Number morphology in Hindi coordinative compounds

Introduction: We examine number morphology on Hindi coordinative noun compounds (CNCs) (e.g., *dog-cat* in (1)). Two common semantic approaches to number are shown to be inadequate for analyzing number morphology on these CNCs. We propose an alternate account, where Hindi number morphology is sensitive to *minimality* (cf. Harbour 2014, Marti 2020).

Number morphology: Singular nouns in Hindi are not overtly marked, while plural marking varies by case and gender. (2) shows that in CNCs, number morphology can only appear on the second noun. We propose that number morphology attaches to the CNC as a whole, and the semantics for number morphology in CNCs will have to take this into account. Evidence that number morphology attaches to the CNC as a whole and not just the second noun comes from the fact that gender-based allomorphy of the plural affix is controlled by the gender of the entire CNC, and not just the second noun. In Hindi, masculine nouns take a null affix, but feminines takes -ã or -ẽ (depending on final vowel). Mixed gender CNCs like in (3) take the null masculine plural affix, even if the second noun is feminine, since the gender of the compound is masculine, as shown by its verb agreement. Feminine plural affixes -ã/-ẽ appear on a CNC only if the compound is feminine, i.e., when both nouns are feminine, as in (2). In the oblique cases, where nouns, regardless of gender, take -õ, a mixed gender CNC do take an overt plural affix, as in (4).

Disjunctive readings: While typically interpreted as collective coordination, both singular and plural CNCs have a disjunctive meaning in downward monotonic (DM) environments like (5)-(6). Compounding differs from overt conjunction in (7), which lacks this meaning. We assume, with Benbaji et al (2022), that the compounding operator, *C* means disjunction, as in (8)-(9).

(8) $[\![C]\!] = \lambda f_{et}.\ \lambda g_{et}.\ \lambda x_e.\ f(x) = 1 \text{ or } g(x) = 1$

(9) If $[\![dog]\!] = \{d_1, d_2\}$ and $[\![cat]\!] = \{c\}$, then $[\![C]\!]([\![dog]\!])([\![cat]\!]) = \{d_1, d_2, c\}$.

This gives the denotation for the singular disjunctive reading. The plural one is derived by applying the distributivity operator, *Dist* to the compound, as shown in (11).

(10) $[\![Dist]\!] = \lambda f_{et}.\ \lambda x_e.\ \forall y \leq_{atom} x\ [f(y) = 1]$

(11) $[\![Dist]\!]([\![C]\!]([\![dog]\!])([\![cat]\!])) = [\![Dist]\!](\{d_1, d_2, c\}) = \{d_1, d_2, c, d_1 \oplus d_2, d_1 \oplus c, d_2 \oplus c, d_1 \oplus d_2 \oplus c\}$

Collective readings: Outside DM environments, compounding means collective coordination. Here, a singular CNC denotes a set of pluralities with two atoms, one each from each noun's denotation: in (1), one dog and one cat were seen. Plural CNCs under a collective reading refer to pluralities with 3 or more atoms: in (12), a cat, a dog and at least one more cat/dog were seen. Collective CNCs ***cannot*** be analyzed like a collective predicate like *pair*. (13) and (14) show that we get distinct counting inferences with a CNC and *pair.* (15) shows that a singular CNC is compatible with a reciprocal, but a collective predicate is not. For these reasons, we treat singular and plural CNCs with a collective reading as a predicate of plural individuals rather than like a noun like *pair*. We derive the collective reading from the plural disjunctive one via a scalar implicature, implemented with a predicate-level exhaustification operator.

(16) $[\![Exh_{pred}]\!] = \lambda f_{et}.\ \lambda x_e.\ f(x) \text{ and } \forall g \in Alt(f)[f \not\subseteq g \rightarrow g(x) = 0]$ (Mayr 2015)

Exh_{pred} applies to a set and removes members of the set also present in the set's alternatives. (17)-(18) illustrate the derivation of the collective reading of the plural CNC *dog-cat-PL*. The relevant alternatives are constructed by replacing the compound with each constituent noun. Applying Exh_{pred} to the set in (11) removes individuals that consist only of dogs or only of cats.

(17) $Alt([\![Dist]\!]([\![C]\!]([\![cat]\!])([\![dog]\!]))) = \{[\![Dist]\!]([\![dog]\!]), [\![Dist]\!]([\![cat]\!])\}$

(18) $[\![Exh_{pred}]\!]([\![Dist]\!]([\![C]\!]([\![cat]\!])([\![dog]\!])))$

$= \lambda x_e.[[\![Dist]\!]([\![C]\!]([\![cat]\!])([\![dog]\!]))](x) = 1\ \&\ [[\![Dist]\!]([\![dog]\!])](x) = 0\ \&[[\![Dist]\!]([\![dog]\!])](x) = 0$

$= \{d_1 \oplus c, d_2 \oplus c, d_1 \oplus d_2 \oplus c\}$

The distribution of Exh_{pred} is subject to the general constraint on exhaustification that it should not lead to a globally weaker meaning (Fox & Spector 2018), ruling it out in the DMEs in (5)-(6). Each individual in the set in (18) contains at least one cat and one dog. But, as noted above, the plural CNC has a stronger meaning, only allowing reference to individuals with at least three atoms. We assume this strengthening is due to competition with the singular version of this CNC, which denotes the set of the two-sized individuals in the set in (18). This strengthening likely involves an exhaustification operator too, but we leave open its exact implementation.
To derive the conjunctive reading of singular CNCs, not accounted for by Benbaji et al (2022), we use the operator *MIN* given in (19).

(19) $[\![MIN]\!] = \lambda f_{et}.\ \lambda x_e.\ f(x) = 1 \text{ and } \forall y\ [y < x \rightarrow f(y) = 0]$ (cf. Winter 2002, Champollion 2016)

This operator applies to a set and returns the set of those individuals which do not properly contain any other individual in the original set. The conjunctive reading of singular CNCs is derived by applying *MIN* to the structure associated with their corresponding plural versions. Applied to (18), this picks out only the pluralities made up a single dog and a single cat.

(20) $[\![MIN]\!]([\![Exh_{pred}]\!]([\![Dist]\!]([\![C]\!]([\![cat]\!])([\![dog]\!])))) = [\![MIN]\!](\{c_1 \oplus d, c_2 \oplus d, c_1 \oplus c_2 \oplus d\})$
$= \{c_1 \oplus d, c_2 \oplus d\}$

Analyzing number: Singular morphology on CNCs under the collective reading is problematic for two prominent analyses of number morphology. Plural-as-*Dist* analyses assume that plural morphology is the realization of *Dist* or some analogous operator like * (e.g., Mayr 2013). This wrongly predicts that singular CNCs under the collective reading should appear with plural morphology, since they use *Dist*, as seen in (20). Singular-as-atomic analyses assume singulars have a presupposition of atomicity and plurals are vacuous, only used when the atomicity presupposition is not satisfied. (e.g., Sauerland 2003). An implementation of this idea would be to say that singular combines with the set denoted by the NP and contributes the presupposition that this set only consist of atoms. This analysis also incorrectly predicts plural morphology on singular CNCs under the collective reading: the set in (20) is made up of non-atoms.

A 'minimal' semantics: We propose that SG and PL have the denotations in (21)-(22). They apply to sets denoted by NPs (regular nouns or CNCs), and return the same set. SG presupposes that all individuals in the set are the minimal element of that set, i.e. they do not contain any proper subparts also in the set. PL does not impose any presupposition. It only occurs when the presupposition of SG is not satisfied due to Maximize Presupposition (cf. Sauerland 2003).

(21) $[\![\text{SG}]\!] = \lambda f_{et}.\ \forall x\ [f(x) \rightarrow \forall y < x\ [f(y) = 0]]:\ f$

(22) $[\![\text{PL}]\!] = \lambda f_{et.}\ F$

For a set made up only of atoms, the presupposition of SG is satisfied, as no atom properly contains any other atom. But for a set of atoms and their sums, it is not, since the sum of the atoms at the very least properly contains the atoms. This predicts SG with the former and PL with the latter. This derives number morphology on non-compounded nouns, and disjunctive CNCs. For CNCs under the collective reading, the set in (18) does not satisfy SG's presupposition. The individual $d_1 \oplus d_2 \oplus c$ is non-minimal as it contains the other two elements in the set. This correctly predicts PL on such CNCs. But the set in (20) does satisfy the presupposition of SG. The individuals in this set, though not atomic, do not properly contain any individual in the set. This correctly predicts SG on such CNCs.

Conclusion: Singular CNCs under a collective reading provide evidence for a semantics of Hindi number morphology that is sensitive to minimality. This is in line with recent work (Harbour 2014, Martí 2020) that argue, based on independent reasons, that number features with similar semantics exist cross-linguistically.

(1) ʊsne kɪsi **kʊtte-bɪlli** =ko dekha
he some dog-cat =ACC saw
'He saw a dog and cat.'

(2) **mã(*-ẽ)-bɛhɛn-ẽ** gəĩ
mother-sisters-F.PL went.F.PL
'The mothers and sisters went.'

(3) **bhai-bɛhɛn-õ/*ẽ** gəe
brother-sister-M.PL/*F.PL went.M.PL
'The brothers and sisters went.'

(4) **bhai-bɛhɛn-õ** =ko dekho
brother-sister-OBL.PL =ACC look.at
'Look at the brothers and sisters.'

(5) əgər tʊmne kɪsi kʊtte-bɪlli =ko dekha to bətana
if you some dog-cat =ACC see then tell
'If you see a dog **or** cat, tell me.'

(6) əgər tʊmne kʊtte-bɪlli-õ =ko dekha to bətana
if you dog-cat-OBL.PL =ACC see then tell
'If you see dogs **or** cats, tell me.'

(7) əgər tʊmne kɪsi kʊtte ɔr bɪlli =ko dekha to bətana
if you some dog and cat =ACC see then tell
'If you see a dog **and** cat, tell me.'

(12) ʊsne kʊtte-bɪlli-õ =ko dekha
he dog-cat-OBL.PL =ACC saw
'He saw dogs and cats.'/ 'He saw a dog and cats.'/ 'He saw dogs and a cat.'

(13) tin kʊtte-bɪlli-õ =ko
three dog-cat-OBL.PL =ACC
'To three cats & dogs' (**3** animals total)

(14) tin joɽi-õ =ko
three pairs-PL =ACC
'To three pairs (**6** people total)'

(15) kɪsi kʊtte-bɪlli/ ??joɽi =ne ek-dusre =ko dekha
some dog-cat/ ??pair =ERG each-other =ACC saw
'A dog and cat/??pair saw each other.'

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