Degrees, times and events: view from amount and event numerals
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Background: even though numerals in general (e.g., Landman (2012), Krifka (2003) a.o.) and Slavic numerals as well (e.g., Ionin and Matushansky (2006), Khrizman and Rothstein (2013) a.o.) received a lot of attention in the semantic literature, there is still a vast empirical territory left unexplored. In this paper, we bring new evidence from two typologically entirely unrelated languages, i.e., Czech and Vietnamese, which fills some of the gaps. We focus on (i) a class of virtually understudied numerals which we call amount numerals (AN), see Czech and Vietnamese examples in (1) and (2); and (ii) a closely related class of numerals counting events (EN), see Czech and Vietnamese examples in (3), (4) respectively; again only rarely studied (Landman (2006), Donazzan (2012)). Intuitively, unlike cardinal numerals, AN and EN count via multiplication. The main goal of our paper is to provide a formal semantic description of ANs and ENs which would contribute to the linguistic understanding of compositionality in numerical NPs, to account for numerals quantifying over degrees/events, and finally to compare two linguistic strategies of ANs/ENs. In sum, this will shed some light on universal semantic tendencies in the composition of numerals with nouns.

Analysis: 1) AN: to systemize the data we carried out a corpus-based study (Czech National Corpus, SYN2010) and classified the collocations of ANs into three representative sub-classes (descending sort by frequency): (i) ANs quantifying over amounts (typical examples: dvojnásobně množství diváků ‘double number of spectators’, dvojnásobná rychlost auta ‘double speed of a car’); (ii) ANs quantifying over social, family, etc. roles (dvojnásobný šampion ‘double champion’, dvojnásobná matka ‘double mother’, …); (iii) AN quantifying over events (via event nouns) like dvojnásobná vražda ‘double murder’, dvojnásobné oslavení ‘double power play’, etc. As for Vietnamese, though we cannot rely on a corpus search for collocations, intuitions of native speakers (n ≈ 7) conform with the picture emerging from the Czech data and similar to Czech, native speakers of Vietnamese intuitively claim the type (i) to be the basic one (prototypical examples (1) and (2)). In the theoretical description of the type (i) we follow Hackl (2000) in positing the parametrized cardinality determiner many (an intersection of NP/VP denotations). However we forked Hackl’s many into (7), i.e., manyₐ: we assume that manyₐ represents the semantics of the morpheme -násobn- in Czech and the gáp-Num-lân construction in Vietnamese, it intersects NP with VP and is true iff NP in the intersection has the degree d (denotation of the numeral). The degree can be quantified directly in the adverbial version of AN (e.g. Czech dvojnásobně dlouhý ‘doubly long’) or via measure function (MF) as in (1) length(key) – nouns in most cases don’t have a degree argument. The composition of AN with a noun and predicate like in (1)/(2) is straightforward and leads to the intuitively valid truth conditions in (7-a)/(7-b): the multiplication quantifies either over contextually determined standard degree as in (7-a) or over a degree provided by the clausal standard as in (7-b). The translation between manyₐ quantifying over degrees and its corresponding noun is in most cases done via an MF word (relating a given entity, denotation of the noun, to maximally one number on a scale: e.g. rychlost auta ‘speed of car’, the MF maps the car to the degree on its speed scale); in (1)/(2) the scale is the degree of the key’s length/subject’s salary. For AN quantification over events/social roles we assume that in Czech there is a silent temporal trace function (τE) mapping between events/_intervals of being in a social role which then can be quantified over by the degree part of manyₐ: dvojnásobná přesilovka ≈ λQ.∃xdd′[Q(x) ∧ τE(PowerPlay(x))] = d ∧ d = d′ * 2. Vietnamese brings a compelling evidence that such mapping is more complex than using an overt measure function as in (1)/(2), since Vietnamese doesn’t allow for prenominal version of (ii) and (iii) subtypes (see ungrammatical attempts to quantify over social roles/events in (6)) of AN and falls to the adverbial usage as in (5). As for 2) EN, they are used mostly to quantify over events as in (3)/(4); to account for such semantics we modify Hackl’s many again to (8), manyₑ, application of (8) to (3)/(4) is (8-a).
There is a sortal distinction between many_d and many_e – the later quantifies over events unlike the degree many_d; moreover there is one bound variable in many_d (Ωd') substituted with a fixed value 1 in many_e (unlike for degrees, for events there’s a standard of comparison, 1). But otherwise both formalizations share a common core: quantification over degrees/events is done by multiplication. The degree/cardinality is either supplied via an overt measure function (AM type i) or via τE (AN type ii and iii), or by measuring the cardinality of events (EN); both many_d and many_e have the same logical type: ⟨⟨⟨(n, (e, t)), (e, t)), t⟩⟩. This common core is well observable in Vietnamese where the same item (and its productive numerical alternatives gấp-Num-lần ‘Num-times’) either counts via many_d when the AN is prenominal as in (2) or it counts events (via many_e: signaled by only -lần morpheme) if the EN is postverbal as in (4). We assume that this follows from the Vietnamese lack of adjectival/adverbial morphological marking; Czech has to use two distinct lexical entries.

(1) Dvojnásobná délka klíče zajišťuje silnější šifrování.
‘Key of the double length provides stronger encryption.’

(2) Tiền-lượng của Petr gấp-hai-lần tiền-lượng của Karel
salary from Petr folded-twice-multiply salary from Karel.
‘Petr has double salary compared to Karel.’

(3) Petr mi volal dnes dvakrát.
Petr me called today twice
‘Petr called me twice today.’

(4) Hôm-nay Petr gọi cho tôi hai-lần rồi.
today Petr call for me twice already
‘Petr called me twice today.’

(5) Anh ấy dã hai-lần là chủ-tịch he DET already two-multiply be president
‘In the past has been president twice.’

(6) a. *gắp-hai-lần chủ-tịch
folded-two-time president ≈ ‘two-time president’

b. *gắp-hai-lán sują-chůțu
folded-two-time reconstruction ≈ ‘two-time reconstruction’

(7) \[\text{many}_d = \lambda n \lambda P \lambda Q. \exists x d''[Q(x) \land P(x) = d \land d = d'' * n \land \text{stnd}(d'')]\]

a. \[(1) = \exists x d''[\text{Prov}_{b} \text{et-enc'}(x) \land \text{Length}(\text{Key}(x)) = d \land d = d'' * 2 \land \text{stnd}(d'')]\]

b. \[(2) = \exists x a' d''[\text{Has}'(\text{Petr}, x) \land \text{Salary}'(x) = d \land d = d'' * 2 \land \text{Has}'(\text{Karel}, x') \land \text{Salary}'(x') = d']\]

(8) \[\text{many}_e = \lambda n \lambda \Theta \lambda Q. \exists e[Q(e) \land \Theta(e) \land \#(e) = n * 1]\]

a. \[(3)/(4) = \exists e[\text{Call'}(e) \land \text{Agens}(e) = \text{Petr} \land \#(e) = 2 * 1]\]