Measuring event participants

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Abstract

Measure nouns like *percent* can be interpreted reverse proportionally, as in "The company hired 50% women." The most influential analyses of this phenomenon derive it via association with focus, which is known to invert restrictor-scope relations for adnominal markers like *only* and *few*. I offer three arguments that reverse proportional readings in Korean are not focus-sensitive, and are instead simply adverbial modifiers quantifying over event participants, in the spirit of Nakanishi's (2007) analysis of bare numerals. I suggest that this opens the door to possible re-analyses of the data crosslinguistically.

1 Introduction

In their foundational work on quantification in natural language, Barwise and Cooper (1981) and Keenan and Stavi (1986) famously conjectured that all quantificational determiners are conservative on their second argument.

(1) Conservativity universal: For any determiner D, and sets R and S, $D(R)(S) = D(R)(R \cap S)$.

However, there are apparent counterexamples. Measure nouns like *percent* can be interpreted nonconservatively. If *50%* were conservative in (2), it should be possible to assess the truth by restricting attention to just the set of women. But its most natural reading requires comparing the proportion of women among the hires to that of non-women, ostensibly violating conservativity.

(2) The company hired 50% women
'50% of women were hired by the company.' (✗proportional)
'50% of the hires were women.' (✓reverse proportional)

Ahn and Sauerland (2017) argue that these violations are only apparent. They assume that focus is required on *women* for *50%* to be interpreted reverse proportionally, and propose that the measure phrase undergoes covert focus movement. Therefore, at LF, the restrictor of *50%* is a contextual parameter bound to the focus alternatives of *50%*'s syntactic restrictor, as in (3).

(3) [50% C] [∼C [λx the company hired [x women$_{\mathbf{F}}$]]]

Other proposals on non-conservativity share the key assumption of Ahn and Sauerland's analysis that focus is required on the NP following the measure phrase for reverse proportional readings to arise, and covert focus movement is what derives the reverse proportional interpretation compositionally (e.g., Li 2022; Pasternak and Sauerland 2022).

In support of this nominal displacement derivation, Ahn and Sauerland show that similar readings emerge in Korean, as in (4b) and (5b), where the measure phrases are clearly pronounced outside of the corresponding nominals, overtly reifying the implicit scope-taking in (3).

(4) a. [haksayng-uy **isip** **phulo**-ka] chamsekhayssta
student-GEN twenty percent-NOM attended

'20% of the students attended.' (✓proportional)

b. [haksayng-i] **isip** **phulo** chamsekhayssta
student-NOM twenty percent attended

'20% of the students attended.' (✓proportional)
'20% of the attendees were students.' (✓reverse proportional)

(5) a. hoysa-ka [isiptay ciwenca-uy **isip** **phulo**-lul] chayyonghayssta
company-NOM twenties applicant-GEN twenty percent-ACC hired

'The company hired 20% of the applicants who were in their twenties.' (✓proportional)

b. hoysa-ka [isiptay ciwenca-lul] **isip** **phulo** chayyonghayssta
company-NOM twenties applicant-ACC twenty percent hired

'The company hired 20% of the applicants who were in their twenties.' (✓proportional)
'20% of the hires were in their twenties.' (✓reverse proportional)

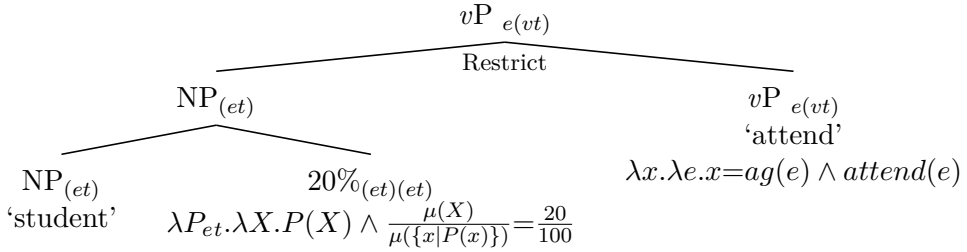
Though the word order is consistent with their analysis, they offer no particular evidence that the reverse proportional measure phrases originate within the nominal. This paper argues that they do not, and furthermore that focus is irrelevant to the reverse proportional interpretation in Korean. Instead, reverse proportional measure phrases are adverbial modifiers that involve quantification over event participants.

2 Analysis

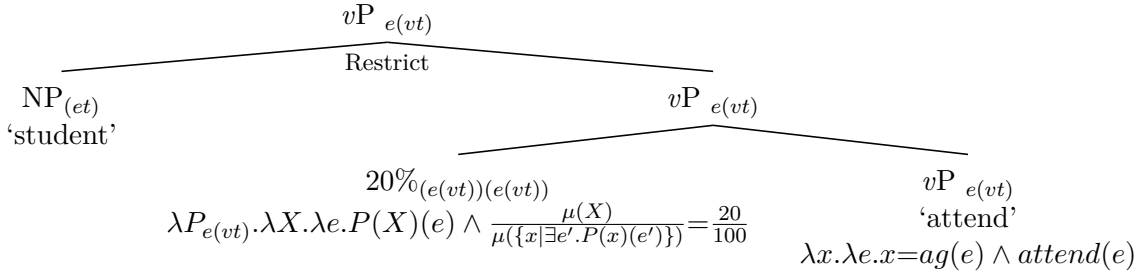
I argue that reverse proportional measure phrases in (4b) and (5b) start out syntactically within the verbal domain rather than the nominal domain, and semantically quantify over event participants rather than focus alternatives. In contrast, measure phrases inside case-marked nominals, (4a) and (5a), are nominal modifiers that quantify over individuals as usual.

(6) and (7) represent the structure and final truth-condition of subjected-oriented measurement sentences, (4a) and (4b), respectively. I assume Chung and Ladusaw's (2004) Restrict for the mode of composition between the properties et and $e(vt)$. The individual and event arguments are later bound by existential closure. x and X are both variables of type e, with the former denoting atomic entities and the latter denoting pluralities.

(6) Proportional measure phrase (4a)
$\exists X.\exists e.student(X) \wedge X{=}ag(e) \wedge attend(e) \wedge \frac{\mu(X)}{\mu(\{x|student(x)\})}{=}\frac{20}{100}$

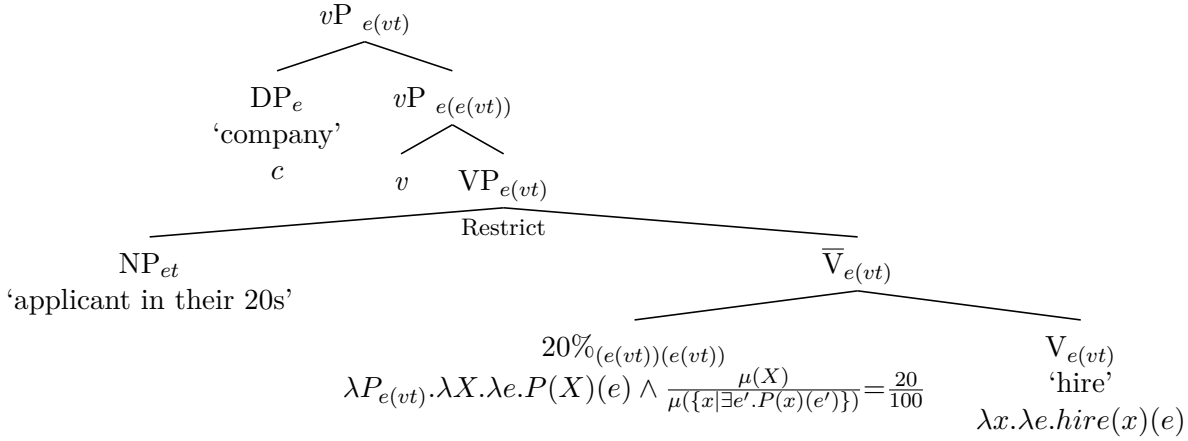


(7) Reverse proportional measure phrase (4b)
$\exists X.\exists e.student(X) \wedge X{=}ag(e) \wedge attend(e) \wedge \frac{\mu(X)}{\mu(\{x|\exists e'.x{=}ag(e')\wedge attend(e')\})}{=}\frac{20}{100}$



For measure phrases in the object position, the relevant event participants are not agents but themes. Therefore, the event participants measured in (5b) are hires.

(8) Reverse proportional measure phrase (5b)
$\exists X.\exists e.20s\text{-}applicant(X) \wedge c{=}ag(e) \wedge hire(X)(e) \wedge \frac{\mu(X)}{\mu(\{x|\exists e'.hire(x)(e')\})}{=}\frac{20}{100}$



20% in (6) and (7) is polysemous, measuring either individuals satisfying the nominal description or individuals participating in an event. The syntactic category of event-participant-measuring *20%* varies depending on the syntactic context: in the subject-oriented sentence (7), it is an adverb adjoined to *v*P, while in the object-oriented sentence (8), it adjoins to a verb head, creating a complex predicate.

The remaining proportional readings in (6b) and (7b) are due to Multiple Nominative Constructions (MNC) and Multiple Accusative Constructions (MAC), productive case configurations in the language. This is evidenced by the fact that sentences with explicit double case-marking allow only proportional readings, as in (9).

(9) haksayng-i **isip** **phulo**-ka chamsekhayssta
student-NOM twenty percent-NOM attended

'20% of the students attended.' (✓proportional)
'20% of the attendees were students.' (✗reverse proportional)

The proposed analysis is inspired by Nakanishi (2007), who argues that bare numerals in Japanese can either be nominal or verbal modifiers. Relevant data for Korean is shown in (10). While numerals do not lead to different interpretations, the idea is that 'two CL' in (10a) is

a nominal modifier, whereas in (10b) it is a verbal modifier—a distinction that can naturally extend to measure phrases, assuming classifiers correspond to measure nouns.

(10) a. [haksayng **twu myeng**-i] chamsekhayssta
student two CL-NOM attended

b. [haksayng-i] **twu myeng** chamsekhayssta
student-NOM two CL attended

'Two students attended'

3 Arguments for the analysis

3.1 Lack of focus intervention effects

Ahn and Sauerland (2017) claim that focus is required on the NP for reverse proportional interpretations to arise. Therefore, in (11), *haksayng* 'student' should be focused.

(11) Focus analysis of reverse proportional measure phrases
[haksayng$_{\mathbf{F}}$ ___$_1$ -i] [**isip** **phulo**]$_1$ chamsekhayssta
student -NOM twenty percent attended

'20% of the attendees were students.' (✓reverse proportional)

The focus analysis predicts that focus intervention effects (Beck and Kim 1997) should arise in wh-questions involving a reverse proportional measure phrase. This prediction is not borne out. With (12a) as a baseline, (12b) can still be interpreted reverse proportionally, despite the putative intervention configuration.

(12) a. *haksayng$_F$-man enu phathi-lul chamsekhayss-ni?
student-only which party-ACC attended-ITR
'Which party did only students attend?'

b. haksayng$_F$-i enu phathi-lul **isip** **phulo** chamsekhayss-ni?
student-NOM which party-ACC twenty percent attended-ITR
'Which party did 20% of the students attend?' (✓proportional)
'Which party had 20% of its attendees as students?' (✓reverse proportional)

3.2 Resistance to narrow scope negation

Second, reverse proportional measure phrases cannot outscope verbal negation.

(13) a. [haksayng-uy **isip** **phulo**-ka] chamsekhaci anhassta
student-GEN twenty percent-NOM attend not.PAST

'20% of students didn't attend.' (✓proportional)

b. [haksayng-i] **isip** **phulo** chamsekhaci anhassta
student-NOM twenty percent attend not.PAST

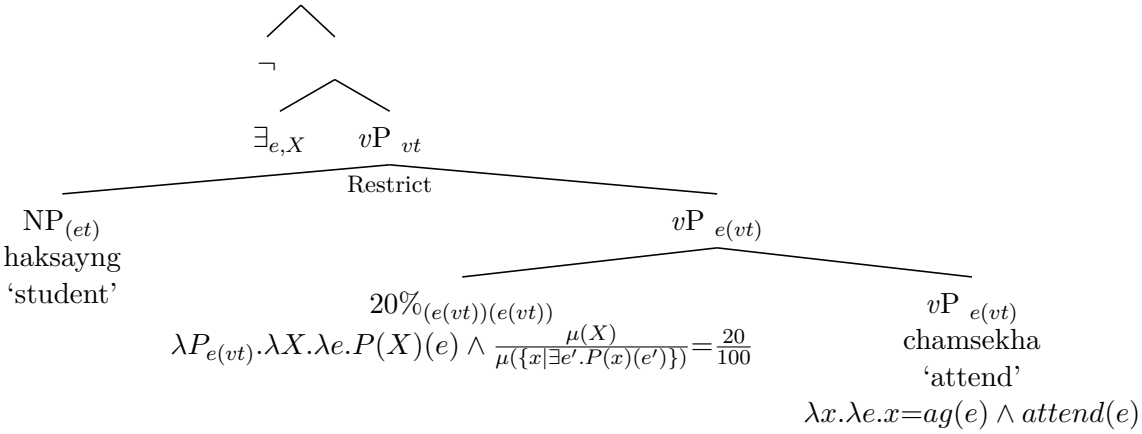
'20% of students didn't attend.' (✓proportional)
'20% of non-attendees were students.' (✗reverse proportional with verbal negation)
'It is not the case that 20% of attendees were students.' (✓reverse proportional with clausal negation)

The resistance to narrow scope negation follows from the proposed analysis, in conjunction with the standard understanding of the placement of negation within the functional hierarchy, as in (14), which is above existential closure of the event argument.

(14) subject T **neg** $\exists e$ [___ v V]

Since negation cannot occur lower than existential closure, there is no way to generate the reading that involves measuring non-attendees. The only possible structure for (13b) is (15).

(15) Reverse proportional measure phrase with negation
$\neg\exists e.\exists X.student(X) \wedge X{=}ag(e) \wedge attend(e) \wedge \frac{\mu(X)}{\mu(\{x|\exists e'.x{=}ag(e')\wedge attend(e')\})}{=}\frac{20}{100}$



In the focus-based nominal displacement analysis, it is not obvious how this restriction with verbal negation could be explained because *20%* moves to the edge of the clause and acts as a propositional operator; it would certainly be well-typed and sensible for it to alternate scopally with clausal negation, yet it does not.

3.3 Similar distributions with adverbs

Adverbs in Korean can occur flexibly either before or after an internal argument, as in (16).

(16) Nari-ka {**kippukey**} phathi-lul {**kippukey**} chamsekhayssta
Nari-NOM happily party-ACC happily attended

'Nari happily attended the party'

If the subject-oriented reverse proportional measure phrase is a verbal modifier attached to vP, as proposed in Section 2, the prediction is that it can also flexibly occur where adverbs can. (17) shows that reverse proportional readings survive regardless of the position of *20%*.

(17) haksayng-i {**isip phulo**} phathi-lul {**isip phulo**} chamsekhayssta
student-NOM twenty percent party-ACC twenty percent attended

'20% of students attended the party' (✓proportional)
'20% of party attendees were students' (✓reverse proportional)

In wh-questions, sentences degrade in acceptability when the adverb *kippukey* 'happily' appears before an internal argument that is a wh-phrase, as shown in (18). The same contrast is observed between (19a) and (19b) under reverse proportional readings, which did not exist in their declarative counterparts.

(18) Nari-ka ?{**kippukey**} enu phathi-lul {**kippukey**} chamsekhayss-ni?
Nari-NOM happily which party-ACC happily attended-ITR

'Which party did Nari happily attend?'

(19) a. haksayng-i enu phathi-lul **isip** **phulo** chamsekhayss-ni?
student-NOM which party-ACC twenty percent attended-ITR

'Which party did 20% of the students attend?' (✓proportional)
'Which party had 20% of its attendees as students?' (✓reverse proportional)

b. haksayng-i **isip** **phulo** enu phathi-lul chamsekhayss-ni?
student-NOM twenty percent which party-ACC attended-ITR

'Which party did 20% of the students attend?' (✓proportional)
'Which party had 20% of its attendees as students?' (?reverse proportional)

4 Conclusion

This paper argued that measure phrase modifiers in Korean are polysemous, involving different types of quantification: one over individuals and the other over event participants. I conclude by suggesting the analytical possibility that reverse proportional measure phrases in German may also be modifiers quantifying over event participants.

(20) **Zwanzig Prozent** Studenten haben für Harris gestimmt
twenty percent students have for Harris voted

'20% of the voters for Harris were students.' (✓reverse proportional)

Pasternak and Sauerland (2022) present convincing arguments that the German reverse proportional measure phrase *zwanzig Prozent* 'twenty percent' in sentences like (20) is not equivalent to *zu zwanzig Prozent* 'at twenty percent,' which also induces a reverse proportional reading. Their arguments are based on case, agreement, and constituency patterns specific to *zu*-phrases. While Pasternak and Sauerland may be correct that preposition-less measure phrases are not covertly *zu*-marked, *zu*-phrases are not the only adverbials that appear next to NPs, seemingly violating the verb-second constraint in German. Following Meyer and Sauerland (2009), they refer to this class as 'DP-adjoinable adverbials', which includes *größtenteils* 'for the most part', *ausschließlich* 'exclusively', and *nur* 'only'.

(21) **Größtenteils** Studenten haben für Harris gestimmt
mostly students have for Harris voted

'Most of the voters for Harris were students.' (✓reverse proportional)

I suggest that this latter class of adverbials is derivationally analogous to the reverse proportional *20%*, quantifying over event participants, given that adverbials such as *größtenteils* can receive an event-based analysis for event predication (Zobel 2021). It is still possible that these adverbials have a distinct derivation from the PP *zu 20%*, even if Pasternak and Sauerland are right that *20%* is not equivalent to *zu 20%*. The only difference from Korean reverse proportional measure phrases is that the German measure phrase in (20) does not syntactically appear in the verbal projection, but rather in the nominal projection, as a DP-adjoined modifier. If this is on the right track, the proposed analysis may provide a semantic model for reverse proportional quantification across a wider range of languages, measuring participants in events.

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