Numerals and Number Marking in English, Turkish and Armenian

Alan Bale (Concordia), Michaël Gagnon (Maryland), Hrayr Khanjian (MIT)

In this paper, we propose that, cross-linguistically, there are two different interpretations for numerals: subsective versus intersective. These two interpretations can account for three types of languages: (i) those in which numerals exclusively combine with singular nouns (e.g., Turkish); (ii) those in which they exclusively combine with plurals (e.g., English); and (iii) those in which they combine with either type (e.g., Armenian).

Proposals & Controversy: Cross-linguistically, numerals (greater than one) behave differently with respect to the requirements they impose on the nouns they modify. The numeral *two* in English requires a plural noun (1a), whereas the Turkish counterpart of *two*, *iki*, requires a bare, singular noun (1b). In contrast to both, the Armenian counterpart, *yergu*, can modify either a plural or bare, singular noun (1c).

(1)   a. two boys/*boy
       b. iki çocuk/*çocuk-lar (two boy / boy-PL)
       c. yergu dəgha / dəgha-ner (two boy / boy-PL)

Ionin & Matushansky (2006) [hereon IM] proposed that bare, singular nouns in any language denote sets of individuals and that underlyingly, all languages are similar to Turkish, where numerals exclusively combine with singulars. Similar to Krifka (1995), they suggest that the plural nouns in (1a&c) are converted to singular denotations via a classifier. Given this perspective, they hypothesize that numerals such as *two/iki/yergu* are interpreted as functions from singular predicates to sets containing groups of two: see (2), where x ranges over groups, *PART(x)* is the set of all partitions of the group x, and $| |$ is the standard cardinality operator.

(2) $[\![two]\!] = \lambda P_{sg}.\{x: \exists Y(Y \in PART(x) \ \& \ |Y|=2 \ \& \ \forall z(z \in Y \rightarrow z \in P_{sg}))\}$

The function in (2) maps singular denotations to the set of groups such that each group can be partitioned into two and each member of the partition is a member of the singular noun. The variable P_{sg} ranges over sets without sums: $\forall P_{sg}(\forall x,y[x,y \in P_{sg} \rightarrow \sim \exists z[z \in P_{sg} \ \& \ z=x \oplus y]])$. According to IM, the phrase $[\![two\ boys]\!]$ would be equivalent to $[\![two]\!]([\![boy]\!])$. If $[\![boy]\!]$ were {*a, b, c*}, then $[\![two]\!]([\![boy]\!])$ would be {*ab, ac, bc*}. Under this proposal, numeral modifiers could be called privative (in the sense of Partee, 2009): the modified noun denotation does not contain any of the same members as the original denotation.

In contrast to IM, Link (1983) and others have proposed that numeral modifiers simply restrict plural nominal denotations and thus are non-privative, just like most adjectival modifiers. A non-privative semantics for the numeral could be represented as in (3a) or (3b).

(3)   a. $[\![two]\!] = \lambda P_{pl}.\{x: x \in P_{pl} \ \& \ \exists Y(Y \in PART(x) \ \& \ |Y|=2 \ \& \ \forall z(z \in Y \rightarrow z \in MIN(P_{pl})))\}$
       b. $[\![two]\!] = \{x: \exists Y(Y \in PART(x) \ \& \ |Y|=2 \ \& \ \forall x(z \in Y \rightarrow z \in ATOM))\}$

The interpretation of *two* in (3a) is subsective since it is a function from plural denotations to groups that can be partitioned into two minimal parts of the plural denotation. The variable P_{pl} ranges over sets that are closed under $\oplus$: $\forall P_{pl}(\forall x,y[x,y \in P_{pl} \rightarrow x \oplus y \in P_{pl}])$. *MIN* is a function that restricts a denotation to its atomic minimal parts. As a result, it is only defined if the minimal parts are non-overlapping: *MIN(P)* is defined iff $\forall x,y(x,y \in P \ \& \ \sim \exists z(z \in P \ \& \ z<y \lor z<x) \rightarrow x \cap y = \varnothing)$. Note, (3a) relativizes the criteria for counting to the noun it modifies. In (3b), *two* is interpreted as the set of groups that can be partitioned into two atoms, without any relativization to the modified noun. As a result, this type of denotation can modify a plural noun through intersection: $[\![two\ boys]\!] = [\![two]\!] \cap [\![boys]\!]$. On the surface, the subsective and intersective interpretation seem to be incompatible with the data in (1b) and (1c).

Theory Comparison: Surprisingly, the semantics in (3) provides a better account of the cross-linguistic variation we see in (1). To understand why, one must investigate the details of plural and singular denotations in English, Turkish and Armenian. In English, the denotation of the bare singular noun contains individuals but not plurals. This is demonstrated by the use of the noun in predicative position as shown in (4).

(4)   a. John is a boy.
        b. ?John and Harry are a boy.

Singular boys, such as John, can serve as the subject to the predicate and yield a true sentence, as in (4a), but groups cannot, as in (4b). Note that syntactic agreement is not an issue here since singular mass nouns can often take plural subjects (e.g., *That couch and chair are furniture*). In contrast, singular nouns in Armenian and Turkish can have groups serving as subjects. As shown in (5), the group consisting of John and Brad can serve as the subject to the singular bare nouns *çocuk* in Turkish and *dəgha* in Armenian. The resulting sentences have a meaning identical to *John and Brad are boys*.

(5)   a. John ve Brad çocuk. (John and Brad boy)
        b. John-ə yev Brad-ə dəgha en. (John-def and Brad-def boy are)

As shown in (6), the singular nouns can also have singular subjects.

(6)   a. John çocuk. (John boy)
        b. John-ə dəgha e. (John-def boy is)

In contrast to English, singular nouns in Turkish and Armenian are actually semantically plural. The denotations of such nouns contain not only atomic minimal parts, but also any group that can be formed from those parts. The denotation of plural nouns in Armenian and Turkish are similar to the singular denotation, in that they can be predicated of groups, as shown in (7).

(7)   a. John ve Brad çocuk-lar. (John and Brad boy-PL)
        b. John-ə yev Brad-ə dəgha-ner en. (John-def and Brad-def boy-PL are)

However, as shown in (8), the plural noun cannot be predicated of singular individuals.

(8)   a. *John çocuk-lar. (John boy-PL)
        b. *John-ə dəgha-ner e/en. (John-def boy-PL is/are)

Thus, the plural denotations differ from the singulars in that they contain groups but no atomic minimal parts.

The nature of the singular denotations in English, and the assumption that *two* is interpreted as subsective or intersective modification, explains why English numerals can only combine with plural nouns. Subsective and intersective modification requires that the modified noun contain groups. Only the plural nouns in English contain such groups.

The natures of the singular and plural denotations in Turkish, and the assumption that *iki* is interpreted as a subsective modifier, explain why Turkish numerals can only combine with singulars. The subsective interpretation in (3a) requires that the modified noun be closed under ⊕ and that it have atomic minimal parts. The singular denotation, unlike the plural one, is **both** closed under ⊕ and has atomic minimal parts.

Finally, the natures of the singular and plural denotations in Armenian, and the assumption that *yergu* is interpreted as an intersective modifier, explain why Armenian numerals can combine with both singulars and plurals. The intersective interpretation in (3b) only requires that the denotation be closed under ⊕; no mention of atomic minimal parts is made. Since both the singular and plural are closed under ⊕, either can be modified by the intersective modifier.