Redefining feature percolation

Dmitrii Zelenskii
Lomonosov Moscow State University
dz-zd@mail.ru

The paper describes a possible approach to the phenomenon known as "pied-piping effect", which mends certain inaccuracies of another recent wide-known approach to it — that of Seth Cable (2007). The notion of feature percolation is redefined to mend those inaccuracies, and the consequences of the redefining are then checked on other phenomena.
Keywords: syntax; pied-piping; Minimalism; generative linguistics; features

1 Introduction: Seth Cable's approach

Feature percolation is an operation usually called upon in the context of the so-called "pied-piping effect". The latter term, first introduced in Ross (1967), corresponds to a variety of cases where, instead of a constituent bearing the relevant feature, e.g., a wh-word, another constituent embedding it undergoes A'-movement (simplistically, A'-movement is phrasal movement not related to case and agreement phenomena). That begs for a theoretical explanation given that movement is now believed to be feature-driven, and a multitude of authors, including Cowper (1986), Heck ((2004), inter alia), tried to give one.

Seth Cable wrote many papers on the topic, starting with Cable (2007). According to him, every language has an interrogative particle called Q (in many languages having a phonological zero as its exponent). It bears an interrogativity feature probed by the complementizer head, C (the exact details depend on the Agree theory, see below on the notion of feature), so that QP moves to SpecCP (either overtly or covertly; Spec stands for specifier). This QP either embeds a phrase with wh-feature or adjoins to it, as illustrated by Figure 1 below (which of the two alternative holds depends on the language). Semantically, Q changes the phrase's meaning to a set of contextually relevant alternatives (similarly to particles like *only*). An overt movement of QP embedding the phrase with wh-feature constitutes languages with wh-movement, the other three possible combinations (covert movement and embedding, covert movement and adjunction, overt movement and adjunction) correspond to wh-in-situ languages.

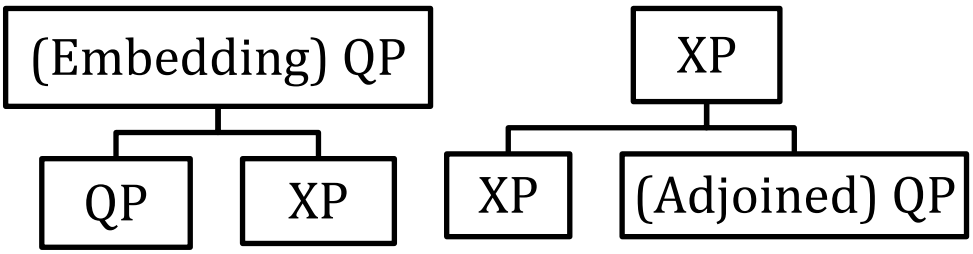

Figure 1. Embedding vs. adjoined QP

By that, the notion of pied-piping is essentially destroyed in Minimalist grammar, remaining only as a descriptive notion: it is QP that undergoes A'-movement, not some undetermined embedding phrase, and the movement proceeds normally. That follows the general logic of locality of Merge.

Cable (2007) claims that percolation beyond a head's maximal projection is also no longer needed and is to be abandoned, according to the Minimalist program (Chomsky, 2000). His argumentation on the issue is taken from Heck (2004) and suggests that percolation is irreducible to Move or Agree: Agree cannot insert features where there were none and Move (a.k.a. Internal Merge) would be expected to obey island constraints (that is, constraints on where a constituent can move from, see Ross (1967) and Chomsky (2000)), which does not hold for most definitions of percolation.

Importantly, Cable (2007) also notes *in passim* that weakening the theory of movement so that any phrase embedding the feature-bearing phrase is empirically inadequate. It is so because different languages show (different) constraints on such movement, like in (1a-b) from English (309 in Cable):

(1) a. Which man do -es Mary believe that Dave
which man T -PRS.3SG Mary believe that Dave
like -s?
like -PRS.3SG
'Which man does Mary believe that Dave likes?'

b. *That Dave like -s which man do -es
that Dave like -PRS.3SG which man T -PRS.3SG
Mary believe?
Mary believe
*That Dave likes which man does Mary believe?
'Which man does Mary believe that Dave likes?'

Cable does not require QP to be as close as possible to the wh-feature bearer (unlike Heck), so he has to make some stipulations including the following: no projection of QP can intervene between a functional head and its complement or specifier. That, however, requires him to claim that prepositions

in languages allowing for preposition stranding (like English illustrated by (2)) and Larsonian (Larson 1988) light verb v (or, equivalently, Kratzer's (1996) Voice) are lexical heads, as otherwise overt A'-movement of DPs out of PP and SpecvP would both be impossible.

(2) Who$_1$ did you talk to t_1?
Who T.PST *you* *talk* *to*
'Who did you talk to?'

That, however, leads him to an empirical problem: in the language of Tlingit, which he studies and where the Q-particle is overt, it cannot appear to the right of the verb (and thus VP) which is unexpected if it is a lexical head's complement – for space considerations I refer to Cable's (2007) work for the thorough description of the problem.

2 The redefinition of feature percolation

2.1 Defining feature percolation

It is worth noting that all of Heck's arguments (accepted by Cable) against postulating an independent percolation mechanism only apply to percolation beyond a head's maximal projection. Percolation to maximal projection, however (called feature projection by Heck), appears to be self-evident for them, and any definition of Agree would be vastly overcomplicated without it.

However, the latter operation, which seems obvious to both Cable and Heck, is to be defined formally by itself. Such a definition, if given properly, may allow for percolation of syntactic features beyond the feature-bearing head's maximal projection in certain strictly defined situations – and in all of those pied-piping is obligatory. Let us define it as follows (Zelenskii, 2017):

If β is a daughter node of α, β and α are of the same syntactic category, β has a feature f and α does not have a feature of the same type as f, α receives f from β (=f *percolates* from β to α). In case α has daughter nodes β and γ, both β and γ have a feature of the same type, α lacks a feature of this type and α, β and γ are all of the same syntactic category, but β is not a maximal projection, f percolates to α from β (not γ).

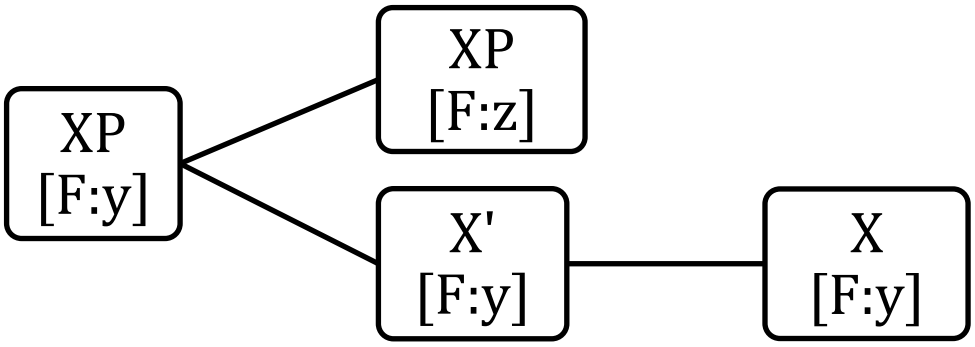

Figure 2. General configuration of feature percolation

Figure 2 illustrates both situations of percolation. Labeling (ascribing syntactic category) under this approach is expected to either be part of Merge or precede all the other feature percolation by a similar (if not the same) rule.

However, the very notion of feature is to be explained, since different Minimalists give rather different explanations of what feature is. My judgments are as follows. For every node and every feature I believe that the node either has an instance of the feature or does not have (a node can metaphorically be said to have a feature, meaning that it has the feature's instance). Every instance of a feature can be either interpretable (and thus go to the Logical Form, LF) or uninterpretable (and thus go to the Phonological Form, PF). Every feature (not an instance, see Feature Sharing in Pesetsky & Torrego (2007)) can also be either valued or unvalued. Unvalued features are to become valued (interpretable instances – before entering LF, uninterpretable can receive it in PF not only in syntax), for which different versions of Agree (such as Chomsky (2000), Zeijlstra (2012), Preminger (2014) or Wurmbrand (2014)) serve. Many theoretical problems of features are observed in Adger & Svenonius (2011). Moreover, every feature has a type, corresponding to the feature's "meaning"; only features of the same type can undergo Agree.

Since at least one object of Merge is a maximal projection and since Merge only generates binary trees, the latter sentence of the definition never fails (so that we will never have two daughter nodes competing for percolation neither of which is a maximal projection). The unresolvable situation, which by this definition is the situation of merging two maximal projections of the same syntactic category (so that the definition cannot choose whose features to percolate), appears to be unattested. For example, under adjunction, noun phrases and adjective phrases are to be embedded in vP (or, in some notations, PredP), creating a so-called small clause with an anaphor PRO as its own "subject". Such adjuncts are adjoined to lexical head phrases but never to vP's as control possibilities in example (3) from Russian (courtesy to John Bailyn) show: subject and direct object can control PRO whereas indirect object cannot.

(3) Abramovich$_1$ [$_{vP}$ t$_1$ v+prodal$_4$ [$_{VP}$ Arshavin -a t$_4$
Abramovich *sold* *Arshavin* *-ACC*
Rabinovich$_3$ -u [$_{vP}$ PRO$_{1/2/*3}$ golym]]]
Rabinovich *-DAT* *naked*
'Abramovich$_1$ sold Arshavin$_2$ to Rabinovich$_3$ naked$_{1/2/*3}$'

2.2 Consequences for Saxon genitive and external arguments

At first glance it would seem that the definition above prevents any percolation beyond the maximal projection. However, that is not fully correct for situations where a phrase of some syntactic category is a complement or a specifier of the head of the same syntactic category, and this is intentional. If the head has a feature of the relevant type, it will percolate to its maximal projection – so the phrase *devil's brothers* in (4a) shall be plural (not singular as *devil*) and, vice versa, *devils' brother* in (4b) shall be singular (not plural as *devils*).

(4) a. devil -'s brother -s come (*-s) for me
devil *-GEN* *brother* *-PL* *come* *-PRS.3SG* *for* *I.OBL*
'devil's brothers come for me'

b. devil -s' brother come *(-s) for me
devil *-PL.GEN* *brother* *come* *-PRS.3SG* *for* *I.OBL*
'devils' brother comes for me'

However, the determiner "-'s" lacks wh-feature altogether (not just its value as this could lead to derivation crash in non-interrogative determiner phrases). Therefore, wh-feature is allowed to percolate from specifier so that both *whose father* and *whose father's books* become interrogative determiner phrases in (5a) leading to obligatory pied-piping. Note that the number feature in (5b) still percolates from the head and not the specifier, as in (4), as figure 3 shows.

(5) a. whose father -'s book -s are there?
who.GEN *father* *-GEN* *book* *-PL* *be.PRS.PL* *there*
'whose father's books are there?'

b. *whose father -'s book -s is there?
who.GEN *father* *-GEN* *book* *-PL* *be.PRS.3SG* *there*
*whose father's books is there
'whose father's books are there?'

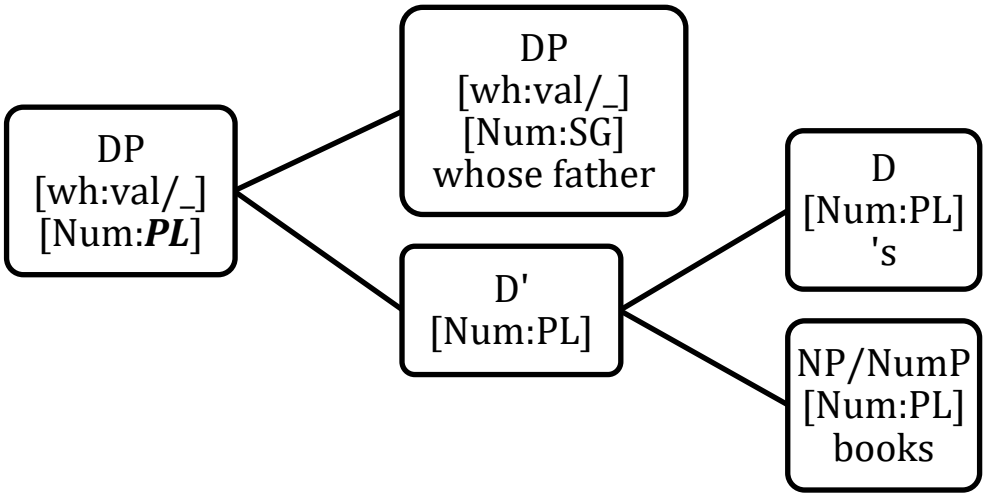

Figure 3. Tree for subject DP in (5a-b) illustrating percolations

Thus a possibility for unlimited embedding of possessors with obligatory pied-piping is created. We can now dispense with Cable's stipulation that disallows QP nodes to intervene between a functional head and its specifier. Instead, we replace it with another stipulation, namely the one that says that QP cannot intervene in structures, which would otherwise be available for percolation. Another stipulation of Cable's, namely, that QP nodes are disallowed to intervene between a functional head and its complement, also still stands.

Now subject as external argument (as per Larson (1988) or Kratzer (1996)) is saved. Since only Q's and D's bear wh-feature, no uncontrollable percolation happens, and thus obligatoriness of pied-piping is limited. Note that Cable allows for fairly distant position of Q if the stipulations are not broken, so that optional pied-piping can still happen beyond such contexts.

So, in essence, refining an independently needed mechanism allowed us to tweak Cable's proposal a bit and get to a both compatible with others' results and more economical model of pied-piping and its syntax.

2.3 Consequences for other structures

Other structures where a phrase of some syntactic category is a complement or a specifier of another phrase of the same syntactic category are now to be discussed. Note that such structures are extremely rare. For example, the famous "that-trace effect", discussed by Pesetsky & Torrego (2001), prevents a TP from being a TP's specifier, as (6) (from English) illustrates:

(6) a. Everyone know -s (that) she came
everyone know -PRS.3SG that she come.PST
'Everyone knows that she came'

b. *[$_{TP}$ she came] is know -n
she come.PST be.PRS.3SG know -PTCP
*She came is known.
'That she came is known'

c. [$_{CP}$That she came] is know -n
that she come.PST be.PRS.3SG know -PTCP
'That she came is known'

Aside from the Saxon genitive structure (DP in SpecDP) discussed above, only two structures of the kind (ignoring cartographic syntax) were found: CP in SpecCP in V2 Germanic languages and vP as a complement of v in distant causatives. One may wonder whether phasehood (if phase-causing heads are a closed list as in Chomsky (2000)) is a necessary condition for being able to be a specifier of one's own category (and, if that's true, whether we observe PP-in-SpecPP structures). Let us discuss both aforementioned structures in the given order.

In many Germanic languages, German included, there is the so-called V2 rule – head-movement of the finite verb form to the complementizer (T-to-C) combined with A'-movement of a phrase not embedding the moved head to SpecCP. In particular, a dependent finite clause, itself a CP, can move to SpecCP.

Let us consider the German example (7) from Zielinski (1981, p. 30):

(7) a. Es interessier -t mich sehr wie er das
it interest -3SG I.ACC very how he that
ge- mach -t ha -t
PERF- do -PTCP have -3SG
'I am very interested in the way he did it'

b. Wie er das ge- mach -t ha -t
how he that PERF- do -PTCP have -3SG
interessier -t mich sehr
interest -3SG I.ACC very
'I am very interested in the way he did it'

Given the information about V2 in German it is obvious that in (7b) the dependent clause *wie er das gemacht hat* is in SpecCP. It is an interrogative clause by itself, but the sentence overall is affirmative. Therefore, percolation, being a value-preserving operation on features, could not have taken place, so we are led to believe that C of the main affirmative clauses has a valued (and interpretable) feature of non-interrogativity belonging to the same type as the

interrogativity feature. Were it unvalued, either the derivation would crash or Agree would take place with downward valuation (as per Wurmbrand (2014)) leading to interrogativity.

The last structure where one could expect percolation beyond maximal projection is distant causatives where vP is a complement of v. However, there are two problems with that.

Firstly, many of the languages featuring the relevant type of distant causatives are left-branching, so that head-movement might leave no trace on surface as the verbal heads are stacked at the right edge of the sentence. So, the Buryat example (8) below potentially can feature any of the following movements and their combinations: V-to-v, v-to-v, v-to-T.

(8)	Dugar	Badma	-da	ʉ:də	nʲə:	-v	-lgə	-bə
	Dugar	*Badma*	*-DAT*	*door.ACC*	*open*	*-CAUS*	*-CAUS*	*-PST*

'Dugar made Badma open the door'

Since head-movement values and percolates features it obviously masks "original" feature percolation had it taken place.

Secondly, since v is a functional head and since no projection of Q-particle can intervene between a functional head and its complement, no QP can be inserted between the two vPs, therefore, an obligatory pied-piping is in order anyway.

So, although the distant causative structure could be of interest in principle, it appears to be empirically untestable for feature percolation.

3 Conclusion

This article suggests a more precise description of pied-piping than Cable's which is at the same time more economical as required by Chomsky's (1993) Minimalist program and despite introducing a third operation in addition to Merge and Agree of Chomsky (2000). It also combines previously incompatible approaches of Larson (1988) and Cable (2007), each of which has advantages against their alternatives.

For that, a definition of feature percolation, which automatically percolates features to the maximal projections of the feature-bearing heads and does so beyond the maximal projections if and only if it is really needed, was given.

Acknowledgements

For my parents, who have been sponsoring me and helping me all the way despite having little to zero knowledge of linguistics.
For Noam Chomsky and for all the founders of my department, whom I never met personally but who created modern linguistics (American and Soviet respectively) as we know it.

For Ekaterina Lyutikova, who taught me syntax and supervised the term paper, which serves as the basis for this article.
For Roumyana Pancheva, who actually gave me the context for the basic idea of the paper.
For Susanna Wurmbrand, who pretty much built in my mind the initial idea of how features work.
For John Bailyn, who organized NY-St. Petersburg Institute of Linguistics, Cognition and Culture where I met Mrs. Pancheva and Wurmbrand and drew my attention to the examples like (2).
And, finally, for Sergei Tatevosov, who took his time and reviewed this paper as my current supervisor.

References

Agder, D. & Svenonius, N. (2011) Features in Minimalist syntax. In C. Boeckx (Ed.) *The Oxford Handbook of linguistic minimalism* (27-51). Oxford: Oxford University Press.

Cable, S. (2007). *The Grammar of Q: Q-Particles and the Nature of Wh-Fronting, As Revealed by the Wh-Questions of Tlingit.* Cambridge, MA: MIT Press.

Cowper, E. A. (1987). Pied-piping, feature percolation and the structure of noun phrase. *Canadian Journal of Linguistics 32(4)*, 321-338.

Chomsky, N. (1993). A minimalist program for linguistic theory. In K. Hale & S.J. Keyser (Eds.) *The view from building 20: Essays in linguistics in honor of Sylvain Bromberger* (1-53). Cambridge, MA: MIT Press.

Chomsky, N. (2000). Minimalist inquiries: The framework. In K. Hale & S.J. Keyser (Eds.) *Step by Step: Essays on Minimalist Syntax in Honor of Howard Lasnik* (89-155). Cambridge, MA: MIT Press.

Heck, F. (2004). *A theory of pied-piping*. Tübingen: Universität Tübingen.

Kratzer A. (1996). Severing the external argument from its verb. In J. Rooryck, L. Zaring (Eds.) *Phrase Structure and the Lexicon* (109-137). Dordrecht: Kluwer.

Larson R. K. (1988). On the double object construction. *Linguistic Inquiry, 36*, 335-391.

Pesetsky, D. & Torrego E. (2001). T-to-C movement: Causes and consequences. *Current Studies in Linguistics Series, 36*, 355-426.

Pesetsky, D. & Torrego E. (2007) The syntax of valuation and the interpretability of features. In S. Karimi, V. Samiian & W.K. Wikins (Eds.) *Phrasal and clausal architecture: syntactic derivation and interpretation in honor of Joseph E. Emonds* (262-294). Amsterdam/Philadelphia: John Benjamins.

Preminger, O. (2014). *Agreement and its failures*. Cambridge, MA: MIT Press.

Ross, J. R. (1967). *Constraints on variables in syntax*. Cambridge, MA: MIT Press. PhD dissertation.

Wurmbrand, S. (2014). The Merge Condition: A syntactic approach to selection. In P. Kosta, S.L. Franks, T. Radeva-Bork & L. Schürcks (Eds.)

Minimalism and Beyond. Radicalizing the interfaces (130-167). Amsterdam/Philadelphia: John Benjamins.

Zeijlstra, H. (2012). There is only one way to Agree. *Linguistic Review, 29(3)*, 491-539.

Zelenskii, D. M. (2017). *Modelirovanie ehffecta kryisolova s pomosch'yu mekhanizma prosachivaniya priznaka [Modeling of pied-piping effect using the mechanism of feature percolation]*. Moscow: Lomonosov Moscow State University. Term paper.

Zielinski, W. (1981). *ABC der Deutschen Nebensätze: Einführung und Übungen.* Ismaning: Max Hueber Verlag.