

## When Unmarked Case matters: Processing Agreement in Hindi

**Introduction.** In Hindi *either a subject or an object* can determine verbal agreement. This is because accessibility for agreement is contingent on being unmarked for case in Hindi, which is distinct from other languages like English, where accessibility for verbal agreement is based on grammatical function (subjecthood) [1,2]. Most previous research on the processing of agreement has looked at this latter set of languages (subject agreement languages), but not examined agreement systems where unmarked case is a deterministic cue for agreement. The current study on Hindi aims to address this gap. The results lend support to the *unmarked case hypothesis* - an unmarked attractor interferes with the processing of agreement relative to an overtly case marked one making the process more error prone. This result points to the parser’s sensitivity not only to overt morphology but also to grammaticized unmarked categories.

**Case determines agreement in Hindi:** *Verbal agreement is with the most prominent argument that is unmarked for case* [2]. In (1) and (2), the verb agrees with the subject since it is *unmarked* for case, that is, it bears no overt case-morphology. In (3) and (4), the overt ergative case-marker *-ne* rules out subject agreement and the unmarked object *book* is agreed with instead. The case status of the object – unmarked or marked – does not affect verbal agreement when the subject is unmarked. If all arguments are overtly case-marked, the verb displays default agreement.

- |  |   |
|--|---|
| (1) <b>laRkii</b> - $\emptyset$ kitaab- $\emptyset$ jaldi-se paRhegii<br>girl.F book.F quickly read.fut.F<br>'The girl will read the book quickly.'      | (2) <b>laRkaa</b> - $\emptyset$ kitaab- $\emptyset$ jaldi-se paRhegaa<br>boy.M book.F quickly read.fut.M<br>'The boy will read the book quickly.'   |
| (3) laRkii-ne <b>kitaab</b> - $\emptyset$ jaldi-se paRhi thii<br>girl.F-ERG <b>book</b> .F quickly read.pfv.F was.F<br>'The girl read the book quickly.' | (4) laRke-ne <b>kitaab</b> - $\emptyset$ jaldi-se paRhi thii<br>Boy-ERG <b>book</b> .F quickly read.pfv.F was.F<br>'The boy read the book quickly.' |

**Agreement and case in processing.** Previous work on subject agreement languages shows that grammatically illicit items can interfere with agreement processes and lead to *agreement attraction* errors. Speakers may produce agreement errors [3] - *\*the key to the cabinets are rusty* - due to an attractor noun which mismatches with the grammatical controller in its number feature - singular *key*, plural *cabinets*. However, production studies have shown that not all nominals interfere with agreement equally - attraction is modulated by overt case forms. [4] investigate production in Slovak with preambles where features and case forms of the grammatical agreement controller and the attractor were manipulated. They find that the likelihood of gender attraction depends on case forms such that high error rates were observed only when both the agreement controller and the attractor mismatched in gender and both nominals were case ambiguous between overtly-marked nominative and accusative declensions (bolded in 5). Similar results have been observed in Dutch and German [5,6], where too ambiguous overt case morphology is associated with an increase in agreement errors.

- (5) **Trest** za {zločin / vraždu / **krádež**} ...  
Punishment.M.AMBIG for crime.M.AMBIG murder.F.ACC theft.F.AMBIG  
The punishment for the crime/ theft/ murder...

**The Unmarked Case Hypothesis.** Since unmarked case is a grammaticized cue for identifying an agreement controller in Hindi, we might expect the online processing of agreement to be sensitive to this cue. Consequently, we predict that *interference in agreement processing should be greater in configurations where an attractor noun is unmarked for case compared to when the noun is overtly marked* leading to more errors in production.

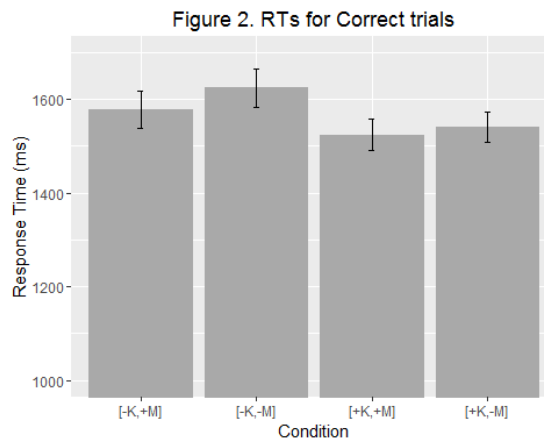
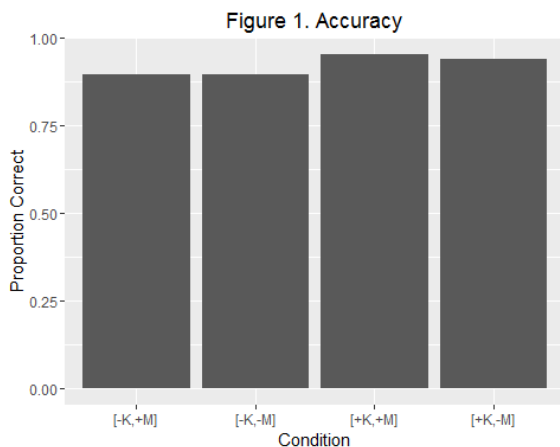
**Experiment: Mimicking Production - Manipulating Case on the Subject.** The unmarked case hypothesis was tested by measuring gender agreement attraction effects using embedded sentence fragments, (6). **Case** was manipulated on the subject: *unmarked* [-K] vs. overtly *marked* [+K] with *-ne*, like in (1,2 vs. 3,4). **Features** were manipulated: *Match* [+M] - both subject & object=feminine - vs. *Mismatch* [-M] - subject=Masculine, object=Feminine, like in (1,3 vs. 2,4). Objects were consistently unmarked for case. These case configurations translate to the subject being the agreement controller (bolded in 6a,b) and the object being the attractor in the [-K] conditions. In contrast, in the [+K] conditions, the object was the

agreement controller (bolded in 6c,d) and the subject was the attractor. The matrix subject was consistently case marked and the matrix verb bore default agreement. 24 items in 4 conditions were presented to Hindi speakers recruited by word of mouth (n=32). All items were presented word by word in centered RSVP format (word time=450ms) based on the methodology in [7]. This was followed by a binary choice decision task where participants selected either a masculine or feminine verb as the appropriate completion within a limited time window (3 seconds). The experiment also included 48 filler sentences.

- (6) **Item template:** matrix-Subject<sub>+K</sub> matrix-Verb<sub>DEFAULT-AGR</sub> that **Subject**-*K/+K* **Object**-*K* **Adverb** ...
- (a) [-K,+M] John-ne socaa ki **laRkii**- $\emptyset$  kitaab- $\emptyset$  jaldi-se (1)  
 John-ERG thought.DEFAULT that girl.F book.F quickly
- (b) [-K,-M] ... **laRkaa**- $\emptyset$  kitaab- $\emptyset$  jaldi-se (2)
- (c) [+K,+M] ... laRkii-ne **kitaab**- $\emptyset$  jaldi-se (3)
- (d) [+K,+M] ... laRke-ne **kitaab**- $\emptyset$  jaldi-se (4)

**Results:** See Table 1, and Figures 1 and 2, for the mean accuracy proportions and raw response times (for correct responses) in milliseconds with standard error in parentheses. A logistic mixed effects model analysis of the **accuracy data** revealed a **main effect of case** ( $z=2.61, p=0.009$ ). Participants were less accurate in the [-K] conditions relative to the [+K] conditions suggesting that an unmarked attractor leads to interference in computing agreement. No other effects – feature manipulation or the feature\*case interaction– were significant ( $ps > 0.5$ ). A linear mixed effects model analysis of log RT did not reveal any significant effects, though the effect of case trends in the expected direction ( $t=-1.82$ ) such that participants were numerically slower to respond in the [-K] conditions, that is, when the attractor was unmarked for case.

TABLE 1		Features on Subject & Object	
		+M	-M
Case (Subj)	-K	0.9 ; 1577(40ms)	0.89; 1624(41ms)
	+K	0.95; 1523(33ms)	0.94; 1541(33ms)



**Discussion.** In allowing subjects *and* objects to bear unmarked case and control verbal agreement, Hindi grammar allows us to examine the online processing of agreement in grammatical systems where unmarked case determines accessibility for agreement. The current experimental study shows that the presence of an unmarked attractor nouns is associated with lower accuracy in production. This result supports the *unmarked case hypothesis* since having multiple nouns (the grammatical agreement controller and the attractor) be unmarked for case makes the computation of agreement more error-prone. The effect of case is possibly independent of the feature manipulation since no interaction between case and features obtains. Furthermore, this result of an increased error rate due to an unmarked attractor suggests that not only is the human sentence processor sensitive to overt morphological material, as has been argued for in previous work in the field, but also that it exhibits sensitivity to unmarked material which has been grammaticized to be a deterministic cue for a syntactic dependency in the language.

**Selected References:** [1] Bobaljik 2008. [2] Bhatt 2005. [3] Bock & Miller 1991. [4] Badecker & Kuminiak 2007. [5] Hartsuiker et al 2001. [6] Hartsuiker et al 2003. [7] Staub 2009.