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# On the asymmetry of wh-doubling in varieties of German and Dutch

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### Abstract:

This paper combines experimental, theoretical and quantitative approaches to syntactic microvariation. The empirical goal is to clarify the situation with respect to *wh*-doubling (also: *wh*-copying) in varieties of German and Dutch. With a large-scale survey in the German and Dutch language areas we sought to establish which speakers allow *wh*-doubling, which speakers allow right-complexity, i.e., configurations in which the lower copy of the *wh*-dependency is more complex than the higher one, and which speakers allow left-complexity, i.e., the reverse, with a more complex higher copy. We also wanted to know whether there are associations between these properties, to identify groups of speakers and dialects. We found three types of grammars: (i) a grammar that allows both *wh*-doubling and right- and left-complexity; (ii) a grammar that allows *wh*-doubling and has a strong preference for right-complexity over left-complexity; and (iii) a grammar that does not allow any *wh*-doubling configuration. This shows that there is a clear limit to variation in this domain. Grammars with a preference for left-complexity do not exist. We then point out the consequences of these findings for the copy theory of movement, and for analyses that enrich this theory with the option of partial deletion.

**Keywords:**

wh-copying; wh-doubling; PF-deletion; German language varieties; Dutch language varieties; complexity asymmetry

## 1. Introduction

Questioning a constituent of a subordinate clause in English requires placing the *wh*-counterpart of that constituent in the first position of the main clause, while leaving the root position of the displaced constituent empty (1a,b). Many varieties of German and Dutch allow, often in addition to (1b), *wh*-doubling (also called *wh*-copying), in which a *wh*-constituent does not only occur in the first position of the main clause but also in the first position of the embedded clause, as is illustrated for German in (1c). In such varieties, the two *wh*-constituents do not always have to be identical, i.e. we also find (1d), where the linearly second *wh*-constituent is more complex than the first one. There are various claims in the literature (e.g., Fanselow and Ćavar 2001) that the reverse is not possible, i.e., it would not be possible for the first *wh*-constituent to be more complex than the second one (1e).

- (1) a. *you think [that she likes **Mary**].*  
 b. ***who** do you think [that she likes \_\_\_\_ ] ?*  
 c. ***wen** denkst du [**wen** sie mag]?* German  
     *who think you who she likes*  
     *‘Who do you think she likes?’*  
 d. ***wen** denkst du [[**wen von den Studenten**] sie mag].* German

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- who think you who of the students she likes right-complexity  
 'Who of the students do you think she likes?'
- e. \***[wen von den Studenten]** denkst du **[wen sie mag]** German  
 who of the students think you who she likes left-complexity  
 'Who of the students do you think she likes?'

Configurations such as (1d,e), henceforth right-complexity and left-complexity configurations, are relevant for the correct formulation of the copy theory of movement (Chomsky 1995), according to which displacements of the type in (1b) are in fact instances of internal Merge: Copying of a wh-constituent, placing the copy in a higher position (to the left of the original) and subsequently deleting the original.

If the contrast between right-complexity (1d) and left-complexity (1e) exists, this would support the copy theory of movement, as it is possible to partially copy a wh-constituent but not to add material to the original. In (1d), [wen] can be a partial copy of [wen von den Studenten]. The sentence in (1e) can not be the result of copying [wen], as this would require adding [von den Studenten] during the copying process. Therefore, the copy theory of movement predicts that right-complexity (1d) is possible, whereas the reverse, left-complexity (1e) should not be possible.

Somewhat more abstractly, Barbiers, Koenenman and Lekakou (2009) argue for cases such as (2a,b) that Dutch *wat* 'what' is simpler than *wie* 'who' in that it has a subset of the features of *wie*, and therefore (2a) can be the result of partially copying *wie*, while (2b) cannot be the result of partially copying *wat* and therefore is impossible.

- (2) a. **wat** denk je **[wie zij mag]**? Dutch  
 what think you who she likes  
 'Who do you think she likes?'
- b. \***wie** denk je **[wat ze mag]**? Dutch  
 who think you what she likes  
 'Who do you think she likes?'

However, observations in the literature suggest that in some varieties the first wh-constituent can be more complex than the second one. Pankau (2014: 47) gives the sentence in (3), which he found to be possible in the grammar of five speakers of different varieties of German that he interviewed, one speaker from Westphalia, one from Rheinland, one from Bavaria, one from Saxony and one from Franconia. According to Pankau, this suggests that this is not a dialectal but an idiolectal phenomenon.

- (3) **welchen Mann** glaubst du **[wen sie eingeladen hat]** German  
 which man believe you who she invited has  
 'Which man do you think she has invited?'

In view of the diverging empirical claims in the literature, the main goal of this paper is to systematically test the hypothesis that right-complexity is possible in wh-dependencies but left-complexity is not. We have tested the hypothesis on a large number of speakers from

different varieties of German and Dutch.<sup>1</sup> We combine a theoretical perspective on this variation with statistical data analysis. If the theory predicts that there are two or more distinct grammars of wh-doubling, then we should be able to find clear and distinct distributional patterns in the German and Dutch population. We will see, however, that this is not the case, with important consequences for the theory.

To be able to test the hypothesis, one has to be explicit about what complexity means in this context. In (1d), this is clear as the second wh-constituent contains a PP that the first one lacks. In (2a) and (3), this is less clear, as the difference in complexity of the two wh-constituents depends on analysis. *wat* ‘what’ in (2a) is only less complex than *wie* ‘who’ if the assumption is correct that it has a subset of the grammatical features of *wie*. In (3), the constituent [welchen Mann] looks more complex than [wen] as it has two words, but a phrasal analysis of [wen] might show that the latter is in fact syntactically more complex.

In this paper, we will therefore restrict our attention to the clearest case, i.e. (1d,e). We test the three sentence types in (4) to answer the following questions:<sup>2</sup>

- Which speakers have wh-doubling (4a)?
- Which speakers have right-complexity in wh-doubling (4b)?
- Which speakers have left-complexity in wh-doubling (4c)?
- Is it possible to identify groups of varieties/speakers based on the answers to (4a-c)?

(4) German

- |    |   |                      |
|----|---|----------------------|
| a. | <i>wen denkst du wen sie mag?</i>                   | <b>simple</b>        |
|    | who think you who she likes                         |                      |
|    | ‘Who do you think that she likes?’                  |                      |
| b. | <i>wen denkst du wen von den Studenten sie mag?</i> | <b>right-complex</b> |
|    | who think you who of the students she likes         |                      |
|    | ‘Who of the students do you think she likes?’       |                      |
| c. | <i>wen von den Studenten denkst du wen sie mag?</i> | <b>left-complex</b>  |
|    | who of the students think you who she likes         |                      |
|    | ‘Who of the students do you think she likes?’       |                      |

The central issue of this paper could also be considered from a functional perspective. The question would then be whether left-complexity is easier to process than right-complexity or vice versa. We do not know of any research on this question in this empirical domain. On the one hand, it might be expected that the sooner a constituent can be fully processed, the lighter the processing load.<sup>3</sup> In the case of right-complexity, identification of the full constituent has to wait until the beginning of the embedded clause, in left-complex constructions it can be identified immediately. Such functional considerations would then lead to the expectation that left-complexity is preferred over right-complexity. On the other hand, there is also a tendency in natural language for heavily loaded information to occur later in

<sup>1</sup> See <https://scholarlypublications.universiteitleiden.nl/handle/1887/3307645> for regions and numbers of speakers per region.

<sup>2</sup> It will be clear that these questions can only be answered with acceptability judgement tasks, not with a corpus study. A corpus study would not provide useful information on the relation between the four questions. More generally, a corpus study can tell us what is possible, not what is impossible.

<sup>3</sup> An anonymous reviewer points out, however, that there is very little evidence in the sentence parsing literature in support of the idea that heavily loaded information would come earlier.

the sentence, for example in sentences with an expletive subject at the beginning and an associated full subordinate clause at the end of the sentence (as in: *It is nice that you have called me.*) No clear predictions can be derived from the current literature on processing. The data that we report on in this paper can be used as the basis for future processing research.

## 2. Background

In this section we briefly describe the empirical and theoretical background against which we have carried out the research for this paper. In the West Germanic languages, one finds a remarkable variety of constructions that are used for questioning a constituent of a subordinate clause. The construction in which the *wh*-constituent is repeated, as illustrated for Dutch and German in (5), also occurs in Frisian (e.g., Hiemstra 1986), Afrikaans (du Plessis 1977), and in Romani (McDaniel 1986).

- (5) a. *wie* denk je *wie* haar gezien heeft? Dutch  
 who think you who her seen has  
 'Who do you think has seen her?'  
 b. *wen* denkst du *wen* sie gesehen hat? German  
 who think you who her seen has?  
 'Who do you think has seen her?'

There is an important restriction on *wh*-doubling in West Germanic. *Wh*-elements in doubling constructions can only occur at the left-periphery of embedded and main clauses. No copy of the *wh*-phrase may appear in the root position of the *wh*-chain (6,7). Therefore, there is also no doubling for short movement in general (8,9).

- (6) Dutch  
 a. *waar* denk je *waar* hij geslapen heeft?  
 where think you where he slept has?  
 'Where do you think that he has slept?'  
 b. \**waar* denk je dat hij *waar* geslapen heeft?  
 where think you that he where slept has  
 c. \**waar* denk je *waar* hij *waar* geslapen heeft?  
 where think you where he where slept has?  
 (7) German  
 a. *wo* denkst du *wo* er geschlafen hat?  
 where think you where he slept has  
 'Where do you think that he has slept?'  
 b. \**wo* denkst du dass er *wo* geschlafen hat?  
 where think you that he where slept has  
 c. \**wo* denkst du *wo* er *wo* geschlafen hat?  
 where think you where he where slept has

- (8) Dutch  
 \* *waar* heeft zij *waar* geslapen?  
 where has she where slept  
 'Where has she slept?'

(9) German

- \* **wo** hat sie **wo** geschlafen?  
where has she where slept  
'Where has she slept?'

This restriction does not hold for Northern Italian dialects, where there may be a wh-copy in the right periphery of the clause, as exemplified by (10) from La Strozza/Lombardy (Manzini & Savoia 2011:8). There is no wh-copy present in the intermediate Spec,CP position of the embedded clause, as illustrated by (11) from the Borgo di Terzo variety (Manzini & Savoia 2011: 14). There is a debate in the literature whether the right-peripheral wh-element in Northern Italian dialects is in its base position (Manzini and Savoia 2011) or has been moved leftward, with the latter movement masked by subsequent remnant movement (Poletto and Pollock 2005). Manzini and Savoia (2011) argue that the main diagnostic used by Poletto and Pollock, i.e. island sensitivity, also allows for an in situ analysis of the right-peripheral wh-element.

(10) Northern Italian (La Strozza/Lombardy)

- a. **ndo** l purt'i: f **indoε**?  
where it bring you where  
'Where did you bring it?'
- b. so mia **ndo** dyr'mi **indoε**?  
I know not where you.sleep where  
'I do not know where you slept.'

(11) Northern Italian (Borgo di Terzo)

- (**koha**) pænset k el vøli mia **ko'hε**?  
what you.think that he wants not what  
'What do you think that he does not want?'

If the right-peripheral wh-copy is in the root position of the chain, the difference between West Germanic and Northern Italian will reduce to the fact that Northern Italian dialects tolerate wh-*in situ*, while West Germanic does not. West Germanic wh-phrases can stay *in situ* only if they compete with another contentful wh-phrase for the left edge position:<sup>4</sup>

(12) Dutch

- wie heeft wat gezien?  
who has what seen  
'Who has seen what?'

(13) German

- wer hat was gesehen?  
who has what seen

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<sup>4</sup> Note, however, that some varieties of Swiss German (e.g., the Uri dialect) have a wh-doubling construction that resembles Northern Italian in some respects (Frey 2005)

(i) was macht de Urs ietz was?  
what does de Urs now what  
'What does Urs do now?'

‘Who has seen what?’

In both language groups, one can identify complexity restrictions for the left wh-copy. Poletto & Pollock (2005) observe that when the copy *in situ* is a PP, only the wh-word itself can appear at the left edge, cf. (14) from Grumello. Likewise, the examples in (10a,b) show that the left copy is phonologically less strong than the right one.

(14) Italian (Grumello)

*koha l fe:t koŋ ko'hε?*  
what it you.do with what  
‘With what did you do it?’

Restrictions on the complexity of the wh-constituents of the construction have also been discussed for Dutch and German. E.g., McDaniel (1986), Höhle (2000), Felser (2004) report that the doubling of wh-phrases is at least questionable for some speakers when the wh-phrase is part of a PP (15b) – a restriction not affecting all speakers (Fanselow & Mahajan 2000) - unless the PP is a single word (a pronominal adverb), as in (15a).

(15) German

- a. *wovon hat sie gesagt wovon sie träumt?*  
where-of has she said where-of she dreams  
‘What has she said she dreams of?’
- b. *%von wem hat sie gesagt von wem sie träumt?*  
of who has she said of who she dreams  
‘Who has she said she dreams of?’

In addition, Fanselow & Ćavar (2001) report that wh-doubling is compatible with the constellation given in (16), in which the right but not the left copy is syntactically complex.<sup>5</sup>

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<sup>5</sup> One could deny that the second copy in (16a) is complex by assuming that *wen* has been subextracted from the NP *wen von den Studenten* when it moves to embedded Spec,CP (Pankau 2014). The linear order in (i) (PP preceding the subject pronoun) implies that this subextraction would have to take place after the complete NP was adjoined (scrambled) to TP:

- (i) [<sub>CP</sub> *wen*<sub>k</sub> [<sub>TP</sub> [<sub>DP</sub> *t*<sub>k</sub> *von den Studenten*]<sub>i</sub> [<sub>TP</sub> *er mag t*<sub>i</sub>]]]  
who of the students he likes

This suggestion seems prosodically implausible (*wen von den Studenten* forms a prosodic unit) and syntactically unlikely, since unstressed subject pronouns are in the Wackernagel position and nothing can be adjoined to this position (Weiß 2016), cf. (ii), as would be required for (i):

- (ii) *\*ich denke dass einen aus Hamburg er mag*  
I think that somebody from Hamburg he likes  
‘I think that he likes somebody from Hamburg!’

Consider (iii), in which the first overt copy of the wh-phrase does not materialize in the clause in which it originated but in a higher clause it can only have reached by wh-movement. Since wh-phrases do not adjoin to TP in cyclic wh-movement, it is unclear how (iii) could be analyzed avoiding the assumption that *wen von den Studenten* sits in the intermediate Spec,CP position.

- (iii) *wen denkst du (wen von den Studenten sie sagt (dass man t einladen sollte))*  
who think you who of the students she says that one invite should  
‘Who of the students do you think she says that one should invite?’

In dialects that tolerate DFCF-violations, sentences such as (iv) are acceptable, which also allow no analysis that does not place a complex wh-phrase into the specifier of the lower CP.

- (iv) *wen meinst du wen von den Studenten dass du einladen musst*  
who think you who of the students that you invite must

The authors propose to derive this from an economy condition on overt copying. The amount of material copied to a higher position must be minimal, i.e. not more material may be copied than necessary for meeting the requirements in the upper position (e.g., clausal typing), which usually means that only the rightmost copy can be larger than a word.

(16) German

- a. *wen denkst du wen von den Studenten er mag?*  
 who think you who of the students he likes  
 ‘Who of the students do you think that he likes?’
- b. *wieviel denkst du wieviel Bücher er geschrieben hat?*  
 how many think you how many books he written has?  
 ‘How many books do you think that he has written?’
- c. *wen meinst du wen sie sagt wen von den Studenten sie vorzieht?*  
 who think you who she says who of the students she prefers  
 ‘Who of the students do you think that she says that she prefers?’

Barbiers, Koenenman & Lekakou (2009) formulate a more general descriptive principle on the distribution of complexity in wh-chains that contain more than one overt element (17). It is derivable on the basis of three assumptions: (i) a rich internal structure of wh-pronouns and wh-phrases; (ii) the complex functional structure of wh-expressions can also be copied partially in the formation of movement chains; (iii) phrasal spell-out of the lower Wh-copy.

(17) In a syntactic movement chain, a higher chain link is not more specified than a lower chain link.

Both Fanselow & Ćavar (2001) and Barbiers, Koenenman & Lekakou (2009) imply that the leftward (= upward) decrease in complexity in wh-chains is an intrinsic consequence of the mechanics of movement and copying.

The predictions are different, however, if movement always involves full copying in syntax and if scattered deletion is possible at the level of spell out (PF; see, e.g., Nunes 2004). The choice of which part of a copy to spell out may then depend on extragrammatical factors, e.g. social variables such as region and register (see Barbiers 2005, 2008). Such a theory would allow for both left- and right complexity.<sup>6</sup>

It is the distribution of complexity among the items in a wh-chain the present paper will be concerned with.

### 3. Variability

The empirical landscape for wh-doubling in West Germanic appears to be even more diversified, however. Höhle (2000) states that wh-doubling is not uniformly accepted by speakers of German, without any obvious regional or dialectal basis. An unpublished study carried out by one of us (Fanselow) with Dario Paape and Nina Wiedenhof confirmed that wh-

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‘Who of the students do you think you must invite?’

<sup>6</sup> An anonymous reviewer suggests that a preference for right-complexity may in fact be a preference to have the restriction (e.g. the PP [*von den Studenten*] in [16a]) close to the quantifier (*wen*). Testing sentences such as *Wen denkst du wen sie von den Studenten geküsst hat?*, lit. who think you who she of the students kissed has, may give an indication as to whether this preference is playing a role.



doubling is acceptable to (some) speakers in all regional varieties, but the Ruhr area, Bavaria and Berlin-Brandenburg come with a slightly higher acceptability of the construction.

For Dutch, a complex geographical distribution is given on two maps (SAND Volume 1, Barbiers et al 2005, maps 91a,b).<sup>7</sup> These maps do not show any clear regions where full and partial wh-doubling are or are not available. Non-systematic observations on Standard Dutch suggest that the two wh-constructions are common in colloquial Dutch and that many speakers have a normative rule that they would not be allowed in more formal Standard Dutch, although the origin of this rule is unclear. The same appears to hold for German.

We also find variability with respect to complexity as such, and its distributions. As Fanselow & Mahajan (2000) and Felser (2004) stress, the exclusion of PPs from doubling (15b) is not true for all speakers of German. Likewise, not all speakers accept partial copying of *wieviel* + NP as in (16b). Ideally, this is related to a similar variability in Left Branch Extraction contexts: (18a) is not acceptable to all, while (18b,c) seem both unacceptable in general.

(18) German

- a. *%wieviel hast du Schweine im Stall?*  
how many have you pigs in-the pigsty  
'How many pigs do you have in the pigsty?'
- b. *\*welche hast du Schweine im Stall?*  
which have you pigs in-the pigsty  
'Which pigs do you have in the pigsty?'
- c. *\*welche denkst du welche Bücher er gekauft hat?*  
which think you which books he bought has  
'Which books do you think he has bought?'

Variability can also arise with respect to the ability of the lower copy of undergoing further grammatical processes. In Dutch, (19) is acceptable (Schippers 2012:86): the lower copy of *waarvoor* has undergone P-stranding, leading to a situation in which the two copies in Spec,CP are not identical. Note that the splitting of the wh-phrase in the complement clause in (19) leads to a constellation in which the left copy is indeed more complex than the right one!

(19) Dutch

*waarvoor denk jij waar deze mensen voor dienen en voor*  
what-for think you what these people for serve and for  
*worden betaald?*  
are paid  
'What do you think that these people serve and are paid for?'

Lohndal (2010) observes that both copies can be full DPs in Afrikaans (20), a structure that does not contradict (17), however. Du Plessis (1977) observes that Afrikaans allows copying of full PPs as well (21).

(20) Afrikaans

*watter meisie se hy watter meisie kom vanaand kuier?*

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<sup>7</sup> Map 92a in SAND Volume II shows that some varieties of Dutch also allow full and/or partial wh-copying with a relative pronoun at the left periphery of the embedded clause.

which girl say he which girl come tonight visit  
 'Which girl did he say comes for a visit tonight?'

(21) Afrikaans

*met wie het jy nou weer gesê met wie het Sarie*  
 with who did you now again said with who did Sarie  
*gedog met wie gaan Jan trou?*  
 think with who go Jan marry  
 'Whom did you say (again) did Sarie think Jan is going to marry?'

German possesses varieties that fail to be in line with (17), as first pointed out by Anyadi & Tamrazian (1993), who report that sentences of the kind of (22) are acceptable in Ruhr/Low Rhine German. Similar claims were made by Fanselow & Ćavar (2001) for the dialects of Bavarian Franconia. As noted in section 1, Pankau (2014) describes a variety of German also allowing (22), but does not attribute it to a particular region. Similar constructions in Dutch (child) language are discussed in Barbiers, Koenenman and Lekakou (2009). They propose, following van Craenenbroeck (2004), that *which*-DPs are base generated in a high dislocated position and that there is an empty operator below it that is associated with the *wh*-phrase that is in the initial position of the embedded clause. Under such an analysis, sentences such as (22) are not a counterexample to (17).

(22) German

*welchen Mann denkst du wen er kennt*  
 which man think you who he knows  
 'Which man do you think that he knows?'

Irrespective of the details of the analysis, the varieties accepting (22) constitute a different system. It is the *left* copy that is a full *wh*-DP, whereas the right copy must be a proform, in particular a free relative proform, as proposed by Pankau (2014). In some varieties, the *d*-form of the relative pronoun can be used instead of the *wh*-form, both in Dutch and German.

(23) German

*welchen Mann denkst du den er kennt*  
 which man think you who he knows  
 'Which man do you think that he knows?'

Fanselow & Ćavar (2001) have proposed that right complexity (24b) and left complexity (24c) belong to different constructions and different dialects. If two dialects are involved, and/or if two constructions are at stake, one would expect to find some variability among speakers. In particular, there should be at least two groups of speakers with respect to the location of the complex *wh*-phrase in a doubling construction. In the dialect that generates *wh*-doubling by copying in the narrow sense, the rightmost copy should (arguably) have to be the complex one. The dialect that generates *wh*-doubling with the help of a free relative pronoun inserted into the lower Spec,CP tolerates complex *wh*-phrases only in the left copy.

More concretely, there should be a group of speakers in which the difference in acceptability between (24a) and (24c) is larger than the difference in acceptability between (24a) and (24b)

(the copying group), and there should be a group of speakers for which the reverse holds (the relative pronoun group).

(24) German

- |  |   |
|--|---|
| <p>a. <i>wen denkst du wen sie mag?</i><br/>         who think you who she likes<br/>         'Who do you think that she likes?'</p> <p>b. <i>wen denkst du wen von den Studenten sie mag?</i><br/>         who think you who of the students she likes<br/>         'Who of the students do you think she likes?'</p> <p>c. <i>wen von den Studenten denkst du wen sie mag?</i><br/>         who of the students think you who she likes<br/>         'Who of the students do you think she likes?'</p> | <p><b>simple</b></p> <p><b>right-complex</b></p> <p><b>left-complex</b></p> |
|--|---|

One of us (Fanselow) ran a pilot study with speakers from Berlin and Brandenburg, with the goal of testing for the existence of two dialects. 32 speakers who indicated that they and at least one of their parents had grown up in Berlin or Brandenburg rated 6 sentences each for the three construction types exemplified in (24) with a Latin square design, in a written acceptability rating study on a seven point scale (1 worst, 7 best). Mean ratings were 3.57 for simple doubling (24a), 3.12 for the right complex version (24b), and 2.69 for left complex constructions (24c).<sup>8</sup> We excluded those 12 participants from the next analysis step who had a mean rating below 3 for simple doubling (assuming this means that doubling is not part of the grammar of the subject). For the remaining 20 subjects, the acceptability of simple doubling was at 4.64, for right complex elements acceptability was at 3.82, and the acceptability of left complex element was at 3.31.

Figure 1 shows the mean rating for the construction exemplified by (24b) on the x-axis, and mean ratings for left-complex constructions (such as [24c]) on the y-axis. Participants with the same mean rating for the two complexity types fall on the diagonal line. Participants with a higher rating for the right-complex construction are below the line. Figure 1 gives no evidence whatsoever for the possible existence of two dialects. According to Hartigans' dip test for unimodality/multimodality, this distribution does not show any significant signs of multimodality. In other words, there is no indication for any dialectal split.

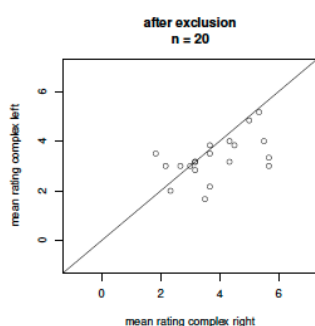


Figure 1: Pilot study Berlin-Brandenburg area

Given that the test was carried out in one region only, and in written rather than spoken language (so that one might miss aspects of colloquial language) we felt it was necessary to

<sup>8</sup> Many thanks go to Marta Wierzbica for carrying out the statistical analysis.

replicate the study in a more systematic way in further areas of German and Dutch, and with auditory presentation.

#### 4. Design of the study

We carried out two parallel acceptability rating experiments for Dutch and German that asked for judgments of doubling constructions that differed with respect to the left vs. right localization of the full complex wh-phrase. The studies tested the same construction with identical (translated) lexical material with the same method in both languages.

All the experiments reported below had the following characteristics. We constructed 18 sentence triplets of the type exemplified in (24) for German and (25) for Dutch, using identical lexical material in both languages, so that each lexicalization appeared in the simple doubling condition (SIMPLE), the left complex condition (LEFT), and the right complex condition (RIGHT).

##### (25) Dutch

- |    |  |                    |
|----|--|--------------------|
| a. | <i>wie denk je wie ze gezien heeft?</i>                  | a: simple doubling |
|    | who think you who she seen has                           |                    |
|    | ‘Who do you think that she has seen?’                    |                    |
| b. | <i>wie denk je wie van de studenten ze gezien heeft?</i> | b: right complex   |
|    | who think you who of the students she seen has           |                    |
|    | ‘Which of the students do you think that she has seen?’  |                    |
| c. | <i>wie van de studenten denk je wie ze gezien heeft?</i> | c: left complex    |
|    | who of the students think you who she seen has           |                    |
|    | ‘Which of the students do you think that she has seen?’  |                    |

In addition, there were 35 distractor items unrelated to wh-doubling, which were also identical in Dutch and German. Each of the experimental items was preceded by a context sentence in order to enhance the acceptability of the items. The material was presented auditorily in an online survey. All test sentences were recorded by a speaker of the pertinent regional dialect or regional version of the standard language.<sup>9</sup>

The experiment was constructed using a Latin square design with three versions, such that each participant was confronted with 6 experimental items per condition (simple, right, left). The sentences were presented to the participants in a pseudo-randomized order. Participants were asked to rate the naturalness of the sentences on a 7-point Likert scale (1 = very unnatural; 7 = completely natural). Participants were born and raised in the relevant region where the dialect/regional variant is spoken and similarly for at least one of their parents.

We were particularly interested if there was any indication in the data collected in the experiments suggesting that there are two (or more) dialects on Dutch and German with respect to left- or right-complexity. To this end, we decided to analyze the data in the frequentist framework using Gaussian finite mixture models, as suggested to us by Shravan Vasishth. A Gaussian finite mixture model can be used to find out how many overlapping normal distributions a given distribution consists of, and to calculate the means and standard

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<sup>9</sup> See <https://scholarlypublications.universiteitileiden.nl/handle/1887/3307645>, Appendix 2, for the full list of test sentences.

deviations of these normal distributions. Crucially, it is also possible to set the unknown parameter that specifies the number of normal components to a certain value before applying the model to the data. Given this possibility, we fitted 3 models to each data set that differed in the number of underlying normal components (1, 2, or 3, models M1, M2, M3). This means that each model is forced to analyse the given data distribution as if it consisted of the specified number of normal components. After fitting the 3 models to a data set, we compared the log likelihoods of these models in a pairwise-fashion (M1-M2, M1-M3, M2-M3) using the likelihood-ratio test procedure. The likelihood-ratio test is a hypothesis test that compares the log-likelihoods (a measure of the goodness of fit of a statistical model to the data) of two nested models to find the model that best fits the data. Whether or not one of the two models being compared is a better fit to the data is indicated by the chi-square value resulting from the comparison of the log-likelihoods. If the observed chi-square value is greater than the critical chi-square value, there is evidence that the two models do not have the same log-likelihoods (i.e., both models differ regarding their ability to explain the data). In this case, the model with the higher log-likelihood is to be preferred, since it is a better fit to the data. If the observed chi-square value is smaller than the critical chi-square value, there is no evidence that the two models do not have the same log-likelihoods (i.e., both models can explain the data equally well). In this case, the simplest model is to be preferred for reasons of parsimony.

It should be noted, however, that our procedure comes with two potential disadvantages: First, it might be possible that a model assuming more than 3 underlying normal components is a better fit to the data than the model picked by our procedure. Second, the procedure makes the assumption that linguistically meaningful dialects correspond to normal distributions in our data. These two factors relativize the force of our conclusions. Note that we also carried out the weaker Hartigan's Dip Test for all our experiments, which never indicated any reason for postulating more than one dialect for our data.

## 5. Variation in Wh-doubling in the Dutch and German varieties: the results

### 5.1 Dutch

For Dutch, our analysis combines data from two studies - one in which speakers gave judgments about the standard language, and one in which speakers of different dialects judged doubling constructions. The conclusions based on the individual studies are very much in line with those based on the pooled data.<sup>10</sup>

161 participants judged the acceptability of 18 doubling constructions in the three conditions simple, right and left complex, as described above. The left part of Table 1 gives the mean ratings of all participants for each of the conditions:

Table 1: Mean ratings; Left: all participants (n = 161), right: after exclusion (n = 112)

left	3.69	left	4.55
right	4.26	right	5.01
simple	4.01	simple	5.00

It makes most sense to control for the existence of two varieties with respect to complexity among those speakers who accept the construction at all – it is difficult to interpret preference

<sup>10</sup> For a more detailed description of the parameters of the individual studies, see <https://scholarlypublications.universiteitleiden.nl/handle/1887/3307645>, Appendix 1.1.

for left or right complexity for speakers whose grammar disallows doubling. Hence we constructed a second data set by excluding the judgments of those participants whose mean rating for the simple construction was below 3.0, assuming this means that they do not accept the construction. The results for this reduced data set can be found in the right part of Table 1.

We observe a slight numerical advantage for constructions in which the complex wh-phrase appears in the right position over constructions in which it occupies the left position, but the difference is rather small ( $<0.5$  on the 7-point Likert scale), and we observe that constructions with two simple wh-phrases and those with a right complex phrase are at (nearly) the same acceptability level.

The plots in Figure 2 show the mean rating for condition b (complex right) on the x-axis and the mean rating for condition c (complex left) on the y-axis for each participant. Participants with an equal rating for both complex conditions fall on the diagonal line. Participants with a higher rating for complex right are below the line. Participants with a higher rating for complex left are above the line. Larger distance from the line reflects a larger distance between the two conditions.

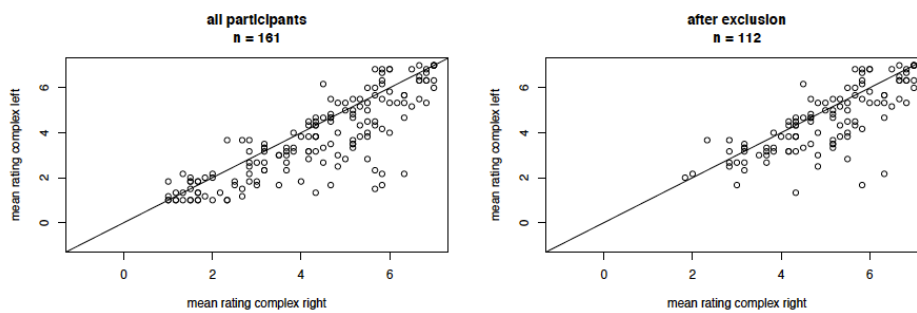


Figure 2

The histograms in Figure 3 show the data distribution when considering the difference between complex right and complex left: e.g., a value of -1 on the x-axis means that the difference between the mean rating for condition b was 1 point lower than for condition c.

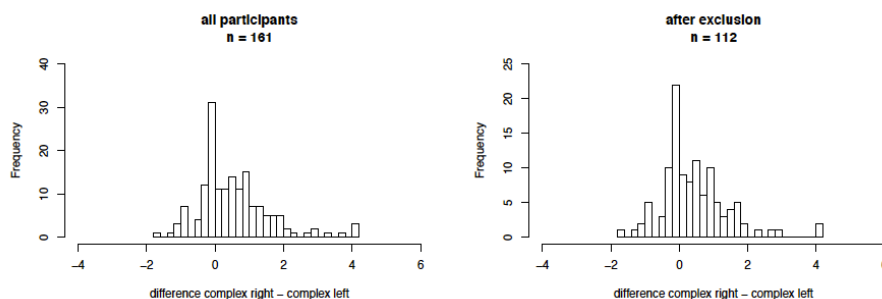


Figure 3

However, we set out to investigate if there are two dialects that govern the distribution of left and right complexity, i.e., whether there are two or more distinct grammars (or speaker types), more specifically grammars with a clear preference for right-complexity and grammars with a clear preference for left-complexity. A statistical method to test for multimodality is

the likelihood ratio test as described above. Here and for the following experiments we fitted 3 Gaussian finite mixture models to the data that differed in the number of underlying normal components (1, 2, or 3, Models M1, M2 and M3). Using the likelihood ratio test procedure, we compared the log likelihoods of these models to find the model that best fits the data.<sup>11</sup>

It turns out that the assumption that there are two normal distributions underlying the data best fits both the complete data set and the reduced data set. In other words, the likelihood ratio test indeed suggests that there are two dialects in Dutch for the distribution of left and right complexity. Figure 4 visualizes these dialects for the complete data set, and Figure 5 for the reduced data set.

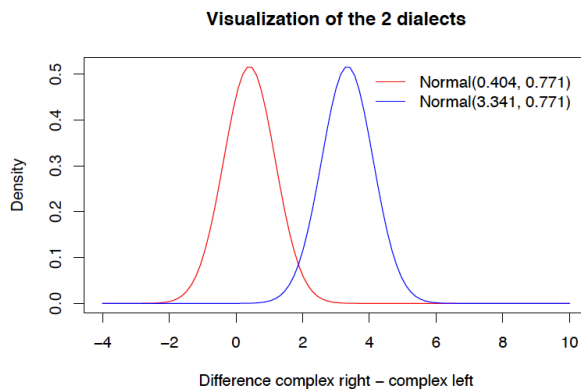


Figure 4: Dialects of complete data set, Pooled Dutch data

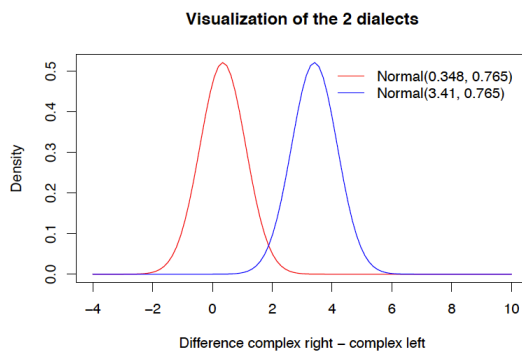


Figure 5: Dialects of reduced data set, Pooled Dutch data

While the existence of two dialects would conform to our expectations, their nature is slightly surprising. The normal distribution of one dialect is characterized by a peak slightly above 0 (a tiny preference for right complexity), while the distribution of the other dialect peaks slightly below 4. It reflects a normal distribution with a strong preference for right complexity, but it is constituted by very few participants as the histogram (figure 3) shows.

## 5.2 German

For German, our analysis also combines data from two studies carried out in two different regions.<sup>12</sup> Again, the conclusions based on the pooled data are similar to those based on the

<sup>11</sup> The details of the statistical analysis for the pooled Dutch data are given in <https://scholarlypublications.universiteitileiden.nl/handle/1887/3307645>, Appendix 1.1.4.

<sup>12</sup> The parameters of the individual studies are described in more detail in <https://scholarlypublications.universiteitileiden.nl/handle/1887/3307645>, Appendix 1.2.

individual studies. 125 participants judged the acceptability of 18 doubling constructions in the three conditions simple, right and left complex, as described above. The left part of Table 2 gives the mean ratings of all participants for each of the conditions, while the right one gives the values for the data of those participants accepting the simple doubling construction as evidenced by a mean rating above 3.

Table 2 Pooled German data

Table 2: Mean ratings; Left: all participants (n = 125), right: after exclusion (n = 111)

left	4.08	left	4.33
right	4.55	right	4.85
simple	4.73	simple	5.07

By and large, the judgments for German are quite similar to those for Dutch, with the difference that doubling constructions involving a complex wh-phrase are rated slightly below their Dutch counterparts, but we doubt the difference can be of a linguistic significance. In particular, just like in Dutch, there is a small numerical advantage for constructions with right complexity over those with left complexity of around 0.5 on the 7 point Likert scale.

The plots in Figure 6 show the mean rating for condition b (right-complex) on the x-axis and the mean rating for condition c (left-complex) on the y-axis for each participant. Participants with an equal rating for both complex conditions fall on the diagonal line. Participants with a higher rating for complex right are below the line. Participants with a higher rating for complex left are above the line. Larger distance from the line reflects a larger distance between the two conditions.

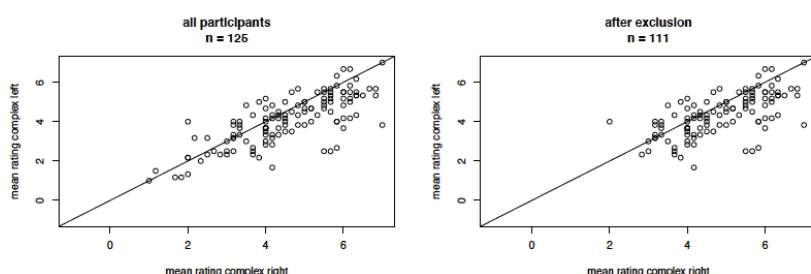


Figure 6

The histograms in Figure 7 show the data distribution when considering the difference between complex right and complex left: e.g., a value of -1 on the x-axis means that the difference between the mean rating for condition b was 1 point lower than for condition c.

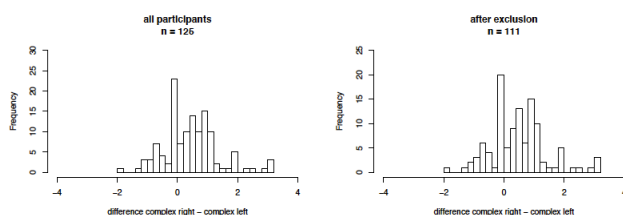


Figure 7



We fitted 3 Gaussian finite mixture models to the data that differed in the number of underlying normal components (1, 2, or 3, Models M1, M2 and M3). Using the likelihood ratio test procedure, we compared the log likelihoods of these models to find the model that best fits the data.<sup>13</sup> Again, the results seem to be best analysed by the assumption that the data is characterized by two normal distributions, both for the complete and the reduced data set. Figure 8 depicts these two normal distributions for the complete data set, and Figure 9 does the same for the reduced data set.

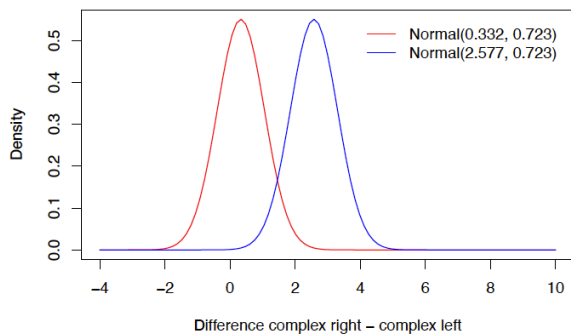


Figure 8 German pooled data

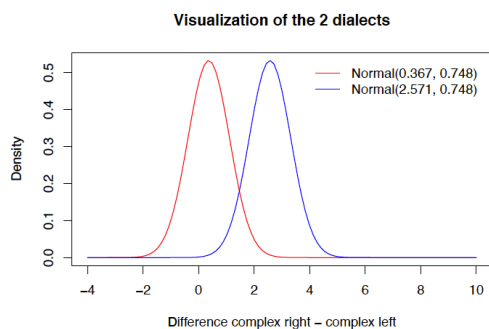


Figure 9: German, reduced data

A comparison of these Figures with the ones presented for Dutch gives no evidence for any interesting difference between the two languages with respect to the location of complexity in the doubling construction.

Hence, both the Dutch and German pooled data sets are characterized by two normal distributions, one that does not make a systematic distinction between left and right complexity (a tiny preference for right complexity notwithstanding) and one that strongly prefers right complexity but is composed of very few participants only.

## 6. Discussion and conclusion

Our experiments have revealed a slight preference for complex wh-phrases to appear in the right copy in a doubling construction both for Dutch and German, that even seems to have the same magnitude in the two languages. The difference in means is rather small, ranging between 0.36 (German, Bochum/NRW) and 0.56 (German, Berlin/Brandenburg).

<sup>13</sup> The details of the statistical analysis for the pooled German data are given in <https://scholarlypublications.universiteitleiden.nl/handle/1887/3307645>, Appendix 1.2.

The absence of a difference between left- and right-complexity can also be taken as an argument against existing theoretical assumptions that favor right-complexity. E.g., a copy and deletion approach to wh-doubling favors right-complexity if it is carried out in a uniformly cyclic fashion, such that (partial) deletion applies after each movement step. It is inconceivable how  $\beta$  might reemerge in the movement step linking 2 to 1 if deletion of the lower copy 2 would have to precede movement (26). Similarly, if the step from 2 to 1 involved partial copying, i.e. only copying of the wh-element  $\alpha$ , one would expect only right-complexity to be possible.

(26)  $\begin{matrix} ({}_{wh} \alpha\beta) & \dots & (({}_{wh} \alpha\beta) & \dots & ({}_{wh} \alpha\beta)) \\ 1 & & 2 & & 3 \end{matrix}$

(27) a-  $({}_{wh} \alpha\beta) \dots (({}_{wh} \alpha\beta) \dots ({}_{wh} \alpha\beta))$   
 - b.  $({}_{wh} \alpha\beta) \dots (({}_{wh} \alpha\beta) \dots ({}_{wh} \alpha\beta))$   
 - c.  $({}_{wh} \alpha\beta) \dots (({}_{wh} \alpha\beta) \dots ({}_{wh} \alpha\beta))$

While it is not possible to make a firm choice between competing theoretical analyses on the basis of our results, this study shows that for phenomena such as the left- and right-complexity of wh-chains, systematic data collection and quantitative analysis is necessary to clarify the empirical and theoretical situation.

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