extended to a new complete phrase Σ' , a set of different variants of Σ' are created. This set is then subject to input/output optimization. The optimal Σ' -output is sent back to the structure building component, which, on the basis of Σ' , creates another set of different phrase markers subject to optimization, etc., until the numeration is empty. As will be illustrated below, LA has the effect that, despite Agree being operative, *wh*-feature checking goes hand in hand with *wh*-movement, provided there is no independent factor that blocks movement.

Second, I will assume that LR is violable, too; i.e., there can be movement that is not feature-driven if a constraint that is ranked higher than LR requires this. In particular, I assume LR to be violable in favor of LA.¹¹

⁹Strictly speaking an EPP-feature on C in the context of *wh*-movement does not yet derive the fact that it will be a *wh*-element (modulo pied-piping) that fills SpecC. In principle, any overt constituent can satisfy the EPP-property. Movement of a *wh*-element is enforced by the additional assumption that feature checking must apply to as many features at once as possible, the so called principle of “maximized matching” (see Chomsky (2001, 15)). Due to this principle the *wh*- and the EPP-feature of a C-head cannot be eliminated by different goals, which forces movement of a *wh*-element.

¹⁰I stick to the standard assumption that a head X projects its features up to XP. I also assume that *wh*-movement always affects maximal projections. Thus, cases of *wh*-movement in Slavic languages that superficially look as if a *wh*-head (a determiner) had been moved to SpecC either involve remnant movement or a phrasal *wh*-determiner.

¹¹For more discussion on non feature-driven movement see Heck and Müller (2000, 2003). In principle LA-driven movement under violation of LR can be rephrased as feature-driven movement (with LR remaining inviolable) by means of insertion of optional EPP-features, parallel to Chomsky’s (2000, 2001) treatment of successive cyclic *wh*-movement; see section 3.1.3.

Finally, the motivation for enlarging the definition of LA to active probes in the sense of (13-b) (by making use of the notion of single probe) will become clear once cases of *wh*-movement are considered that involve longer movement paths (see section 3.1.3.). For the moment, the discussion is confined to the case (13-a).

On this basis, consider the following partial derivation of short *wh*-movement without pied-piping in an English relative clause.

- (14) a person who adores you
- a. $[_{VP} \text{ who}_3 \text{ adores}_{2+V} [_{VP} t_2 \text{ you}]] \rightarrow$ (Merge T + Move *who*)
- b. $[_{TP} \text{ who}_3 \text{ T} [_{VP} t_3 \text{ adores}_{2+V} [_{VP} t_2 \text{ you}]]] \rightarrow$ (Merge C + Move *who*)
- c. $[_{CP} \text{ who}_3 \text{ C} [_{TP} t'_3 \text{ T} [_{VP} t_3 \text{ adores}_{2+V} [_{VP} t_2 \text{ you}]]]] \rightarrow \dots$

After the subject *who* and the T-head have been merged, the EPP-feature of T seeks its c-command domain for a goal to establish Agree with. It encounters the subject *who*, which is appropriate to check T's EPP-feature. [EPP] is active (due to (13-a)) and thus LA forces raising of *who* from Spec_{vP} to Spec_T: Raising across the vP-boundary avoids one LA-violation. Agree is established between T and *who*, resulting in the elimination of [EPP] on the TP-cycle with no violations of either LA or LR (see (14-b)).¹² Once C is merged, its active *wh*-probe seeks a goal and finds [wh] on *who*. Again, there is one phrase boundary intervening between probe and goal: TP. Optimization with respect to LA on the CP-cycle triggers raising of *who* to Spec_C. In sum, LA derives *wh*-movement in an Agree-based framework without recourse to generalized EPP-features.

3.1.2. Short Wh-Movement with Pied-Piping

Next consider a case of pied-piping by the *wh*-element *whose* in English; see (15).

- (15) a person whose son adores you
- a. $[_{VP} [_{DP} \text{ whose son}]_3 \text{ adores}_{2+V} t_2 \text{ you}] \rightarrow$ (Merge T + Move *whose son*)
- b. $[_{TP} [_{DP} \text{ whose son}]_3 \text{ T} [_{VP} t_3 \text{ adores}_{2+V} t_2 \text{ you}]] \rightarrow$
(Merge C + Move *whose son*)
- c. $[_{CP} [_{DP} \text{ whose son}]_3 \text{ C} [_{TP} t'_3 \text{ T} [_{VP} t_3 \text{ adores}_{2+V} t_2 \text{ you}]]] \rightarrow \dots$

The first steps (including raising to subject) proceed as in (14). But after C is merged, things differ slightly. C's active *wh*-probe seeks a goal and encounters [wh] on *whose*. Two phrase boundaries intervene between probe and goal: TP and DP₃. Raising of bare *whose* would avoid the two LA violations induced by these boundaries; however, it would violate an island constraint operative in English – the LEFT BRANCH CONDITION (LBC, see Ross (1967, 1986)).¹³ Thus raising of bare *whose* is blocked and pied-piping of DP₃ applies, crossing one phrase boundary (namely TP) and thereby reducing the violations of LA from two to one.¹⁴ The remaining LA-violation is not fatal, though, due to lack of alternatives that

¹²If Agree applies after raising to Spec_T, this presupposes that T must be able to project its EPP-feature in order to ensure c-command between probe and goal.

¹³I suppose that the LBC (and other island constraints mentioned below) is not a primitive of the theory but rather a theorem that can be derived from other principles.

¹⁴In optimality theoretic terms this means that the LBC is ranked higher than LA or that it is inviolable. Note also that the step from (15-b) to (15-c) motivates the assumption that LA is gradient; if it were not, then

violate LA less often and that also respect FC and LBC. This illustrates how pied-piping is treated without invoking feature percolation.

3.1.3. *Successive Cyclic Wh-Movement without Pied-Piping*

Before extending the analysis to cases of pied-piping in the context of successive cyclic *wh*-movement, I must introduce some further assumptions. To begin with, Chomsky (2000, 2001) classifies CP and vP as phases. The phasal property relevant here is the potential to create opaque domains. This is expressed by the PHASE IMPENETRABILITY CONDITION (PIC, Chomsky (2001, 14)); see (16).

(16) PHASE IMPENETRABILITY CONDITION

The domain of a head H of a phase HP is not accessible to operations at ZP (the next higher phase). Only H and its edge domain are accessible to such operations.

The PIC dictates that movement from within a lower to a higher phase must pass via the edge of the lower phase. As will become clear in section 3.1.4., there is reason to define the notions of “accessibility” and “(edge) domain” recursively.

Suppose now that Ω is dominated by the current phrase Σ , that Σ in this case is a phase, and that there is no phase between Ω and Σ . Accessibility is then defined as follows.

(17) *Accessibility*

γ is accessible in Ω iff a. or b. hold.

- a. Ω is a phase and γ is in the edge domain of Ω .
- b. Ω is not a phase and γ is in the domain of Ω .

(18) *Edge domain*

γ is in the edge domain of a phase Ω iff a. or b. hold.

- a. γ is a specifier of Ω .
- b. (i) α is a specifier of Ω and
(ii) γ is accessible in α .

(19) *Domain*

γ is in the domain of Ω iff a. or b. hold.

- a. γ is immediately dominated by Ω .
- b. (i) α is immediately dominated by Ω and
(ii) γ is accessible in α .

For the purpose of the present section it is enough to conceive of the edge domain of a phase as its specifiers (i.e., the base case (18-a) of the recursive definition). Later, the recursive steps of accessibility will become relevant. That said, let me turn to (20), which involves *wh*-movement in an embedded question in English.

(20) John wonders when Dickens died

a. $[_{VP} \text{ Dickens died}_{2+V} [_{VP} \text{ t}_2 \text{ when}_4]_5] \rightarrow \dots$

there would be no reason for DP_3 to move to SpecC, thereby skipping TP, as LA is already violated once by the DP_3 -boundary.

At point (20-a) the *wh*-goal *when* must raise to the edge of *v*.¹⁵ Otherwise, it would not be accessible at the next higher phase (the CP), and the *wh*-probe on C could not be checked, in violation of the FC. In theories where LR is assumed to be inviolable, raising must be feature-driven. What is the probe responsible for raising in these theories? On the one hand, a *wh*-probe alone on *v* cannot force raising of *when* to Spec*v* because such a *wh*-probe could be checked by remote Agree. On the other hand, an unspecific EPP-feature on *v* that requires Spec*v* to be overtly filled would not suffice either – crucially, it is the *wh*-element that must raise to the edge of *v*; for instance, *Dickens* in Spec*v* cannot serve this purpose. Chomsky (2000, 108f.) suggests that movement to an intermediate phase edge is triggered by an EPP-feature that is relativized to the type of probe that is at the final landing site of the movement operation ([*wh*] for the case at hand; see also Chomsky (2001, 34)).¹⁶ Insertion of this EPP-feature is optional.

I will depart from this line of reasoning here and instead contend (following Heck and Müller (2000, 2003)) that everything needed for deriving successive cyclic *wh*-movement is already in place, once the independently motivated concept of the numeration is taken into account. Recall that (13-b) extends the domain of active probes to “single” probes in the numeration *N*. The idea is that a single probe β in *N* is a probe for which there is no matching goal in *N*, i.e., a probe that must be eliminated by a goal γ that is already part of Σ ; otherwise β will not be eliminated at all, violating FC. Now, every time a new head is merged with Σ (forming Σ'), LA favors movement of a goal γ to Spec Σ' if γ matches an active probe β . Such movement violates LR if β is still part of *N* because then γ does not check β on the Σ' -cycle; however, the violation is tolerated in order to satisfy LA. This also happens in the case of a phasal head and thus γ is placed at the phase edge.¹⁷ If something in the grammar blocks movement to the phase edge (in violation of LA) then a violation of the FC causes the derivation to crash at some later point, due to inaccessibility of the goal. As a consequence, LA requires successive cyclic movement to the edge of each phrase, if possible.¹⁸ Provided that there are phrases that are not phases (PPs, for instance) it is not sufficient to rely on a mechanism that forces successive cyclic *wh*-movement to phase edges. This will become

¹⁵Following Huang (1982), Aoun (1986), and others I assume that *when* is merged VP-internally.

¹⁶This amounts to saying that two features are inserted at the edge of intermediate phases: [EPP] and [*wh*], the latter being an automatic reflex of the former (the issue was presented in these terms in an earlier version of Chomsky (2000)). Together with the principle of maximized matching (see footnote 9), the desired effects are derived. Further work on feature-driven successive cyclic *wh*-movement includes Collins (1997), Fanselow and Mahajan (2000), McCloskey (2002).

¹⁷Raising of a goal is banned if there is a second goal in the numeration that is principally able to check the probe, i.e., the probe is not a single in this case, hence not active. This accounts for why raising of *what* in (i-a) cannot apply (see Heck and Müller (2000, 2003) for explicit discussion):

- (i) a. *What did you persuade who to give to Mary
- b. Who did you persuade to give what to Mary

¹⁸It shares this property with the theories of Riemsdijk (1978), Boeckx (2001), and Müller (2004).

particularly evident in section 3.3.1., where *wh*-movement to the PP-edge is discussed.^{19,20} On the other hand, if movement to the edge is blocked in non-phasal contexts, then this leads to non-fatal violations of LA. To summarize: There is information in the numeration that can be accessed in order to trigger successive cyclic *wh*-movement in the absence of a matching probe in the structure. As the numeration is a concept that is argued for on independent grounds, it is natural to assume that the derivation can make use of it.

Under this view, the derivation (20) proceeds by raising *when* to Spec_v (see (21-a)), thereby violating LR in favor of LA (*when* does not check any probe on the vP-cycle). Movement is triggered by the active *wh*-probe in N (which is not dominated by VP, in contrast to the goal; see the definition of LA in (12)). The subsequent steps of the derivation proceed along the same lines.

- (20) b. [_{VP} when₄ Dickens died_{2+v} t₂ t₄] → (Merge T + Move *Dickens*, *when*)
 c. [_{TP} when₄ Dickens₆ [_{VP} t'₄ t₆ died_{2+v} t₂ t₄]] → (Merge C + Move *when*)
 d. [_{CP} when₄ C [_{TP} t''₄ Dickens₆ [_{VP} t'₄ t₆ died_{2+v} t₂ t₄]]] → ...

3.1.4. Successive Cyclic Wh-Movement with Pied-Piping

I next turn to the partial derivation (21), which involves successive cyclic pied-piping. No raising of PP₄ applies at the VP₅-level (see (21-a)): Before and after the raising of PP₄ to SpecV, both VP₅ and PP₄ separate probe and goal. As such movement violates LR, it is blocked. Raising of the bare *wh*-goal *what matter* to Spec_v would improve on LA, but it would violate the CED because PP₄ constitutes an island in (21).²¹

¹⁹If PPs were phases, too, then it would be possible to derive these instances of *wh*-movement by means of the same mechanism that derives movement to the edge of other phasal categories. It is unclear, however, how one could then explain the fact that many languages do not involve movement to the edge of PP (if what counts as a phase is not subject to parametrization). Moreover, this would leave the last resort effects discussed in section 3.4. unaccounted for. The present theory in terms of LA offers a unified theory for all of these phenomena.

²⁰A common argument for successive cyclic *wh*-movement to phase edges is based on the observation that it correlates with a certain reflex on the (head of the) phase in some languages. If successive cyclic *wh*-movement targets *phrase* edges instead, one would expect the reflex to appear in non-phasal positions, too. This seems to be the case (see, e.g., Collins (1994) on the choice of subject pronouns in Ewe). McCloskey (2002, 5) argues that the fact that the reflexes in intermediate positions are the same as the one in the final position constitute an argument in favor of feature-driven successive cyclic *wh*-movement and against a non-feature driven approach (as in Heck and Müller (2000, 2003), or here). This follows if the reflexes indicate feature-checking, since all steps are triggered by the same feature (as opposed to the approach here, where only the final step is feature-driven). However, the argument does not make explicit the correlation between the appearance of a marker and feature checking. In principle, such reflexes could just as well be taken to indicate the filling of a certain specifier position. Moreover, there are reflexes of successive cyclicity that are sensitive to the distinction between intermediate and final positions. In Duala, the marker *no-* occurs in the clause that contains the final landing cite of *wh*-movement, but not clauses that *wh*-movement passes through (see Epée (1976)). The inverse can be observed in Wolof (see Torrence (2005)) and Kitharaka (see Muriungi (2003)), where the markers *u-* and *n-*, respectively, appear only in intermediate positions of successive cyclic *wh*-movement. Hence, the distinction between feature-driven and non-feature driven movement might turn out useful in accounting for this phenomenon.

²¹Witness the ill-formedness of **John wonders what manner Dickens died in*. This presupposes that *in what manner* occupies a non-complement position in (21).

- (21) John wonders in what manner Dickens died
- a. $[_{VP} \text{died } [_{PP} \text{in what manner }]_4]_5 \rightarrow$ (Merge v + verb raising)
 - b. $[_{VP} \text{died}_{2+V} [_{VP} t_2 [_{PP} \text{in what manner }]_4]_5] \rightarrow$ (Merge *Dickens*)
 - c. $[_{VP} \text{Dickens died}_{2+V} [_{VP} t_2 [_{PP} \text{in what manner }]_4]_5] \rightarrow$ (Move PP_4)
 - d. $[_{VP} [_{PP} \text{in what manner }]_4 \text{Dickens died}_{2+V} [_{VP} t_2 t_4]_5] \rightarrow$...

At the vP-cycle (see (21-c)), things change. Movement can now optimize the number of LA-violations (by violating LR in favor of LA), but still this minimally requires pied-piping of PP_4 to Specv. Note in passing that, after pied-piping PP_4 to Specv, the goal is accessible within vP, even if it stayed there until the next higher phase is constructed (e.g., if for some reason PP-raising to SpecT were banned): The goal does not occupy Specv, rather PP_4 does; but PP_4 , which is not a phase, immediately dominates the *wh*-goal, i.e., the *wh*-goal is accessible within PP_4 . It follows by recursion (step (18-b-ii) of the definition of “edge domain”) that the *wh*-goal is also accessible within vP. Perhaps at first sight (remnant) raising of VP_5 to Specv in order to place the goal within an accessible domain should be possible, too; see (21-d’).

- (21) c. $[_{VP} \text{Dickens died}_{2+V} [_{VP} t_2 [_{PP} \text{in what manner }]_4]_5] \rightarrow$ (Move VP_5)
 d’ $[_{VP} [_{VP} t_2 \text{in what manner }]_5 \text{Dickens died}_{2+V} t_5] \rightarrow$...

In section 3.4. I will illustrate that this possibility is ruled out. The rest of the derivation proceeds along the lines already discussed, with raising of both *Dickens* and PP_4 to SpecT (with PP_4 violating LR in favor of a reduction of the number of LA-violations from two to one) and subsequent raising of PP_4 to SpecC (not violating LR because Agree applies, but with one LA-violation left due to the PP-boundary).

This completes the illustration of the theoretical background assumed here. In the following sections three properties of pied-piping that are attested in different languages are illustrated. It is then shown how they follow from the present theory, and how illicit cases of pied-piping can be blocked.

3.2. Recursive Pied-Piping

The first property is based on the observation that pied-piping is recursive; see (22).

- (22) *Generalization on Recursive Pied-Piping*
 If α can pied-pipe β , and β is in a canonical position to pied-pipe γ , then α can also pied-pipe γ .

A canonical pied-piping position within β is a position P such that if P is occupied by a genuine *wh*-phrase α , then β can be pied-piped by α (see the cases in section 3.1.).

3.2.1. Recursive Specifiers

The best-known instance of (22) in English occurs when the pied-piper is buried in a specifier cascade. Thus, it has been observed that alongside (23-a) (23-b,c) are equally well-formed (see Sells (1985), Cowper (1987), Grimshaw (1991, 2000), among others).

- (23) a. a man $[_{DP} \text{whose deckchair }]_2$ you spilled coffee on t_2

- b. a man [_{DP} whose sister's deckchair]₂ you spilled coffee on t₂
- c. a man [_{DP} whose sister's lawyer's deckchair]₂ you spilled coffee on t₂

Consider the derivation of (23-b). SpecD is a canonical position for pied-piping a DP (see (23-a)). Since *whose sister* occupies this position within the DP *whose sister's deckchair* in (23-b), it follows by recursion (see (18-b-ii)) that *whose* can pied-pipe *whose sister's deckchair*.

Recursive pied-piping of this type is not restricted to English. Parallel structures are attested for other languages as well (see Rappaport (1995) on Polish or Heck (2004) on Danish). A similar type of recursive pied-piping is observable in the context of the German (colloquial) *dem-sein*-construction, which involves a dative possessor; see (24).²²

- (24) a. jemand, [_{DP} dem seine Tochter]₂ du t₂ magst
 someone who his daughter you like
 'someone whose daughter you like'
- b. jemand, [_{DP} dem seiner Tochter ihren Sohn]₂ du t₂ magst
 someone who his daughter her son you like
 'someone whose daughter's son you like'
- c. jemand, [_{DP} dem seiner Tochter ihrem Sohn seine Art]₂ du t₂ magst
 someone who his daughter her son his way you like
 'someone whose daughter's son's way you like'

The *dem-sein*-construction arguably involves a DP headed by a possessive pronoun (like *sein* ("his") or *ihr* ("her")); see also de Vries 2005 on this construction). The specifier of this DP can be occupied by a simple *wh*-element (see *dem* in (24-a)) or by a complex *dem-sein*-phrase that in turn can host the pied-piper as in (24-b), etc. This type of recursive pied-piping is derived in the same way as in English: the pied-piper occupies the edge of a DP that in turn occupies the edge of a DP, etc.²³

²²Specifier cascades of the English type are rare in German, presumably due to a language specific constraint that requires that the genitive be morphologically marked (for instance by *-s*; see Gallmann (1996)). In (i) this constraint is not observed (but cf. Haider (1988)).

- (i) a. *ein Mann, [_{DP} dessen Mutter Liegestuhl]₂ du t₂ ruiniert hast
 a man whose mother's deckchair you ruined have
 "a man whose mother's deckchair you have ruined"
- b. *ein Mann, [_{DP} dessen Mutter Schwester Liegestuhl]₂ du t₂ ruiniert hast
 a man whose mother's sister's deckchair you ruined have
 "a man whose mother's sister's deckchair you have ruined"

For some speakers the examples improve if the required morphological marking is present (the masculine nouns *Vater*, *Bruder* bear the *-s*-genitive, as opposed to the feminine nouns *Mutter*, *Schwester*):

- (ii) a. ein Mann, [_{DP} dessen Vaters Liegestuhl]₂ du t₂ ruiniert hast
 a man whose father's deckchair you ruined have
 "a man whose father's deckchair you have ruined"
- b. ?ein Mann, [_{DP} dessen Vaters Bruders Liegestuhl]₂ du t₂ ruiniert hast
 a man whose father's brother's deckchair you ruined have
 "a man whose father's brother's deckchair you have ruined"

²³Percolation-based approaches derive the effect by recursive percolation under recursive "specifier-head agreement" (for instance Cowper (1987), Grimshaw (1991, 2000), Moritz and Valois (1994), and Aissen

Note that recursive pied-piping of DP is possible from SpecD, but not from the complement branch within DP. To be precise, not even simple pied-piping is possible in this context. Thus, for instance (23) contrasts with (25).

- (25) a. *a man [_{DP} the deckchair of whom]₂ you spilled coffee on t₂
 b. *a man [_{DP} the deckchair of the sister of whom]₂ you spilled coffee on t₂
 c. *a man [_{DP} the deckchair of the sister of the lawyer of whom]₂ you spilled coffee on t₂

These facts fall into place if one assumes that alongside with vP and CP, DP also constitutes a phase (see, e.g., Svenonius (2003)).²⁴ Consider (25-a): When the DP *the deckchair of whom* is constructed, the *wh*-goal *whom* must move to SpecD. If it does not, as in (25-a), the goal will not be accessible when the next higher phase (vP in this case) is constructed. Ultimately, this leads to a violation of the FC on the CP-cycle, due to an unchecked *wh*-probe on C. The same holds for (25-b,c).

Interestingly, pied-piping in the context of specifier cascades of the English type is not well-formed in Tzotzil (Aissen (1996)), San Dionicio Zapotec (Broadwell (2001)), or Chol Mayan (Coon (2007)). I will offer an explanation for this fact in section 3.4.4. that seeks to reduce it to an independent difference between English and these languages.

3.2.2. Recursive Complements

Recursive pied-piping can also be observed with complement cascades. In German a preposition must be pied-piped by its complement (see (26-a))²⁵, which therefore occupies a canonical pied-piping position. (26-b) illustrates that if the PP of (26-a) occupies the complement position of another preposition, then the matrix PP is also pied-piped.²⁶

(1996)). They correlate two observations: First, that pied-pipers mostly occupy specifier positions (though not always); second, that agreement often takes place between specifier and head. Percolation is then assumed to be parasitic on an independent agreement relation. However, most of the cases discussed do not involve any independent agreement. Thus either percolation is not derived as parasitic or agreement has to be stipulated (Aissen (1996) calls this “abstract agreement”; see also Chomsky (1986, 24)). Clearly, the relevant agreement cannot be *wh*-agreement because this would presuppose the presence of a *wh*-feature precisely on the head that is assumed to acquire this feature via percolation.

²⁴ (25-a) cannot be blocked by the alternative **a man who(m) the deckchair of you spilled coffee on*, which presumably violates a restriction that only possessors are able to appear in SpecD (see Giorgi and Longobardi (1991)). A reviewer wonders how extraction of non-possessors from DP can be compatible with DP being a phase: If DP is a phase, then extraction must pass via its edge, which in turn is impossible for non-possessors if such a restriction exists. One answer is that the restriction must only refer to elements that are spelled out in SpecD.

Also, it is not sufficient to assume that (25-a) is blocked by a variant that extracts the *wh*-phrase (*a man (who) you spilled coffee on the deckchair of*; cf. section 3.4.), which would seem to make superfluous the assumption that DP is a phase. The reason is that pied-piping as in (25-a) remains ungrammatical even if the DP in question forms a subject island (witness **a man the attitude of whom impressed us*). If (25-a) were blocked by a variant that involves extraction, one would expect the pied-piping structure to become possible if extraction is blocked (as in the context of a subject island), contrary to fact.

²⁵The well known exception to this are R-pronouns (see, e.g., Riemsdijk (1978), Trissler (1993), Müller (2000)), which can strand prepositions, in some dialects at least.

²⁶See Cinque (1982, 257, footnote 22) for similar cases in Italian.

- (26) a. ein Punkt, [_{PP} zu dem]₂ man t₂ gehen kann
 a point to which one go can
 ‘a point which you can go to’
 b. ein Punkt, [_{PP} bis zu dem]₃ man t₃ gehen kann
 a point until to which one go can
 ‘a point up to which you can go’

(26) is derived as follows: PP₂ in (26-a) is not a phase and immediately dominates the *wh*-goal *dem*. Thus *dem* is accessible in PP₂ (see (19-a)). In (26-b) the *wh*-goal is not immediately dominated by PP₃, but PP₂ is. Thus, it follows by one recursive step (see (19-b-ii)) that the *wh*-goal is also accessible in PP₃.²⁷

3.2.3. Hybrid Recursion

The two types of recursive pied-piping can be mixed. For instance, a *wh*-phrase in SpecD can pied-pipe a PP if the DP in question is the complement of P; see (27). Such cases are straightforwardly derived by combining the steps involved in the derivations in section 3.2.1. and section 3.2.2.

- (27) a. jemand [_{PP} über dessen Geschmack]₂ man t₂ streiten kann
 someone about whose taste one argue can
 ‘someone whose taste one can argue about’
 b. jemand [_{PP} über dem seinen Geschmack]₂ man t₂ streiten kann
 someone about who his taste one argue can

To sum up, recursive pied-piping is derived in the present theory by interaction of the recursive definition of accessibility, the notion of a phase, and Agree. Recursive pied-piping is attested in different languages. Its mere existence suggests that pied-piping is (at least partially) determined by general principles, recursion being a core property of human language.

²⁷A reviewer points out the ungrammaticality of the German examples in (i):

- (i) a. *jeder Krieg, bis vor dem die Welt ruhig war
 every war until before which the world quiet was
 ‘every war, which the world was quiet before it started’
 b. *jede Innenstadt, bis in die man mit dem Auto fahren kann
 every city center, until in which one with the car go can
 ‘every city center which one can reach by car’

I mostly agree with the judgements. But notice that the examples improve dramatically if the quantifier head noun of the relative clause is substituted by an indefinite or definite head noun:

- (ii) a. der Krieg, bis vor dem die Welt ruhig war
 the war until before which the world quiet was
 b. eine Innenstadt, bis in die man mit dem Auto fahren kann
 a city center until in which one with the car go can

This suggests that what causes the problems in (i) is not pied-piping of a preposition cascade; rather there must be some interfering factor at work (again, compare Cinque (1982, 257, footnote 22) for Italian). I must leave it open what this factor is, though.

3.3. Secondary *Wh*-Movement

The second property of pied-piping is given in (28).²⁸

(28) *Edge generalization*

If α pied-pipes β , then α has to be at the edge of β .

In what follows, a *wh*-phrase that moves to an edge position that is not its scope position will be said to undergo *secondary wh*-movement. This contrasts with *primary wh*-movement (or simply *wh*-movement), which moves a *wh*-phrase to its scope position.²⁹ The evidence for (28) consists of cases where pied-piping is contingent on secondary *wh*-movement within the pied-piped category.³⁰

3.3.1. Possessors in Tzotzil

Abundant support can be found in Mesoamerican languages (see Aissen (1996), Smith Stark (1988), Broadwell (2001), Coon (2007)). For now, I will concentrate on Tzotzil.³¹ To begin with, the position of the genitive within the Tzotzil noun phrase is strictly post-nominal, see (29) (Aissen (1996, 454f.)).³²

- (29) a. s-p'in li Maruch-e
 A3-pot the Maruch-ENC
 'Maruch's pot'
 b. *Maruch s-p'in
 Maruch A3-pot

Interestingly, pied-piping of the noun phrase requires obligatory inversion of the genitive *wh*-phrase and the head noun (see Aissen 1996, 457). Aissen analyzes this instance of secondary *wh*-movement as DP-internal movement of the *wh*-phrase to SpecD.

- (30) a. [_{DP} Buch'u₂ x-ch'amal t₂]₄ i-cham t₄?
 who A3-child CP-died
 'Whose child died?'
 b. * [_{DP} X-ch'amal buch'u₂]₄ i-cham t₄?
 A3-child who CP-died

The same observation can be made if pied-piping affects a PP and if the pied piper is a genitive phrase that originates within the complement DP of P. According to Aissen the possessor *wh*-phrase moves via Spec-D into the specifier of the PP.

²⁸The concept "edge of β " in (28) denotes a position not dominated by other maximal projections than β , usually, a specifier of β . This is not to be confused with the notion of "edge domain", see (18).

²⁹Thus, the notion of secondary *wh*-movement covers both the intermediate steps of successive cyclic *wh*-movement and what Riemsdijk (1985) calls *internal wh*-movement.

³⁰It is supported by a rather large body of evidence (see also Heck (2004)).

³¹Broadwell's (2001) discussion involves more intricate patterns. I believe that to the extent that they are not covered by (28), they can be explained by independently motivated assumptions for the most part.

³²The affixes are glossed the following way: a1/2/3 are set a affixes for 1st/2nd/3rd person, b1/2 are set b affixes for 1st/2nd person, ENC denotes an enclitic, and CP denotes completive aspect and icp incomplete aspect; see Aissen (1996, 488f).

- (31) a. $[_{PP} \text{Buch}'u_2 \text{ ta } [_{DP} t'_2 \text{ s-na } t_2]_3]_4 \text{ ch-a-bat } t_4?$
 who to A3-house ICP-B2-go
 ‘To whose house are you going?’
 b. $*[_{PP} \text{Ta } [_{DP} \text{s-na } \text{buch}'u_2]_3]_4 \text{ ch-a-bat } t_4?$
 to A3-house who ICP-B2 go

Both instances of secondary *wh*-movement follow without further ado from LA.³³ Consider the derivation of (31-a).

- (32) Buch'u ta s-na ch-a-bat?
 who to A3-house ICP-B2-go
 a. $[_{NP} \text{s-na buch}'u] \rightarrow$ (Merge D + Move *buch'u*)
 b. $[_{DP} \text{buch}'u_2 \text{ D } [_{NP} \text{s-na } t_2]] \rightarrow$ (Merge P + Move *buch'u*)
 c. $[_{PP} \text{buch}'u_2 \text{ ta } [_{DP} t'_2 \text{ D } [_{NP} \text{s-na } t_2]]] \rightarrow$ (Merge V)
 d. $[_{VP} \text{ch-a-bat } [_{PP} \text{buch}'u_2 \text{ ta } [_{DP} t'_2 \text{ D } [_{NP} \text{s-na } t_2]]]] \rightarrow \dots$

In (32-b) there is an active *wh*-probe in the numeration. Therefore, LA is relevant and raising of *buch'u* to SpecD reduces the number of LA-violations from two to one (the NP-boundary is skipped). The same holds for (32-c), where raising from SpecD to SpecP is forced. Note that in (32-d) the possessor cannot raise to SpecV because PP is an island in Tzotzil (see Aissen 1996, 467ff.).³⁴ In the remaining steps of the derivation PP is pied-piped to SpecC (successive cyclically via Specv and SpecT). The LA-violation due to the PP-boundary, which emerges at each cycle, is not fatal.

3.3.2. French Relatives with *dont*

Another language that provides evidence for (28) is French. The construction in question involves the relative pronoun *dont* (which is a PP). As in Tzotzil, French nominals select their prepositional arguments to the right.

- (33) a. le comportement de son mari
 the behavior of her husband
 ‘her husbands behavior’
 b. *de son mari le comportement
 of her husband the behavior

Now consider (34-a), analyzed as pied-piping of a DP by its complement *dont*.

- (34) a. un homme $[_{DP} \text{dont}_2 \text{ le } \text{comportement } t_2]_3 t_3 \text{ devient } \text{inquiétant}$
 a man of-who the behavior becomes alarming
 ‘a man whose behavior becomes alarming’

³³Other accounts analyze secondary *wh*-movement as a precondition for feature percolation in specifier-head configuration (see, e.g., Moritz and Valois (1994), Aissen (1996), Ortiz de Urbina (1990)), as movement driven by some LF-requirement (see Safir (1986), Rappaport (1995)), in terms of *wh*-feature checking (see Lutz and Trissler (1997), Trissler (1999)), or as a c-command requirement (see Kayne (1994)).

³⁴A possessor can (sometimes) strand a DP if it is not a PP-complement. In such cases, pied-piping and stranding coexist, which is unexpected under the present theory. I address this issue in section 3.4.5.

- b. *un homme [_{DP} le comportement dont₂]₃ t₃ devient inquiétant
 a man the behavior of-who becomes alarming

Crucially, *dont* must appear on the left edge of the DP, not in the position where such PP-complements are merged, see (34-b). This is straightforwardly analyzed in terms of secondary *wh*-movement in the context of pied-piping.³⁵

Similarly, Kayne (1976, 261) mentions that pied-piping of a PP by *dont* was possible in earlier stages of French in cases where *dont* was the complement of a nominal that was the complement of the pied-piped P. Again, pied-piping involved secondary *wh*-movement of *dont* to the edge of the outer PP (see also Kayne 1975, 112, footnote 57).^{36,37} To conclude, pied-piping of DP (or PP) by *dont* is (or was) dependent on secondary *wh*-movement. The LA-based derivation of these effects mirrors exactly the one given in section 3.3.1. for Tzotzil.³⁸ Finally note that the approach is flexible enough to explain cases where there is no secondary *wh*-movement. For instance pied-piping of German PPs does not involve

³⁵An analysis of (34-a) in terms of extraction of *dont* from the DP is problematic because it involves extraction out of a subject island. A reviewer remarks that there are analyses without pied-piping that do not face this problem. Moreover, he points out that the pied-piping analysis predicts that it should be impossible for subject-external material to intervene between *dont* and the rest of the subject. I acknowledge the relevance of these points. They are addressed in appendix 2.

³⁶This is illustrated in (i):

- (i) a. la fille [_{PP} dont₂ au frère t₂]₄ tu plais t₄
 the girl of-whom to the brother you please
 ‘the girl whose brother you pleased’
 b. *la fille [_{PP} au frère dont₂]₄ tu plais t₄
 the girl to the brother of-whom you please

To assume that (i-a) involves extraction of *dont* from PP₄ plus PP₄-topicalization is problematic as extraction from the complement of P is usually banned in French, see (ii) (from Vergnaud (1974, 107)).

- (ii) *la fille dont₂ j’ai juré [_{PP} contre le père t₂]
 the girl of-who I-have cursed against the father
 ‘the girl whose father I have cursed’

³⁷Kayne notes that *dont*-raising to SpecP is impossible in modern French. As LA is violable, it is enough to assume that in modern French there is an intervening factor that prohibits raising to SpecP. In a similar vein, the contrast between (i-a) and (i-b) (assuming that both involve secondary *wh*-movement) illustrates that secondary *wh*-movement is possible with *dont*, but not with the relative PP *de laquelle*.

- (i) a. la ville [_{DP} dont₂ la destruction t₂]₃ t₃ serait entreprise
 the city of-which the destruction would-be undertaken
 ‘the city whose destruction would be undertaken’
 b. *la ville [_{DP} [_{PP} de laquelle]₂ la destruction t₂]₃ t₃ serait entreprise
 the city of the-which the destruction would-be undertaken

I tentatively assume that this is due to an independent constraint that bans complex PPs from SpecD in French, in contrast to *dont*.

³⁸Rappaport (1995) observes similar facts in Polish: DP-internal *wh*-genitives in Polish move to the left edge of DP in the context of pied-piping. Polish differs from Tzotzil in that secondary *wh*-movement cannot target SpecP (if DP and PP are pied-piped) but must remain in SpecD. This can be accounted for by assuming that in Polish (just like in modern French) there is an interfering factor that bans genitive *wh*-phrases from SpecP, in contrast to Tzotzil (or older variants of French).

secondary *wh*-movement; see (35).³⁹

- (35) a. eine Sache, [_{PP} an die₃]₂ ich nicht t₂ glauben will
a thing on which I not believe want
'a thing I don't want to believe in'
b. *eine Sache, [_{PP} die₃ an t₃]₂ ich nicht t₂ glauben will
a thing which on I not believe want

Assuming that there is no empty functional head above PP in German (but see Riemsdijk (1978)) whose specifier secondary *wh*-movement could target, it follows that raising in (35-b) targets SpecP. Such raising, however, does not eliminate any LA-violations (movement is too short) but still violates LR and is hence blocked.⁴⁰ Other cases where secondary *wh*-movement is blocked arise if there is an independent ban on movement to a certain specifier position (see footnotes 37 and 38).⁴¹

3.4. Last Resort Effects

I now turn to the last of the three properties of pied-piping, which is presented in (36).

(36) *Repair generalization*

Pied-piping of β by α is possible only if movement of α from β is blocked.

According to (36), pied-piping is a last resort that only applies so as to avoid greater damage.⁴² Evidence for (36) comes from cases where pied-piping is avoided in favor of moving the bare *wh*-phrase and cases where the amount of pied-piped structure is minimized; see Bošković (2004) and Heck (2004) for further evidence (but cf. Fanselow and Lenertová (2006) for potential counter-evidence).

3.4.1. French *dont*-Relatives Again

Consider again *dont* in French relative clauses. A closer look at the cases of secondary *wh*-movement of *dont* within DP discussed in section 3.3.2. reveals that they exclusively

³⁹Inversion of *wh*-R-pronouns is not an exception because this type of potential movement to SpecP also arises with non-*wh* variants of these pronouns; thus, inversion is not contingent on [wh].

⁴⁰Thus the interaction of LR and LA derives at least some cases of anti-locality (see Abels (2003), Grohmann (2003)).

⁴¹As a reviewer remarks, the theory predicts that secondary *wh*-movement should not affect in-situ *wh*-phrases in multiple *wh*-constructions: As the *wh*-probe is not active (there is another *wh*-phrase that will ultimately move to check it), LA cannot trigger secondary *wh*-movement of the in-situ *wh*-phrase. It is impossible to check the prediction for Tzotzil or French because Tzotzil does not have multiple questions (see Aissen (1996, 453)) and French lacks in-situ relative clauses. However, there are cases of DP-internal secondary PP-raising in Spanish and German that suggest that the prediction is borne out, at least as a tendency (see Heck (2004)).

⁴²Cf. Chomsky (1995, 262ff.), who argues that *wh*-movement should exclusively affect *wh*-features due to reasons of economy. He then attributes the existence of phrasal *wh*-movement to conditions that force economy to be overruled as a last resort ("generalized pied-piping"). See also Watanabe (1992, 57), Kayne (1994, 25), and Roeper (2003) for remarks that point to a last resort analysis of pied-piping. Recent optimality theoretic analyses that follow this intuition are Gouskova (2001) and Christensen (2003).

involve DPs in subject position. Crucially, analogous examples with DPs in object position are ungrammatical; see (37).

- (37) *la fille [_{DP} dont₂ le frère t₂]₃ tu as rencontré t₃
 the girl of-who the brother you have met
 ‘the girl whose brother you met’

Note that subjects in French are islands (see appendix 2), whereas complements of verbs are not. Putting things together, the ill-formedness of (37) can be interpreted as support for (36): (37) involves pied-piping of a DP that figures as the complement of the verb. This DP should thus be transparent for extraction of *dont*, which is the case, see (38).

- (38) la fille dont₂ tu as rencontré [_{DP} le frère t₂]₃
 the girl of-who you have met the brother
 ‘the girl whose brother you met’

Thus, under the present analysis the ill-formedness of (37) falls into place without further ado. Consider how (37) is blocked.

- (39) *la fille dont le frère tu as rencontré
 a. [_{NP} frère dont₂]₃ → (Merge D + Move *dont*)
 b. [_{DP} dont₂ le frère t₂]₃ → (Merge V + Move *dont*)
 c. [_{VP} dont₂ rencontré [_{DP} t'₂ le frère t₂]₃] → ...

At the VP-cycle raising of *dont* to SpecV economizes on the number of LA-violations (DP₃ is skipped). The alternative that does not involve movement of *dont* and that (37) is actually based on is thus filtered out by optimization on the VP-cycle already.

3.4.2. Possessors in Chamorro

Chung (1998, 391f, footnote 5) mentions that a *wh*-possessor in Chamorro cannot pied-pipe a DP if it can strand the DP, which is the case if the D-head is null; see the contrast in (40) (from Chung (1991)):⁴³

- (40) a. * [_{DP} Hayi₂ munika-ña]₃ un-yulang t₃?
 who? doll-AGR3S INFL2S-break
 ‘Whose doll did you break?’

⁴³According to Chung (1991) the possessor in Chamorro appears post-nominally. She analyzes (40-a) as involving pied-piping of the possessed DP plus subsequent extraction of the possessor. I assume that such a derivation is ruled out by the CED because moved categories are islands (see Ross (1967, 1986), Wexler and Culicover (1980), Collins (1994), Chomsky (1995)). An alternative derivation (respecting the SCC) that first extracts the *wh*-phrase, and then applies remnant DP-fronting plus subsequent *wh*-movement involves “chain interleaving,” which has been argued to be blocked for independent reasons (see Collins (1994)). Sandra Chung (p.c.) provides an example that shows that pied-piping by a post-nominal possessor is equally impossible; see (i).

- (i) *Kao ma-faisin hao [_{DP} patgun hayi]₃ asuddä'-mu t₃?
 Q AGR-ask you child-L who? WH-OBL-meet-AGR
 ‘Did they ask you whose child you met?’

- b. Hayi₂ un-yulang [DP munika-ña t₂]₃?
 who? INFL2S-break doll-AGR3S

Again, this is the pattern of (36). Under the present analysis, it follows without further ado: As extraction of the possessor from DP is possible, it must apply, thereby optimizing the structure with respect to LA. The alternative that involves pied-piping is blocked.⁴⁴

3.4.3. Predicates

Predicates, which are generally transparent for extraction, usually cannot be pied-piped. The following pattern from German shows that a participle does not undergo pied-piping (see (41-c)), even if pied-piping obligatorily affects a PP (see (41-a,b)). In other words, pied-piping of the preposition does not allow an unrestricted amount of structure to be dragged along; rather pied-piping is minimized.

- (41) a. *jemand, dem₄ Maria [VP [PP mit t₄]₂ getanzt]₃ hat
 someone whom Maria with danced has
 b. jemand, [PP mit dem₄]₂ Maria [VP t₂ getanzt]₃ hat
 someone with whom Maria danced has
 c. *jemand, [VP [PP mit dem₄]₂ getanzt]₃ Maria t₃ hat
 someone with whom danced Maria has

Again, this follows from LA – pied-piping of both VP and PP incurs two LA-violations, pied-piping of PP only one. The analysis thus directly rules out a whole class of illicit instances of pied-piping (like the cases in (6)), simply because they all involve pied-piping of categories that are transparent for extraction.

Recall in this context that in section 3.1.3. the issue arose whether (remnant) VP₅ pied-piping to Specv is possible on the vP-cycle of the derivation (42).

- (42) John wonders in what manner Dickens died
 c. [VP Dickens died_{2+V} [VP t₂ [PP in what manner]₄]₅] → (Move VP₅)
 d.' [VP [VP t₂ in what manner]₅ Dickens died_{2+V} t₅] → ...

Such a derivation is ruled out. Subsequent pied-piping of VP₅ to SpecC based on (42-d') eventually results in the right word order. But movement of VP₅ induces three LA-violations on the vP-cycle (due to PP₄, VP₅, and vP) whereas movement of PP₄ is left with two viola-

⁴⁴A reviewer observes that pied-piping of a subject infinitive in English is strongly ungrammatical, even if secondary *wh*-movement applies (see (i-a)); he points out that this might be problematic in view of the fact that such infinitives constitute islands for extraction in English (see (i-b)).

- (i) a. *I wonder who to have kissed would cause Mary to be happy
 b. *Who did you say to have kissed caused Mary to be happy?

Note that the generalization in (36) is an implication. For pied-piping to apply, extraction must be impossible, but not the other way round. Consequently, the ill-formedness of (i-a) could be due to an independent reason. Suppose that subject infinitives in English actually involve more structure than meets the eye, namely, that they are embedded under a DP-shell. As SpecD can only be occupied by a possessor at spell out (see footnote 24), it follows that *who* in (i-a) is not accessible. The derivation crashes due to a violation of FC. See Kayne (1994, 24, footnote 18) for a similar approach to the ungrammaticality of pied-piping acc-ing gerunds in English.

tions (PP₄ and vP). LA thus predicts (42-d') to be blocked.⁴⁵ There is good reason to assume that subsequent pied-piping of VP₅ to SpecC based on (42-d') is an illusion. Related derivations that involve passive and pied-piping of VP lead to ill-formedness, presumably due to the lack of verb raising (contingent on the presence of v), which masks the ungrammaticality of (42-d'); see (43).

(43) *John wonders [_{VP} killed t₃ in what manner]₅ Dickens₃ was t₅

This is predicted by the present approach.

3.4.4. *Possessors in Tzotzil Revisited*

As mentioned at the end of section 3.2.1., pied-piping of recursive specifiers of the English type is impossible some languages; see (44-b) for Tzotzil (from Aissen (1996, 481)).

- (44) a. I-'ixtalaj [_{DP} s-kayijonal y-osil li j-tot-e]₂
 CP-ruin A3-firelane A3-land the A1-father
 'My father's land's firelane was ruined'
 b. * [_{DP} Buch'u y-osil s-kayijonal]₂ i-'ixtalaj t₂?
 who A3-land A3-firelane CP-ruin
 'Whose land's firelane was ruined?'

Note, however, that the following structures are possible (from Aissen (1996, 485)):

- (45) a. [_{DP} Buch'u s-kayijonal y-osil]₂ i-'ixtalaj t₂?
 who A3-firelane A3-land CP-ruin
 b. [_{DP} Buch'u y-osil]₃ i-'ixtalaj [_{DP} s-kayijonal t₃]₂?
 who A3-land CP-ruin A3-firelane

In (45-a) the *wh*-phrase *buch'u* undergoes secondary *wh*-movement to the topmost SpecD-position with subsequent pied-piping of the complete DP₂. In (45-b) *buch'u* moves to SpecD of the embedded DP₃ with subsequent pied-piping of DP₃, stranding the topmost DP₂.⁴⁶ Under the present approach the contrasts between (44-b) and (45-a,b) are expected: A pied-piper in the specifier of the topmost (moved) DP incurs only one LA-violation and therefore blocks pied-piping of recursive specifiers, which incurs one additional LA-violation per embedding. Note that in contrast to Tzotzil, English and German do not allow the type of extraction in (45). The possibility of pied-piping of recursive specifiers can thus be seen as a consequence of the impossibility of left branch extraction in these languages.

3.4.5. *Apparent Optionality*

So far, I have ignored a problem that is posed by the existence of optional pied-piping. If pied-piping is a last resort operation (as proposed here) that applies in order to avoid

⁴⁵Also ruled out is a continuation of (42-d') that involves pied-piping of PP₄ to SpecC, thereby stranding the evacuated VP₅ in Specv. The reason is that VP₅, having been pied-piped to Specv, should turn into an island and thus bar extraction (see footnote 43; cf. Postal (1972) for a similar discussion, albeit with different conclusion).

⁴⁶The same options exist in San Dionicio Zapotec (Broadwell (2001)) and Chol Mayan (Coon (2007)), where pied-piping of recursive specifiers is banned, too, just as in Tzotzil.

island violations, then one would not expect pied-piping and stranding to coexist: Stranding should always block pied-piping. Only if stranding is not available can pied-piping become an option. At least at first sight, this prediction does not seem to be borne out. Consider the case of *was-für*-split in German (see (46); Besten (1984), Riemsdijk (1989), Corver (1990), among many others).⁴⁷

- (46) a. Was hast du für Leute eingeladen?
 what have you for people invited
 ‘What kind of people did you invite?’
 b. Was für Leute hast du eingeladen?
 what for people have you invited

If *was* (“what”) in (46) is not the head of the phrase *was für Leute* (“what kind of people”), then the *wh*-feature of *was* cannot project up to the whole phrase. But then (46-b) involves pied-piping. This, however, is not expected given the existence of (46-a), which apparently involves stranding.

Abels (2003, 212ff.) (elaborating on Starke (2001, 44ff.)) offers an analysis of this construction that paves the way for an explanation of the apparent optionality.⁴⁸ The idea is that (46-a) does not involve sub-extraction of *was* but rather sub-extraction of *für Leute* plus subsequent pied-piping of the remnant by *was*. In (46-b), of course, no extraction of *für Leute* takes place. Abels’ main argument for this analysis comes from examples like (47), where *wh*-movement of bare *was* pied-pipes a preposition P that takes as complement the complete *was-für* phrase. This suggests that the moved *was* is contained in a remnant derived by *für*-phrase extraction (the finite verb in (47) can only be preceded by one constituent).⁴⁹

- (47) Mit was hast du für Leuten gesprochen?
 with what have you for people spoken
 ‘What kind of people did you talk to’

The two derivations in (46) presumably involve different lexical items, assuming that PP-movement is triggered by a feature that is present in the numeration of the derivation of (46-a), but not in the one of (46-b). Following a standard assumption in competition based frameworks that two objects can only compete if they contain the same lexical material (see, e.g., the notion of “reference set” in Chomsky (1995)), Abels’ analysis solves the problem of apparent optionality for *was-für*-split.

Another popular case of optional pied-piping involves left branch extractions: In Slavic languages a possessor can both strand or pied-pipe the DP it is associated with (see, e.g., Ross (1986, 145), Corver (1990, 330)). (48) illustrates this for Russian.

- (48) a. Ja sprosil kakuju ty čital knigu
 I asked whose you read book

⁴⁷Similar constructions are attested in other languages as well, like in Dutch (see Besten (1984), Corver (1990)), in Norwegian (see Lie (1982)), or Danish (see Vikner (1995)).

⁴⁸Fanselow and Ćavar (2002) offer an alternative. They argue that the stranding variant of this construction does not involve extraction of *was* but copying of the *was-für*-phrase plus distributed deletion.

⁴⁹In the same vein, Abels (2003, 174ff.), following Starke (2001, 44ff.), analyses *combien*-splits in French in terms of remnant movement, based on the same type of argument (see Kayne (1983, 51f.) for evidence).

- ‘I asked whose book you read’
 b. Ja sprosil kakuju knigu ty čital
 I asked whose book you read

Again, Abels (2003, 160ff.) argues that these cases should be treated in terms of sub-extraction plus subsequent pied-piping of the remnant, parallel to the *was-für*-split.^{50,51}

Finally, consider briefly the case of optional pied-piping of a preposition by an R-pronoun in German. (49-a) involves *wh*-movement of the R-pronoun *wo* (‘where’) out of a PP (headed by *gegen*, ‘against’). This is possible, at least in some dialects. But in the same context, pied-piping of the PP is also possible; see (49-b).

- (49) a. Wo stimmt Fritz immer gegen?
 where votes Fritz always against
 ‘What does Fritz always vote against?’
 b. Wogegen stimmt Fritz immer?
 where-against votes Fritz always

It has been proposed by Lutz and Trissler (1997) and Vries (2005) that (49-a) involves movement of the the R-pronoun to SpecP, with subsequent *wh*-movement of bare *wo*, whereas in (49-b) first incorporation of *wo* into the P-head takes place, which in turn forces pied-piping of the PP, excorporation being impossible. Apparent optionality of pied-piping is reduced to whatever causes optionality between head-movement and phrasal movement of *wo*.^{52,53}

Of course, the above discussion is far from exhaustive. But still, it seems that solutions for the problem posed by optional pied-piping are at hand, although they might form a heterogeneous group.

⁵⁰Bošković (2004, 699, footnote 22) proposes that the absence of left branch violations in a language correlates with the absence of a DP-projection in that language. He further suggests that the absence of DP-shells might be optional in languages that exhibit the Russian pattern of left branch extraction. The analysis thus reduces the optionality of pied-piping to the optional presence of D.

⁵¹In footnote 34 it was mentioned that pied-piping by possessor in Tzotzil apparently alternates freely with stranding (see (i); Aissen (1996, 456)). This appears, at least in principle, to be amenable to an analysis in terms of remnant movement, too.

- (i) Buch’u i-cham x-cha’amal
 who CP-die A3-child
 ‘Whose child died?’

Things are more complicated if multiple genitives (as in section 3.4.4.) are considered. Their treatment might require additional assumptions (cf. Aissen (1996, 486, footnote 37) and Aissen (1996, 485)).

⁵²Fleischer (2002) argues that (49-a) does not involve P-stranding by *wo* in the first place (see also Oppenrieder (1991)). Under this view, the problem posed by R-pronouns disappears, too.

⁵³Another often cited case of optional pied-piping involves PPs in English. Bošković (2004, 729ff.) offers a structural explanation for the apparent optionality. Alternatively, one can argue that P-stranding in English is obligatory if possible (see Bouchard (1982, 277), Sells (1985, 18), Kayne (1994, 25), to name just a few), the apparent optionality being due to a prescriptive rule against stranding. Lack of prepositional pied-piping can also be observed in some Scandinavian P-stranding languages (see the discussion in Heck (2004) and references therein). These observations support the last resort analysis of pied-piping.

4. Conclusion

To conclude, I have argued that an Agree-based theory of pied-piping that dispenses with feature percolation is indeed possible. Furthermore, I illustrated how the Agree-based theory can straightforwardly account for three properties of pied-piping that are attested in different languages. The three properties of pied-piping were its recursive nature, its co-occurrence with secondary *wh*-movement, and its behavior as a last resort. I suggested that these properties can be derived by means of (i) a recursive notion of accessibility within a phase-based framework and (ii) the assumption that at least some constraints, namely LR, which penalizes non-feature driven movement, and LA, which seeks to render agreement relations as local as possible, are violable. LR was assumed to be violable in favor of LA, which in turn was assumed to be violable in favor of (perhaps inviolable) constraints, typically a family of island constraints. A welcome result was that LA not only derives the last resort effects and secondary *wh*-movement in pied-piping but also offers a handle on the treatment of successive cyclic *wh*-movement.

Cross-linguistic variation was not implemented by constraint re-ranking by the present proposal, as is usually assumed in optimality theory. Rather, I followed the assumption in the minimalist program that such variation reduces to differences in the lexicon. For instance, I assumed that languages may differ with respect to whether a certain head offers a specifier-position as landing site for movement or not (similar to the filters proposed in Koopman and Szabolcsi (2000)). In principle, however, one might consider constraint re-ranking as an alternative strategy. For instance, re-ranking of LA and LR would predict the existence of languages without *wh*-movement (cf. footnote 5), although this poses the problem how the relationship between the two *wh*-features in such a case could be maintained to hold across phase-boundaries (see Legate (2004) and Heck (2004) for related questions). The consequences of re-ranking island constraints are unclear as these were considered to be theorems and not atoms of the theory. I leave these issues open here.

In appendix 1, I argue that a theory that reduces feature percolation to one of the standard construals of the minimalist program, Move and Merge, cannot cover the same range of empirical data without resorting to additional and unattractive assumptions. Moreover, I take it that a theory that does not reduce feature percolation to some more general mechanism but rather assumes it to be an elementary operation of the grammar, is inferior for conceptual reasons. These two points taken together form a conceptual argument in favor of the Agree-based theory of pied-piping that was presented here.

Appendix 2 contains a justification of my assumptions about the syntax of French relative clauses with *dont*, which some of the arguments given above were based on.

5. Appendix 1: Conditions on Feature Percolation

According to Chomsky (1995, 2000, 2001) the only construal operations in syntax are Merge and Move. If percolation is not another elementary operation, it should be reducible to one of them (cf. Hornstein (2001) on reducing control to movement). If this turns out to be impossible, then a theory without percolation is to be preferred.

5.1. Percolation Reduced to Move

Percolation could be feature movement in the sense of Chomsky (1995) (see de Vries (2005); Lutz and Trissler (1997) pursue a similar idea). According to Chomsky (1995), a moved feature adjoins to the target head. On the basis of this, consider (50).

(50) a person whose daughter you go out with

The *wh*-feature of *whose* in (50) should move to the head of *whose daughter* and adjoin to it.⁵⁴ Being an instance of Move, feature percolation is expected to be subject to the usual restrictions on Move (see Takahashi (1997), Nakamura (2002) for arguments that feature movement obeys island constraints). It turns out, however, that there are at least three constraints on movement that feature percolation does not obey.

First, movement is subject to island conditions. As mentioned in section 3.1., I assume that categories in specifier position are islands for movement (as implemented by the CED). Thus *whose* in (50) should actually form an island for movement.⁵⁵ Consequently, *wh*-feature movement out of *whose* in (50) should be blocked by the CED and (50) should be ungrammatical, contrary to fact.

Second, *wh*-feature percolation from *whose* to the D-head of the pied-piped phrase *whose daughter* in (50) involves lowering, an acyclic operation violating the SCC. Baker (1988) observes that incorporation from a specifier position into the specifier's head is generally ruled out. Such ill-formed incorporation completely parallels the hypothetical case of *wh*-feature movement in (50).

Third, standard movement and feature percolation differ in that the target position of a moved element must always c-command its base position (see Fiengo (1977, 45)). Clearly, feature percolation in (50) from *whose* to D does not obey this constraint either.⁵⁶ I therefore take it that a reanalysis of feature percolation in terms of movement is problematic. If feature percolation does not obey constraints on movement, it should not be analyzed as movement, but rather as an independent operation of the grammar.⁵⁷

⁵⁴Technically, this is not enough to establish a local relation between the *wh*-feature on *whose* and on C (see (5) in section 2.2.), respectively, provided that adjoined elements do not project: The DP-boundary would still separate probe and goal. It must thus be assumed that feature movement integrates the moved feature into the feature set of the target head.

⁵⁵That a category that is transparent if it occupies a complement position indeed turns into an island if it occupies SpecD (the position of *whose* in (4)) is illustrated by contrasts as *Who did you see a brother of?* vs. **Who did you see a brother of's car?*.

⁵⁶All three arguments might be challenged by the assumption that the genitive *whose* in (50) could be merged in complement position (undergoing subsequent raising to SpecD). Feature movement would then proceed from this base position without problems. Such an objection is not applicable to other cases of pied-piping like, for instance, *I wonder how many people you go out with*.

⁵⁷The situation would change if one could come up with a theory that correlates the exemption of feature percolation from movement constraints with some other property that distinguishes feature percolation from standard movement. One such property could be that feature percolation does not affect phonological features, but standard (overt) movement does.

5.2. Percolation Reduced to Merge

Alternatively, consider the possibility to integrate a *wh*-feature via Merge into the head of a phrase that is supposed to undergo pied-piping. In order to prevent this operation from violating the INCLUSIVENESS CONDITION (see Chomsky (1995, 228); IC)⁵⁸ assume that an arbitrary number of bare *wh*-goals can optionally enter the numeration. At any point, the derivation can pick one of those and merge it into the feature structure of the root's head (this obeys IC and a moderate version of the SCC). To briefly illustrate, consider the derivation of (51).

(51) the manner [_{PP} in which]₂ Dickens died t₂

After a *wh*-feature has been inserted into the feature structure of the preposition *in*, it can be projected and PP can undergo *wh*-movement in agreement with the locality condition on *wh*-feature checking (see (5) in section 2.2.). The same procedure applies if the pied-piper occupies a specifier position of the pied-piped constituent (as in *a person whose daughter you go out with*). Thus, for simple cases the approach works well.

However, it turns out that Merge of *wh*-goals must be subject to additional constraints in order to derive the three observations discussed in the main text (recursive pied-piping, edge effects, last resort effects). Moreover, these constraints do not apply if Merge affects lexical *wh*-words, which makes Merge of bare *wh*-features a special operation. Finally, it appears that Merge of *wh*-goals must apply counter-cyclically in order to account for the facts. To see this, consider first the ill-formed case of pied-piping a DP in German in (52).

(52) *eine Person, [_{DP} die Tochter von der]₂ dich t₂ mag
 a person the daughter of whom you likes
 'a person whose daughter likes you'

Somehow, Merge of [wh] with the D-head *die* in (52) must be blocked. A way to account for the contrast between (52) on the one hand and (50) and (51) on the other hand is to say that Merge of [wh] with a head H is only possible if H is c-commanded by another *wh*-goal.⁵⁹ But note that (53) is grammatical, despite the lack of such c-command:

(53) eine Person, [_{PP} mit deren [_D –] Tochter]₂ du t₂ ausgehst
 a person with whose daughter you out-go
 'a person whose daughter you go out with'

Thus assume that Merge of [wh] in (53) applies recursively: First the (empty) D-head of *deren Tochter* acquires [wh] via Merge (being c-commanded by *deren*) and projects [wh] to the DP *deren Tochter*. Then the P *mit* acquires [wh] via Merge (being c-commanded by *deren Tochter*) and projects [wh] to *mit deren Tochter*. Of course, if percolation can apply

⁵⁸A version of the IC is given in (i):

(i) INCLUSIVENESS CONDITION
 Material that is not part of the numeration before the derivation starts is not accessible throughout the derivation.

⁵⁹Something like this is needed anyway to block Merge of [wh] in contexts that lack any *wh*-phrase (such as **the manner in that Dickens died* or **the way in some(thing) Dickens died*).

recursively, then one needs an additional restriction to block it in (52). To this end, suppose that Merge of [wh] cannot apply to lexical heads (see Grimshaw’s theory of extended projections), in which case percolation will get stuck at N in (52).

This analysis follows standard ideas on percolation. At first sight, it also provides an account for secondary *wh*-movement (see section 3.3.). The idea is that secondary *wh*-movement applies in order to move a *wh*-word past a lexical head that is not accessible for *wh*-feature insertion. For example, the possessor in Tzotzil raises to SpecD past N in order to c-command a non-lexical head (an empty D) that can then acquire the *wh*-goal via Merge:

- (54) [DP Buch’u₂ x-ch’amal t₂]₃ t₃ i-cham?
 who A3-child CP-died
 ‘Whose child died?’

However, the account does not cover the full range of secondary *wh*-movement. Consider the case of pied-piping PP in Tzotzil. As Aissen argues, the *wh*-phrase *buch’u* in (55) undergoes secondary *wh*-movement from SpecD to SpecP.

- (55) [PP Buch’u₂ ta t’₂ s-na t₂]₃ ch-a-bat t₃?
 who to A3-house ICP-B2-go
 ‘To whose house are you going?’

There is no blocking head between D and P in (55). Raising the *wh*-phrase to SpecD (as in (54)) plus subsequent recursive percolation should be enough for the PP to acquire the *wh*-feature, but it is not (see Aissen (1996, 472)). Thus, again, more assumptions are needed.

Finally, recall that according to the evidence presented in section 3.4. pied-piping is only possible if extraction is blocked. As a reviewer suggests, these effects can be derived by putting a certain cost on feature-percolation (i.e., on Merge of bare *wh*-goals). These costs are only justified if pied-piping is forced by some island. Notice, however, that if the island-hood of a phrase is determined by its structural position, it follows that it must be possible to apply Merge of *wh*-goals counter-cyclically. To illustrate, consider again the following contrast that involves French relative clauses with *dont*:

- (56) a. la fille [DP dont le frère]₃ t₃ t’a rencontré
 the girl of-whom the brother you-has met
 ‘the girl whose brother met you’
 b. *la fille [DP dont le frère]₃ tu as rencontré t₃
 the girl of-who the brother you have met
 ‘the girl whose brother you met’

Merge of a *wh*-feature is necessary and therefore justified in (56-a), DP₃ being an island, but unnecessary and therefore blocked in (56-b), DP₃ being transparent. But before DP₃ is merged it remains unclear whether it will end up as an island or not. Only after Merge of DP₃ can it be decided whether Merge of [wh] must or must not apply. It follows that Merge of the *wh*-goal is strongly counter-cyclic.⁶⁰ Furthermore, if secondary *wh*-movement were triggered by the need to merge a *wh*-feature (see above), then by the same reasoning secondary *wh*-movement would have to be counter-cyclic, too.

⁶⁰This problem also arises under a reconstruction of feature percolation in terms of Move.

To summarize, reducing feature-percolation to Merge requires certain additional conditions on Merge when applied to bare *wh*-goals, as opposed to lexical *wh*-goals: The target of Merge must be c-commanded by a *wh*-goal, Merge cannot apply to lexical heads and is only possible in the local context of an island. Moreover, Merge of *wh*-goals must be able to apply counter-cyclically. Finally, to account for secondary *wh*-movement, the percolation based approach requires further assumptions.⁶¹

I conclude that there is no satisfying way to reduce feature percolation to one of the standard construals Merge or Move. This supports the analysis of pied-piping in terms of Agree (which is motivated on independent grounds) as proposed in section 3.

6. Appendix 2: Remarks on the Syntax of *dont*

In sections 3.3.2. and 3.4.1. I assumed that French *dont* can pied-pipe subject DPs. This pied-piping analysis is not standard. One reason that *dont* is usually assumed not to be able to pied-pipe is due to contrasts like the following (see Hirschbühler (1978, 110)):

- (57) a. la fille dont tu as rencontré le frère
 the girl of-whom you have met the brother
 ‘the girl whose brother you met’
 b. *la fille le frère dont tu as rencontré
 a girl the brother of-whom you have met
 c. *la fille dont le frère tu as rencontré
 the girl of-whom the brother you have met

(57-b) is straightforwardly analyzed in terms of pied-piping of the DP *le frère* by *dont*. Its ungrammaticality suggests that *dont* cannot pied-pipe. This view also accounts for the ungrammaticality of (57-c), assuming that French does not have scrambling (to account for

⁶¹ There is a parallelism between binding (see Reinhart (1983, 177)) and pied-piping in (i) that suggests that an appropriate definition of c-command that derives binding in (i-a,c) would also rule in the licit cases of pied-piping in (i-b,d) (while excluding illicit cases as (ii-c)). All that seems necessary for pied-piping to be well-formed is that the *wh*-phrase c-command (in the relevant technical sense) the C-head that bears [wh].

- (i) a. [Every girl’s]₂ father thinks she₂ is a genius
 b. a man whose mother’s deckchair you spilled coffee on
 c. John talks with Mary₂ about herself₂
 d. the manner in which Dickens died

Kayne (1994, 23ff.) makes such a proposal. In his theory an element c-commands out of a specifier position (or a cascade of specifier positions) it occupies. Relevant in the present context is the fact that the c-command condition on C-heads also derives some instances of secondary *wh*-movement. But as Kayne himself notes (see Kayne (1994, 25)), the parallelism in (i-a,b) breaks down in other contexts. Cf. (i-a) vs. (ii-a), and (ii-b) (from May (1985, 69)), vs. (ii-c).

- (ii) a. *[Every girl’s]₂ father admires herself₂
 b. Someone from [every city]₂ despises it₂
 c. *a man the deckchair of whom you spilled coffee on

Thus, Kayne’s theory requires covert secondary *wh*-movement to SpecP (or something comparable) in (i-c,d); it is not clear why such movement should be possible in (ii-b), too, but not in (ii-c) (see Kayne (1994, 135, footnote 18)).

dislocation of *le frère* independently from *dont*). On the other hand, (57-a) lends itself to an analysis in terms of extraction. Such an analysis raises the question how to account for the purported extraction of *dont* from a subject island in (56-a).

6.1. Islands and *dont*

First note that subjects in French indeed form islands for movement (of, e.g., a complex PP), but objects do not (see Vergnaud (1974), Tellier (1991), Sportiche (1998)).

- (58) a. la ville [_{PP} de laquelle]₂ le général avait ordonné [_{DP} la destruction t₂]
 the city of which the general had ordered the destruction
 ‘the city whose destruction the general had ordered’
 b. *la ville [_{PP} de laquelle]₂ [_{DP} la destruction t₂]₃ serait entreprise
 the city of which the destruction would-be undertaken
 ‘the city whose destruction would be undertaken’

Also, the non-operator variant of *dont*, the clitic *en* (“thereof”), often (though admittedly not always) behaves like *dont*. And *en*-movement out of subjects is impossible, but it is impeccable out of objects (see Ruwet (1972), Boivin (2005), among others). The null hypothesis is that *dont* and *en* should behave alike, i.e., should be sensitive to subject islands. Finally note that *dont*-movement is sensitive for islands like complex noun phrases or adjuncts (see Godard (1985), Tellier (1991, 85, footnote 4)).

- (59) a. *l’enfant dont tu connais les écoliers qui se sont moqués
 the-child of-whom you know the pupils that SELF are made-fun
 ‘the child who you know the pupils that made fun of’
 b. *un problème dont tout ira bien mieux quand vous vous serez
 a problem of-which all will-go well better when you SELF will-be
 débarassé
 got-rid-of
 ‘a problem which everything will go much better once you have got rid of it’

One therefore should expect *dont*-movement to obey subject islands. Thus, the puzzle posed by (56-a) for analyses that deny the possibility of pied-piping by *dont* is real.

6.2. Analyses without Pied-Piping

There are theories that try to account for the puzzle without invoking pied-piping. Godard (1985) proposes that *dont* does not move but is connected with the gap in the relative clause by a mechanism of chain formation. The analysis is modified in Godard (1988), assuming that *dont* is a special complementizer. Tellier (1990, 1991) combines this latter idea with a movement analysis. According to her, *dont* is a complementizer that agrees with an empty *wh*-phrase that has been moved from within the relative clause. By assumption, *dont* has the property of L-marking (in the sense of Chomsky (1986)) its complement TP (similar to the agreeing complementizer *qui*, as opposed to *que*). L-marking percolates downwards, thereby voiding the island-hood of the subject. Thus, extraction of the empty operator from within the subject is possible only in the local context of *dont*. Sportiche (1998) proposes a variant, based on the idea that *dont* is a clitic that moves from within the subject in order to adjoin to

the adjacent C-head. From there, *dont* L-marks the TP and, by percolation, the subject. This eliminates the subject's island-hood, which clitic-movement would violate otherwise.

It has been noted in the literature that these solutions have some drawbacks. First, the analysis in Godard (1985, 1988) is conceptually unattractive because it postulates two types of relative clauses in French, one with and the other without movement. In addition, the latter must be able to bind a gap within a subject island but not within other islands, see (59). Next, analyses that assume that *dont* is a complementizer have to explain why *dont* cannot appear as an intermediate C-head in the case of long relativization (see (60-a); Tellier (1990, 308, footnote 2)). This question is pressing in view of the fact that the *que/qui*-alternation patterns exactly the other way round: Agreeing *qui* can only appear on the most embedded C-head (see (60-b,c)).

- (60) a. *l'homme avec qui je crois dont tu parles
 the-man with whom I believe that you talk
 'the man I believe that you talk to'
 b. l'homme que je crois qui est venu
 the-man that I believe that is come
 'the man I believe has come'
 c. *l'homme qui je crois que est venu
 the-man that I believe that is come

Another problem is that in dialects of French that do not have the doubly-filled Comp filter (see (61-a); Guiraud (1966), Bouchard (1982)), *dont* cannot co-occur with the relative operator in SpecC (see (61-b); Tellier (1990, 1991)). Moreover, it seems possible in such dialects for *dont* to co-occur with the complementizer *que* (see (61-c); this argument is attributed to Pollock (1993)).

- (61) a. l'homme de qui que je parle
 the-man of whom that I speak
 'the man of whom I speak'
 b. *l'homme de qui dont je parle
 the-man of whom that I speak
 c. la personne dont que j'ai parlé
 the person of-whom that I-have spoken
 'the person I spoke of'

The arguments do not affect Sportiche's analysis. However, it remains somewhat unclear why *dont* as a clitic should adjoin to a phonologically empty C-head, which cannot provide it with phonological support, and why *dont* cannot cliticize on lower elements when it originates within the object.⁶² None of these problems is an issue under the pied-piping analysis.

⁶²Note in passing that Sportiche's approach is incompatible with the view that island conditions are conditions on movement rather than conditions on representations (resulting from movement). This is so because what voids barrier-hood in Sportiche's theory is L-marking, which in turn can only apply after *dont*-movement from within the subject island has applied (dubbed "Münchhausen" head movement by Sternefeld (1991)). This does not hold for Tellier's theory because there the C-head and *dont* are identical, thus C inherently possesses the ability to L-mark its complement.

6.3. Consequences of the Pied-Piping Analysis

The pied-piping analysis faces some apparent problems. I argue that they can be explained away. It also makes some predictions that are shown to be borne out.

6.3.1. Adverbs

As noted above (see section 3.3.2.) the pied-piping analysis predicts that no subject-external material can intervene between *dont* and the subject it is associated with. This prediction seems to be falsified by some adverbs (as *effectivement* or *sans doute* in (62)):

- (62) a. un homme dont, effectivement, le comportement devient inquiétant
a man of-whom really the behavior becomes alarming
'a man whose behavior really becomes alarming'
b. Colin, dont, sans doute, la coiffure blonde peroxydée choque
Colin of-whom without doubt the hair blonde peroxyde shocks
'Colin, whose peroxide blonde hair shocks'

In written language, adverbs in this position are often (but not always) set off by commas, as indicated in (62). In spoken French, they can be, but are not necessarily, pronounced with an intonational break before and after the adverb. I propose that in all cases we are dealing with parenthetical adverbs. Like other parentheses, they can be prosodically integrated into or be separated from their environment (see Reis (1995, 2000) for cases of integrated parentheses in German). There are theories of parenthesis (such as the one in McCawley (1982)) under which the positioning of the adverbs in (62) is compatible with the pied-piping analysis. The parenthesis analysis is supported by the observation that the adverbs in (62) occupy a niche that is typically targeted by other elements, too, that are arguably parentheses, see (63).⁶³

- (63) a. un homme dont, comme nous le savons, le comportement devient
a man of-whom as we it know the behavior becomes
rapidement inquiétant
rapidly alarming
'a man whose behavior, as we know it, becomes rapidly alarming'
b. Colin, dont, comme disait Marie, la coiffure blonde peroxydée choque
Colin of-whom as said Marie the hair blonde peroxyde shocks
'Colin, whose peroxide blonde hair, as Marie put it, shocks'

⁶³A reviewer notes that in English a prenominal genitive cannot be separated from the remnant of the DP by a parenthesis, see (i). The distribution of parenthetical elements in English thus seems to differ from the distribution of such elements in French. An explanation for this asymmetry is desirable.

- (i) a. *a man whose, without a doubt, behavior shocked the teacher
b. a man whose behavior, without a doubt, shocked the teacher

Actually, if one follows Abney (1986) in assuming that the genitive suffix in English is an enclitic element merged in D, then the parenthesis *without doubt* in (i-a) separates D from NP. In the relevant French cases, however, the parenthetical element separates *dont* in SpecD from D. Thus, there is a potential source that the asymmetry can be reduced to.

6.3.2. Long Relativization

Another prediction is that long relativization of *dont* out of the subject (without pied-piping) should be ungrammatical. In fact, Tellier (1991, 95) (see also Tellier (1990)) observes that in the context of long relativization of *dont* subject island effects return:

- (64) a. *un homme dont je refuse que le fils vous fréquente
 a man of-whom I refuse that the son you visits
 ‘a man whose son I refuse that he visits you’
 b. *un bandit dont le juge a ordonné que les complices purgent une
 a bandit of-whom the judge has ordered that the accomplices serve a
 peine de dix ans
 sentence of ten years
 ‘a bandit whose accomplices the judge awarded a ten-year sentence’

Thus the prediction is borne out.⁶⁴ Note that long relativization is generally possible in French (see, e.g., Tellier (1991, 86)). Moreover, long relativization from objects is also possible across the predicates *ordonner* (“to order”) and *refuser* (“to refuse”) (see Tellier (1991, 95)), which leads to ungrammaticality in the case of extraction from a subject in (64). Thus, the ungrammaticality of the examples in (64) cannot be traced back to the idea that *ordonner* and *refuser* might be non-bridge verbs.⁶⁵

⁶⁴The prediction is also made by Tellier’s and Sportiche’s accounts because in both theories the relation between *dont* and the subject must be local. Note in passing that if in Sportiche’s approach *dont* were allowed to excorporate (after having L-marked the subject) and to move further up, one would expect long relativization out of subjects to be possible.

Tellier (1990, 1991) observes that there are other predicates (e.g., *dire* (“say”), *prétendre* (“claim”), *croire* (“believe”), *savoir* (“know”)) that seem to allow long *dont*-relativization out of subjects:

- (i) a. un homme dont je sais que le fils vous fréquente
 a man of-whom I know that the son you visits
 ‘a man of whom I know that the son visits you’
 b. un bandit dont on croit que les complices purgent une peine de dix ans
 a bandit of-whom one believes that the accomplices serve a sentence of ten years
 ‘a bandit of whom one believes that the accomplices serve a ten year sentence’

Her explanation is that these predicates allow *dont* to associate with them. In other words, the examples in (i) do not involve long relativization but rather relativization within the matrix clause (see also Sportiche (1998), who adopts this explanation.)

⁶⁵There is a complication with the pied-piping analysis in the context of long relativization. Namely, long pied-piping of subjects by *dont* is ungrammatical, too, see (i):

- (i) *un homme dont le fils je refuse que vous fréquente
 a man of-whom the son I refuse that you visits
 ‘a man whose son I refuse that he visits you’

I attribute this to the fact that two marked strategies (a repair and long movement) act in concert. A similar effect can be observed in the following examples of short and long participle pied-piping in German:

- (ii) a. Fritz will wissen wie schön geschrieben man haben muss
 Fritz wants know how nicely written one have must
 ‘Fritz wonders how nicely one must have written’
 b. *?Fritz will wissen wie schön geschrieben Maria glaubt dass man haben muss
 Fritz wants know how nicely written Maria thinks that one have must

6.3.3. Stylistic Inversion

Given theories of stylistic inversion in French that assume that the subject remains in Specv in this construction (see Déprez (1990), Valois and Dupuis (1992)) the present analysis predicts that *dont*-movement out of an inverted subject should be impossible. This prediction is borne out, too, see (65).⁶⁶

- (65) a. *un homme dont devient rapidement inquiétant le comportement
a man of-whom becomes rapidly alarming the behavior
'a man whose behavior rapidly becomes alarming'
b. *Colin, dont choque la coiffure blonde peroxydée
Colin of-who shocks the hair blonde peroxide
'Colin, whose peroxide blonde hair shocks'

As expected, the same restriction holds for *en* (see Pollock (1986), Boivin (2005)).

6.3.4. Parasitic Gaps

It has been argued that *dont* can occur with two gaps (see Kayne (1975, 112, footnote 57) Bouchard (1982, 354, footnote 52), and Tellier (1991) and references therein):

- (66) a. la fille dont le père ne parle plus avec la mère
the girl of-who the father NE speaks more with the mother
'the girl whose father doesn't talk to its mother any more'
b. un enfant dont l'honnêteté se voit dans les yeux
a child of-whom the-honesty SELF sees in the eyes
'a child whose honesty reflects in its eyes'

Tellier (1991) argues that the second gap is parasitic and must be c-commanded by *dont*. Acting on the assumption that Tellier is right and that there are two gaps involved here, it follows under the pied-piping analysis that the relevant c-command relation can be established if binding of parasitic gaps parallels binding of variables in other contexts, which seems to be able to proceed out of DP specifiers (cf. footnote 61).⁶⁷

'Fritz wonders how nicely Mary thinks that one must have written'

⁶⁶Tellier's theory makes the same prediction, but only if percolation of L-marking into the complement domain of T is blocked. In Sportiche's theory it must be ensured that *dont* cannot cliticize on T, thereby L-marking the subject in Specv, which would predict the examples in (65) to be well-formed.

⁶⁷In fact, Müller (1995, 115f.), citing Jochen Geilfuß, notes that licensing of a parasitic gap in German is impossible, if the binder is a PP that underwent DP-internal raising to SpecD, see (i):

- (i) *[_{PP} Über Metaphern]₂ einen Artikel t₂ schreibe ich ohne vorher ein Buch e₂ gelesen zu haben
about metaphors an article write I without before a book read to have
'I will write an article about metaphors without having read any book about it before'

However, parasitic gaps in German are more marked than in English (and presumably French), where they already are of a rather colloquial style. In addition, DP-internal PP-raising of the type in (i) is considered marginal in itself (see Webelhuth (1992)). I conclude that (i) is not ungrammatical due to lack of c-command but because these two marked strategies co-occur.

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