

# Towards a Hierarchy of Featural Mismatch Effects in the Acquisition of A'-Dependencies: A Comprehension Study with French Children

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## 1. Introduction

The current study investigated the comprehension of object relative clauses (ORs) by French-speaking children with a focus on how the type of embedded subject impacts children's comprehension of this type of structure. Cross-linguistically, ORs have been shown to be harder for children to comprehend than subject relatives (SRs) (Friedmann, Belletti & Rizzi. 2009, Adani, van der Lely, Forgiarini & Guasti. 2010, Belletti, Friedmann, Brunato & Rizzi. 2012). Examples of SRs and ORs appear below, showing that the two structures differ in terms of movement: while movement takes place from the embedded subject position in SRs (1), movement occurs from the embedded object position in ORs (2), as indicated by the element in inverted brackets:

- (1) Show me the mouse [that <the mouse> is pulling the turtle ].
- (2) Show me the mouse [that the turtle is pulling <the mouse>].

The syntax-based intervention account (Friedmann et al. 2009, Grillo 2009, Belletti et al. 2012) explains this asymmetry found in children's comprehension of ORs relative to SRs in terms of an intervention effect triggered by the similarity in morphosyntactic features between the moved OR head and the intervening subject. This account builds on the syntactic principle of locality, formalized as Relativized Minimality (RM) (Rizzi 1990) and subsequently refined (Rizzi 2004, 2013), which holds that a (local) relationship between two positions X and Y fails across an intervening element Z if this intervening element "fully matches the specification of X in the relevant morphosyntactic features" (Rizzi 2013: 34). Specifically, the intervention account attributes children's difficulties with ORs to the presence of an NP-feature on both the head of the OR and on the embedded subject (schematized in (3) below). In other words, children struggle with the comprehension of ORs in which the moved object and the intervening subject are lexical NPs.

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- |  |        |     |   |
|--|--------|-----|---|
|  | X      | Z   | Y |
| (3) Show me the mouse that the turtle is pulling <the mouse> . | +R +NP | +NP |   |

Friedmann et al. (2009) postulate that the relativized object in (3), *the mouse*, is specified as both [+R] and [+NP], while the subject *the turtle* is specified as [+NP]. This partial overlap of features between the two constituents gives rise to an inclusion configuration which, although grammatical according to RM, is more difficult for children to compute and therefore leads to difficulties in comprehension. However, Friedmann et al. (2009) found evidence that such difficulties diminish with pronominal subject interveners: the 5-year-old Hebrew-speaking children they assessed showed improved comprehension of ORs with an unpronounced subject pronoun with arbitrary interpretation (see example (4) which is taken from Friedmann et al. (2009)). The authors attribute this facilitation in comprehension to the presence of a mismatch in the +NP feature between the OR head and the intervener: while the OR head in *ha-sus* ('the horse') contains an NP restriction and is consequently specified as +NP, the embedded pronominal subject (the impersonal *pro* subject) does not. This gives support to the hypothesis that the presence of an embedded pronominal subject enhances OR comprehension because these constituents are not specified with a +NP restriction and therefore do not give rise to intervention effects similar to those found with ORs in which both the head of the relative and the embedded subject share the lexical restriction.

- |             |    |        |      |               |
|-------------|----|--------|------|---------------|
| (4) Tare li | et | ha-sus | she- | mesarkim oto. |
|             |    | +R +NP | -NP  |               |

show to-me ACC the-horse that-*pro* brush-3<sup>rd</sup>-PL him  
 'Show me the horse that **they** are brushing.'

Improved performance with ORs containing a pronoun in the embedded subject position has also been reported in instances when the subject was a 1<sup>st</sup> person pronoun (Arnon 2010, Bentea & Durrleman 2022), a 2<sup>nd</sup> person pronoun (Kidd, Brandt, Lieven & Tomassello (2007) for children, Gordon et al. (2001), (Warren & Gibson (2002) for adults), or an overt 3<sup>rd</sup> person pronoun (Brandt et al. 2009).

However, a closer examination of Friedmann et al.'s results and of other studies exploring children's comprehension of ORs with an embedded personal subject suggests that this facilitation could also be attributed to mismatches in the fine-grained Number or Person features, which are relevant for locality because they are attractors for movement and realized in the clausal inflectional head (Belletti et al. 2012, Bentea & Durrleman 2021, 2022). As shown by the number agreement on the verb in (4), the arbitrary *pro* in Hebrew triggers 3<sup>rd</sup> person plural agreement on the embedded verb *brush*, while the moved object is singular. Number mismatches have been shown to improve comprehension of ORs in a variety of languages, not only when both the head noun and the intervener contain

a + NP specification (Adani et al. 2010, Contemori & Marinis 2014; Bentea & Durrleman 2017), but also when the OR head is –NP, so a pronominal element as in the case of ORs in French introduced by a demonstrative pronoun *celui/celle* roughly translated as ‘that one’ (Bentea & Durrleman 2021). The improvement observed with a mismatch in number between the OR head and the intervener has been argued to give rise to an *intersection* relation them (i.e., a relation in which the morphosyntactic features specified on the two elements intersect, see (5)) which is easier for children to compute (Belletti et al. 2012).

- (5) Show me the mice that the turtle is pulling <the mice>.  
           +R+NP+PL           +NP+SG

Number is therefore relevant for alleviating the processing of structures that involve an intervention configuration because, at least in the languages tested, it belongs to the class of features that function as attractors for movement of the subject and it has a morphological reflex in the tensed verb inflection (Belletti et al. 2012). Following this line of reasoning, the facilitation observed by Friedmann et al. (2009) in the comprehension of ORs in Hebrew with an impersonal arbitrary *pro* as subject could stem from the mismatch in number between the head noun ‘the horse’ and the inherently plural embedded *pro* subject.

Haendler & Adani (2018) tested such number effects on the comprehension of ORs with an arbitrary *pro* in Hebrew and found that children aged 3 to 6 find these ORs difficult to comprehend when the head noun and the embedded *pro* subject match in number features, as illustrated in (6), from Haendler & Adani (2018: 964), in which they are both marked for plural::

- (6) Ma ha-ceva shel ha-susim she- tofsim otam?  
       what the-color of the-horses; that-*pro* catch.3<sup>rd</sup>.PL them;  
       Meaning: What color are the horses that someone is catching?

Haendler and Adani (2018) conclude that Friedmann et al.’s (2009) results should not be exclusively traced back to the presence of a null *pro* and that Hebrew-speaking children’s improved performance with this type of OR is triggered by different number marking on the moved object and the intervening subject. In a similar vein, Haendler, Kliegl & Adani (2015) found that German-speaking 5-year-olds show poor performance when assessed on the comprehension of ORs with a 3<sup>rd</sup> person singular pronoun, despite the lack of a lexical restriction on the embedded pronominal subject (see also Bentea & Durrleman 2021 for similar results with ORs introduced by a demonstrative pronoun). This again suggests that performance with ORs does not depend on the pronominal nature of the intervener, but rather on whether the intervener (pronominal or lexical) matches or mismatches the relative head in morphosyntactic features like Number.

Similarly, children’s good performance with ORs in which the embedded subject is a 1<sup>st</sup> person pronoun, as in (7) (Arnon 2010, Bentea & Durleman 2022, Haendler et al. 2015) can be explained by the mismatch in the Person feature

between the moved object and the intervening subject, Person being another overtly marked feature on the inflectional head that is relevant for the computation of intervention effects.

- (7) Show me the grandmother that I am watching.  
           +R+NP+3<sup>rd</sup> pers                    -NP +1<sup>st</sup> pers

Research suggests that the status of Person and Number features is not equivalent with regards to numerous grammatical phenomena (Nevins, 2011). For example, *pro*-drop appears in languages that morphologically distinguish person in verbal agreement (Vikner 1997). Rodrigues (2004) shows that *pro*-drop was lost in Brazilian Portuguese when the morphosyntactic distinction between 2<sup>nd</sup> and 3<sup>rd</sup> person disappeared, although the language preserved the singular-plural distinction. It would thus be intriguing to find a differential impact of Person and Number features on the comprehension of ORs.

In this study, we therefore investigated the role of pronominal interveners in the acquisition of relative clauses in French with the aim of determining (i) whether mismatches in Person and Number features modulate intervention effects in ORs and (ii) whether there is a differential impact of these features on OR comprehension.

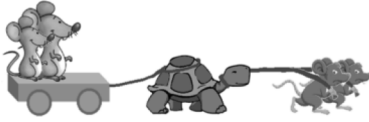
## 2. Participants

Fifty-four typically developing French-speaking children, aged 4;3 to 5;9 (mean age 4;10, standard deviation (SD) 5.3 months) took part in a comprehension task that consisted of choosing the correct character among three possible choices. All children were recruited from public schools in Geneva and were tested individually during a twenty-minute session that took place at their school. The study was approved by the Service de la Recherche en Éducation (Department of Research in Education) of the canton of Geneva and parents provided written consent for their child to participate.

## 3. Method and materials

We assessed children's comprehension of object relative clauses in a character selection task in which children had to identify the correct referent of the relative clause head by pointing to one of three characters in the display (see Figure 1). The intervening subject was always a pronominal element, a 1<sup>st</sup> person or a 3<sup>rd</sup> person pronoun, and it appeared either in the singular or in the plural form. We thus used a 2x2 factorial design in which we manipulated the featural specification of the subject in order to assess the effect of Person (1<sup>st</sup> person vs 3<sup>rd</sup> person) and of Number (singular vs plural) on the comprehension of object relative clauses headed by a lexically-restricted noun phrase. The four conditions that we tested in the study, together with the corresponding images, were as follows:

- (8) Regarde la tortue! Montre-moi les souris qu'elle tire.  
 'Look at the turtle. Show me the mice that she is pulling.'



**Figure 1. Example of image corresponding to a trial with a plural OR head and 3<sup>rd</sup> person singular subject (*elle*)**

- (9) Regarde les deux souris! Montre-moi la chenille qu'elles arrosent.  
 'Look at the two mice. Show me the caterpillar that they are splashing.'



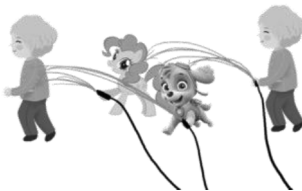
**Figure 2. Example of image corresponding to a trial with a singular OR head and a 3<sup>rd</sup> person plural subject (*elles*)**

- (10) Et ici c'est moi. Montre-moi les grand-mères que je regarde.  
 'And here it's me. Show me the grandmothers that I am watching.'



**Figure 3. Example of image corresponding to a trial with a plural OR head and a 1<sup>st</sup> person singular subject (*je*)**

- (11) Me voilà ici avec Stella. Montre-moi la grand-mère que nous arrosons.  
 'Here I am with Stella. Show me the grandmother that we are splashing.'



**Figure 4. Example of image corresponding to a trial with a singular OR head and a 1<sup>st</sup> person plural subject (*nous*)**

Examples (8) and (9) illustrate object relative clauses with a 3<sup>rd</sup> person singular (*elle* ‘she’) and a 3<sup>rd</sup> person plural pronoun (*elles* ‘they’), respectively. The sentences (10) and (11) are examples of object relatives with a 1<sup>st</sup> person singular (*je* ‘I’) and a 1<sup>st</sup> person plural pronoun (*nous* ‘we’). There were 8 items for each condition. As shown by the examples above, all the object relatives in the study contained a mismatch in number between the head noun and the intervening subject. In half of the conditions the head of the relative clause was plural and the embedded subject was singular (as in (8) and (10)), while in the other half the head noun was singular and the intervening subject was plural (see examples (9) and (11)). Given that there is no audible difference in French between *elle* (she) in the singular and *elles* (they) in the plural, we signaled the plural form of the pronoun either by using verbs with audible number agreement which take a different form when combined with a 3<sup>rd</sup> person plural subject (e.g. *suivre* ‘follow’, *poursuivre* ‘chase’) or by using verbs that start with a vowel (*arroser* ‘splash’, *attraper* ‘catch’) and which trigger the use of the *liaison* in French, thus rendering the plural marking on the pronoun audible through the pronunciation of the linking consonant *-s*.

The set-up of the study was similar to the one used in Bentea & Durrleman (2022) which also tested the effect of a mismatch in person features on the comprehension of relative clauses. Similarly to Bentea & Durrleman (2022), we used Belle, a pink pony, as narrator of the task and as referent for the first person pronoun *je*. Since in the current study we were interested in testing the effect of number mismatch on relative clauses with pronominal interveners, we also used the 1<sup>st</sup> person plural pronoun *nous* as intervener. In order to ensure that the referent for *nous* was clearly identified in the task, the pink pony (Belle) introduced herself at the beginning, together with her dog friend Stella, and explained that she would show the children images about herself, her and Stella, and their friends. Whenever Belle appeared in an image alone (Figure 3), she would refer to herself as *je* ‘I’, and she would use *nous* ‘we’ whenever she appeared with Stella (Figure 4). The lead-in for test sentences containing a 3<sup>rd</sup> person pronominal subject (*elle* ‘she’ or *elles* ‘they’) introduced the antecedent of the pronoun, thus ensuring pronominal referents were made salient in the preceding context (see examples (8) and (9)).

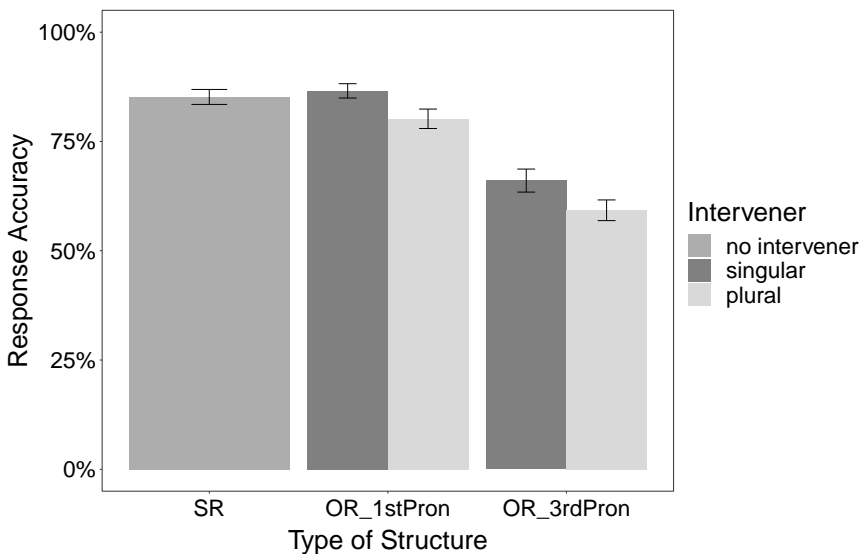
In addition to the test times containing object relative clauses, we also included 8 subject relative clauses in which both the head noun (the subject) and the embedded noun (the object) contained a lexical restriction. We used these items as baseline items against which to compare children’s performance of object relative clauses with an embedded pronominal subject. We also included 20 filler items, half of which were sentences of the type *Show me the turtle.*, and half were questions like *Who is combing the king?*. Children therefore saw a total of 60 items, which were preceded by two practice items aimed to show the children what they have to do in the task.

The task started with a familiarization phase in which the experimenter told the child that they would meet a puppet who likes to play games with children. The experimenter then introduced Belle (a pink pony puppet) who started

interacting with the children and explaining that they will play a game together in which children will see various images of herself, Belle, her friend Stella the dog, as well as many other images of Belle's friends. The child's task was to listen carefully and choose the correct character after each sentence they'd hear. The sentences were pre-recorded by a French native-speaker and presented together with the images on a laptop screen. The order of presentation of the items was pseudo-randomised. In order to interpret object and subject relative clauses correctly, children had to point to one or the other of the characters/ pairs of characters on the sides. We counter-balanced the position of the correct character, as well as the direction of the action among trials. Therefore, to prevent children from developing an answer strategy by pointing only to the characters on the sides, the correct answer for the filler sentences was always the character in the middle.

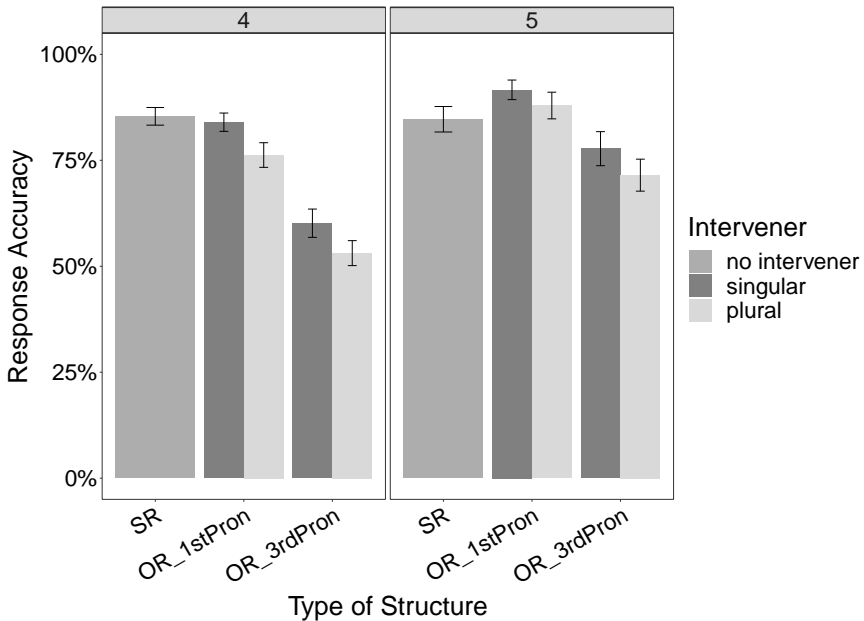
#### 4. Results

Figure 5 gives an overview of children's comprehension accuracy for the baseline condition (subject relatives – SR) and for the test conditions (object relatives with a 1<sup>st</sup> person pronominal subject – ORs\_1<sup>st</sup> Pron – and object relatives with a 3<sup>rd</sup> person pronominal subject – ORs\_3<sup>rd</sup> Pron). The results reveal that 4- to 5-year-old French-speaking children comprehend well both SRs and ORs in which the subject is a 1<sup>st</sup> person pronoun (*je* and *nous*), however they display lower accuracy scores for ORs with a 3<sup>rd</sup> person pronoun as embedded subject.



**Figure 5. Response accuracy for SRs and for ORs with a singular or a plural pronominal subject. The bars represent the standard error.**

The same performance pattern also holds when breaking down the results for each age group (Figure 6). Although comprehension improves overall in the 5-year-old compared to the 4-year-old children, the older children still have more difficulties with the correct interpretation of object relatives in which the subject is a 3<sup>rd</sup> person pronoun (singular or plural).



**Figure 6. Response accuracy for SRs and for ORs with a singular or a plural pronominal subject for 4-year-old (4) and 5-year-old (5) children. The bars represent the standard error.**

We fit the accuracy data to a generalized linear mixed model using the *lme4* package (Bates, Maechler, Bolker, & Walker 2015) in the R environment (R Development Core Team 2022). Since we were interested on the effect of person and number on the comprehension of object relatives, we only analysed the response accuracy for the OR items, without including the SRs. The fixed predictors in the model were Condition (OR\_1<sup>st</sup>-Pron vs. PR\_3<sup>rd</sup>-Pron) and Intervener (singular vs. plural). These were coded using repeated contrast coding, which allows to compare the factor levels against each other. Age was a continuous predictor in the model and intercepts for random effects of subjects and items. We also included random intercepts for participants (ID) and items (Item), as well random slopes for Condition by participant. The model output given in Table 1. The statistical analysis revealed a significant effect of Condition with a comprehension advantage for object relatives with a 1<sup>st</sup> person pronominal subject (indicated as 2 in Table 1) compared to object relatives with a 3<sup>rd</sup> person



pronominal subject (represented as 1 in Table 1). There was also a significant effect of Intervener showing that object relatives were overall comprehended better when the intervener was a pronoun in the singular, in other words, when the head of the relative clause was plural and the intervener singular. The effect of age also turned out significant indicating that children’s comprehension of object relatives improved with age. The interaction between Condition and Intervener was not significant.

**Table 1. Summary of GLMM output (fixed effects) for response accuracy on the comprehension of object relative clauses by French-speaking children.**

<i>Predictors</i>	<b>CorrectAnswer</b>		
	<i>Odds Ratios</i>	<i>CI</i>	<i>p</i>
(Intercept)	4.06	2.96 – 5.57	<b>&lt;0.001</b>
Condition2-1	3.69	2.43 – 5.59	<b>&lt;0.001</b>
Intervener2-1	0.62	0.43 – 0.89	<b>0.009</b>
AgeMonths	1.08	1.02 – 1.13	<b>0.006</b>
Condition2-1:Intervener2-1	0.68	0.33 – 1.39	0.294
Observations	1728		
Marginal R <sup>2</sup> / Conditional R <sup>2</sup>	0.129 / 0.333		

## 5. Discussion

With this study we examined whether mismatches in Person and Number features between the OR head and an intervening pronominal subject have a similar or a different impact on the comprehension of object relatives in French. We compared children’s comprehension of object relative clauses containing either a singular or a plural 3<sup>rd</sup> person pronoun as embedded subject, as well as their comprehension of object relative clauses containing either a singular or a plural 1<sup>st</sup> person pronoun. All the structures tested contained a mismatch in Number features between the OR head and the embedded subject (when the intervening subject was a singular pronoun *elle* or *je*, the OR head was plural and when the intervening subject was a plural pronoun *elles* or *nous*, the OR head was singular). This allowed us to assess only the effect of a Number mismatch in ORs with a 3<sup>rd</sup> person pronoun as subject and the effect of a Number and a Person mismatch in ORs with 1<sup>st</sup> person pronoun subjects.

Our results reveal that children comprehend ORs with a person mismatch due to an intervening 1<sup>st</sup> person pronoun very well, on a par with SRs. In contrast, they show lower performance with ORs in which the head noun and the embedded pronominal subject display a Person match (i.e. they are both +3<sup>rd</sup> person).

However, when comparing the current results to those reported in Bentea & Durrleman (2022) who assessed the comprehension of ORs with a 3<sup>rd</sup> person pronominal subject matching in Number features with the object head (both were singular), we observe that this difficulty with ORs containing a 3<sup>rd</sup> person pronominal intervener is alleviated in the presence of a number mismatch. While the percentage of correct responses in the current study was between 59% and 66%, the children in Bentea & Durrleman’s study only gave 50% correct responses. Therefore, the presence of a Number mismatch helps comprehension by creating an intersection relation between the features specified on the OR head and the features of the intervening subject, and this intersection relation is easier for children to compute.

Interestingly, the effect of this number mismatch has a stronger impact when the OR head is plural and the intervener is singular (12), than when the head is singular and the intervener plural (13).

(12) Montre-moi **les souris** qu’ **elle** tire.  
 +R +NP +3<sup>rd</sup> pers +PL -NP +3<sup>rd</sup> pers +SG  
 ‘Show me the mice that she is pulling.’

(13) Montre-moi **la chenille** qu’ **elles** arrosent.  
 +R +NP +3<sup>rd</sup> pers +SG -NP +3<sup>rd</sup> pers +PL  
 ‘Show me the caterpillar that they are splashing.’

This is in line with previous findings in French (Bentea & Durrleman 2021) showing that when the marked value (plural) of the mismatching Number feature is present on the OR head, this configuration seems to give rise to a greater degree of distinctness between the target X and the intervener Z than when the unmarked value (singular) is present on the OR head and the marked value (plural) is specified on the intervener.

The results that we obtain for ORs with a 1<sup>st</sup> person pronoun are comparable to those of Bentea & Durrleman (2022). In this case, we see similar performance irrespective of the presence or absence of a mismatch in Number features. This suggests that Person has a larger impact than Number in locality computations and can be indicative of a hierarchy for the effects of features on the comprehension of A’-dependencies, in which Person > Number. This is in line with processing studies on pronoun resolution and agreement violations suggesting the greater salience of the Person feature than the Number feature at multiple levels of representation.

## 6. Conclusion

To conclude, we see that difficulties with object relative clauses stem from intervention effects which arise in the absence of a lexical NP restriction. Indeed these effects were clear even with pronominal interveners, provided these pronouns matched in morphosyntactic features with the head of the chain. The

morphosyntactic features examined in this work were Person and Number: all configurations included mismatches in number, while we modulated a mismatch in Person. Considered together with previous work (Bentea & Durrleman, 2022) where Number was also modulated, we were able to observe that while both Person and Number are relevant for the computation of locality, they impact this computation to different degrees. More specifically, mismatches in Person appear to trigger a stronger alleviation on OR comprehension than mismatches in Number. Regarding Number more specifically, the findings also suggested that in mismatch contexts, when the marked (plural) feature is encoded on the head of the chain, the effect is stronger than when the unmarked (singular) feature is realized in this initial position. Future work is however necessary to determine if this directionality effect is indeed a robust one.

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