

## The two lives of *zero*: numeral, intensification, and scale boundary

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This paper argues that *zero* has a second meaning as a degree quantifier, in addition to the numeral meaning explored in Bylinina and Nouwen (2017). It further suggests that scale boundaries are key to providing a more general theory of intensification that connects numerals and degree modification.

**Numeral Zero** The Generalized Quantifier Theory uses set relations to treat *zero* on a par with the negative quantifier *no*, predicting the two to be semantically equivalent (Barwise & Cooper, 1981). However, it has been noted that *zero* and *no* differ in terms of negative inversion and licensing (Déprez, 1999; Gajewski, 2011; Moltmann, 1995). Recently, Bylinina and Nouwen (2017) observe that *zero* contrasts with *no* in terms of NPI licensing:

- (1) a. No students *ever* say anything.
- b. \*Zero students *ever* say anything.

They argue that *zero* is not a quantifier and should be treated just as other numerals in order to capture its weak negative quantificational force. But given the range of theoretical possibilities concerning the status of *zero*, it seems only reasonable to also compare it with other numerals. While Bylinina and Nouwen’s analysis focuses only on plural count nouns, the modification of *zero* with other types of nouns sheds new light on its meaning(s).

**Intensifier Zero** In another life, *zero* has an intensifier meaning based on key observations about its modification of abstract nouns, which typically have a degree adjective counterpart (Morzycki, 2009). Specifically, the use of *zero* as an intensifier can be distinguished from its numeral use because only the latter can felicitously combine with *exactly*:

- (2) a. ??Mary has exactly *zero* tolerance for betrayal.
- b. Exactly *zero* students came to the lecture today.

When modifying plural count nouns, all *zero*-sentences can be optionally modified by *exactly*, which is expected in Bylinina and Nouwen’s numeral account that assumes obligatory exhaustification operation for *zero*. However, the intensifier use contrasts with the numeral use systematically in the *exactly* test, suggesting that when *zero* is used as an intensifier, cardinality evaluation is not directly at play.

Furthermore, *zero* exhibits two characteristic properties of an intensifier: first, *zero-N* must follow the unintensified form, as in many well-studied intensification constructions:

- (3) a. The justice department revealing it has found no evidence, *zero* evidence that Donald Trump tower was ever wire-tapped as the President has alleged the series of tweets. (CNN Newsroom)
- b. Iraq vote is close, *real* close. (Politico)
- c. But he was crazy about her. Like *crazy crazy*. (Discretion: A Novel)

Second, the negation of *zero-N* is compatible with the unintensified form, in line with Beltrama and Bochnak’s (2015) observation:

- (4) McEwen is cautious about the chances of seeing the missing lander this way, giving it a “small but *not zero*” chance of success. (Nature)
- (5) Travelers who have no measured fever, and have been determined to have low, but *not zero* risk will be released. (Virginia Department of Health)

Crucially, in the above examples, *zero* can be conjoined with a degree adjective in a way that no other numerals can, which is again surprising if *zero* is just a regular numeral. Note also that only negative degree adjectives can be conjoined with *zero*, contrasting with other intensifiers whose scale is contextually determined by the null degree morpheme *POS* (von Stechow, 2009).

**Analysis** Following Morzycki (2009), I assume abstract nouns are gradable predicates of type  $\langle d, et \rangle$ , just like their degree adjective counterparts:

$$(6) \quad \llbracket N_{\langle d, et \rangle} \rrbracket = \lambda d. \lambda x. P(x) \wedge \mu_S(x) \geq d$$

*Zero* is a degree quantifier of type  $\langle dt, t \rangle$ . Its meaning is modelled on *POS*, but instead of assuming a “neutral range” *N* on the scale *S*, *zero* takes the full range *F* on a reversed scale *S* that goes from larger degrees to smaller degrees, with the endpoint being 0. By including 0 in the scale, this move is analogous to introducing the full lattice in Bylinina & Nouwen’s theory of plurality.

$$(7) \quad \llbracket zero_{\langle dt, t \rangle} \rrbracket = \lambda I_{\langle d, t \rangle}. \forall d \in F_S. I(d)$$

Note that since *N* takes a degree as its argument and *zero* is a degree quantifier, *zero* will have to QR, leaving behind a trace of type *d*. Taking *Zero evidence was found* as a simple example, I show the (abridged) compositional analysis of a *zero*-sentence as follows:

$$\begin{aligned}
 (8) \quad & \llbracket [DP \emptyset t_1 \text{ evidence}] \rrbracket = \llbracket N \rrbracket (d_1) \\
 & = \lambda x. \text{evidence}(x) \wedge \mu_S(x) \geq d_1 && \text{by FA} \\
 & \llbracket [IP \emptyset t_1 \text{ evidence was found}] \rrbracket = ( \llbracket t_1 \text{ evidence} \rrbracket ) ( \llbracket \text{was found} \rrbracket ) \\
 & = \lambda x. \text{evidence}(x) \wedge \mu_S(x) \geq d_1 \wedge \text{found}(x) && \text{by PM} \\
 & \Rightarrow \exists x. \text{evidence}(x) \wedge \mu_S(x) \geq d_1 \wedge \text{found}(x) && \text{by } \exists C \\
 & \Rightarrow \lambda d_1 \exists x [\text{evidence}(x) \wedge \mu_S(x) \geq d_1 \wedge \text{found}(x)] && \text{by PA} \\
 & \llbracket [IP [\text{zero}][\emptyset t_1 \text{ evidence was found}]] \rrbracket \\
 & = \forall d \in F_S [\exists x [\text{evidence}(x) \wedge \mu_S(x) \geq d \wedge \text{found}(x)]] && \text{by FA}
 \end{aligned}$$

Essentially, the sentence is true iff the amount of evidence that was found is greater than all degrees on *S*, which must be the numerically smallest degree 0 since *S* is a reversed scale.

**Implications** The intensifier analysis of *zero* is not only empirically motivated but also illuminating. The intensifier meaning of *zero* is derived from the basic numeral meaning by virtue of being the end of the numerical scale, and it raises the question of whether the two meanings can be reduced to one principle. We discuss the role of scale boundaries and sketch a more general theory of intensification which connects the numeral and intensifier uses.

**Selected references** Barwise, J. & Cooper, R. (1981). Generalized quantifiers and natural language. • Beltrama, A. & Bochnak, M. R. (2015). Intensification without degrees cross-linguistically. • Bylinina, L. & Nouwen, R. (2017). On “zero” and semantic plurality. • Morzycki, M. (2009). Degree modification of gradable nouns: size adjectives and adnominal degree morphemes. • von Stechow, A. (2009). The temporal degree adjectives früh(er)/spät(er) ‘early(er)’/‘late(r)’.