Scalar implicature and negative strengthening in different types of gradable adjectives

Nicole Gotzner, Stephanie Solt and Anton Benz (Leibniz-ZAS)

According to a tacit assumption in the theoretical and experimental literature, scalar implicature is based on a single mechanism and the behaviour of one scale generalises to the whole family of scales [van Tiel et al., 2016]. Contrary to this uniformity assumption, experimental research has demonstrated great variability in the rates of scalar inferences across different triggers, in part being explained by factors such as boundedness of a scale and semantic distance between scale-mates [Doran et al., 2009, van Tiel et al., 2016].

In the study by van Tiel et al. [2016] participants were presented with statements involving a weak scalar term and were asked whether they would infer the negation of a stronger scale-mate, e.g. whether the statement in (1) licenses the scalar inference in (2).

(1) John is attractive

(2) John is not stunning

Problematically, the utterance *John is not stunning* may itself be strengthened to convey that John is rather ugly, which is incompatible with the semantic meaning of *attractive*. This so-called negative strengthening is based on a different conversational principle, the R-principle, and it is discussed in terms of politeness considerations [Horn, 1989, Levinson, 2000, Krifka, 2007]. A previous study by Benz et al. [2017] demonstrated that endorsements of scalar implicature were anti-correlated with the degree of negative strengthening of the stronger scale-mate in van Tiel et al's task. Further, the authors showed that the data are consistent with a modified version of the uniformity assumption taking into account negative strengthening.

The current study investigates the interplay of scalar implicature and negative strengthening in a balanced set of adjectival scales. The main goal is to show that variation across adjectival scales is more systematic than previously thought and that the scale structure underlying the semantics of gradable adjectives systematically affects inference patterns. Thus, we argue that insights concerning the semantics of scales should be integrated in theories of pragmatic strengthening.

Experiments We created a set of 71 adjective pairs with weak and strong scale-mates. These adjectives were embedded in 7 separate tasks administered to 40 subjects each.

Main tasks: The two main tasks were based on the paradigm by van Tiel et al. [2016]. In the first task, participants were presented with the weaker term and had to indicate whether they endorse the negation of the stronger term (e.g., whether (1) implies (2)). In the second task, participants were asked whether the negation of the stronger term suggests the negation of the weaker term. For example, participants saw the statement *John is not brilliant* and were asked whether they conclude that John is not intelligent. The latter task is a measure of negating strengthening of the stronger scale-mate.

Additional measures: Additionally, we collected a variety of measures such as the semantic distance of the scale-mates (rating of the perceived difference in strength between the two scale-mates), a cloze task measuring the availability of the stronger alternative, the relative frequency of the weak and strong term and their latent semantic values (LSA, Landauer and Dumais, 1997). Participants also rated the kindness/politeness of statements involving the weaker and stronger terms and the negation of the stronger term (following the methodology by Bonnefon et al., 2009). Further, we annotated the scale structure of the different adjective pairs taking into account upper and lower boundedness [Kennedy and McNally, 2005], whether the stronger term is extreme (e.g., *enormous*, based on Morzycki, 2012's diagnostics) and polarity (e.g., *tall* vs. *short* with the positive term being the one on which the relevant dimension is measured, Cruse, 1986).

Results: Table 1 presents a sample of adjectives with different scale structures and their respective endorsement rates in the scalar implicature and negative strengthening task. A Pearson's correlation test revealed that the two ratings were anti-correlated (R

= .66, p <.001, see Figure). That is, the less likely participants were to endorse the scalar implicature, the more likely they applied negative strengthening.

Table 1: Example scales and their respective endorsement rates in the scalar implicature (SI) and negative strengthening (NS) task

Weak term	**Strong term**	**Scale structure**	**SI**	**NS**
attractive	stunning	unbounded extreme positive	0.08	0.60
wet	soaked	lower bounded extreme positive	0.24	0.44
cool	cold	unbounded non-extreme negative	0.43	0.54
difficult	impossible	upper bounded extreme negative	0.76	0.35

We fit two linear regression models involving all predictors outlined above for the scalar implicature and the negative strengthening task (see Table 2). The regression analysis showed that endorsements of the scalar implicature were higher for upper bounded scales (p <.05), more distant scale mates (p <.0001) and higher for negative compared to positive scales (p <.05). Conversely, extreme adjectives yielded lower endorsement rates compared to non-extreme ones (p <.0001). The negative strengthening task showed the opposite pattern with higher endorsement rates for closely-rated scale-mates (p <.001) and extreme adjectives (p <.001) while boundedness and polarity were not significant predictors. In this task, there was a marginal effect of the politeness ratings involving the statement with the weaker term and an effect of cloze probability (p <.05). That is, the stronger term was more likely to receive negative strengthening the stronger the association strengths between the scale-mates.

Discussion: We showed that endorsements of scalar implicature are anti-correlated with the degree of negative strengthening of the stronger scale-mate. At the same time, we replicated the finding by van Tiel et al. [2016] that upper bounded and semantically distant scale-mates yield higher scalar implicature rates. Going beyond the latter study, we found that several additional factors related to the scale structure underlying the semantics of different adjectives predict variability, in particular polarity and adjectival extremeness. While association strength between scale-mates (measured by a cloze task) did not predict endorsement rates of scalar implicature, it predicted the likelihood of negative strengthening. Our data also provided some evidence that negative strengthening is related to politeness of the statement involving the weaker scale-mate, however, scale structure was a stronger predictor of variability. In addition, negated extreme adjectives may convey that the situation is non-stereotypical thereby encouraging negative strengthening.

Conclusions Our research revealed an interaction between scalar implicature and negative strengthening, which are based on distinct conversational principles, the Q and R principle [Horn, 1989, Levinson, 2000]. These principles are assumed to govern each other, therefore an interaction between the two kinds of strengthening mechanisms is expected (see also Krifka, 2007). We showed that the most important predictors explaining differences across triggers was the underlying scale structure of the adjectives we tested (boundedness, semantic distance, extremeness and polarity). Thus far, insights concerning the semantics of scales have not been well integrated into theories of scalar implicature and negative strengthening. For example, Cruse [1986] presents evidence that while positive adjectives are associated with the entire underlying measurement scale, negative adjectives take up only the lower end (and are presuppositional). Further, extreme adjectives are know to have specific semantic properties [Morzycki, 2012]. These differences in the semantics of adjectives may govern which alternatives are used in pragmatic strengthening (see also [Leffel et al., 2016]). For this reason, we propose that the semantics of different scales should be a central aspect of study in theories of implicature.

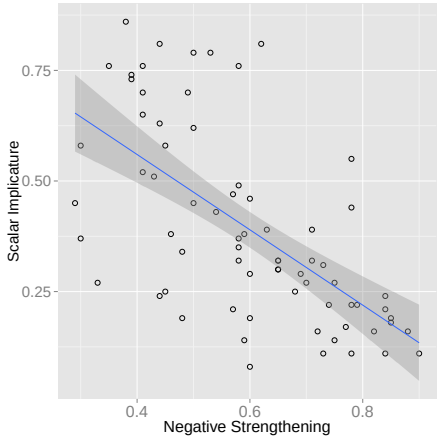

Figure 1: Correlation between endorsements in the scalar implicature and negative strengthening task (proportion of YES responses).

Table 2: Predictors of endorsements in (a) the scalar implicature and (b) negative strengthening task.

(a) Scalar implicature	Estimate	SE	t-value	p-value	
(Intercept)	-0.450962	0.200752	-2.246	0.0285	
lower bounded	-0.025124	0.052719	-0.477	0.6355	
upper bounded	0.091486	0.045143	2.027	0.0473	*
extremeness	-0.273715	0.052290	-5.235	2.39e-06	***
polarity	0.114126	0.048065	2.374	0.0209	*
semantic distance	0.155524	0.028026	5.549	0.000	***
politeness weak	0.008772	0.036372	0.241	0.8103	
politeness strong	0.020949	0.021826	0.960	0.3411	
relative frequency	0.009177	0.022509	0.408	0.6850	
LSA	0.012314	0.105014	0.117	0.9071	
(b) Negative strengthening	Estimate	SE	t-value	p-value	
(Intercept)	1.472420	0.307221	4.793	0.000	
lower bounded	-0.039224	0.043193	-0.908	0.36764	
upper bounded	-0.046990	0.037755	-1.245	0.21837	
extremeness	0.146204	0.045073	3.244	0.00197	**
polarity	-0.008700	0.039276	-0.222	0.82548	
semantic distance	-0.109197	0.025060	-4.357	0.000	***
politeness weak	-0.043342	0.025452	-1.703	0.09403	.
politeness 'not' strong	-0.049070	0.045032	-1.090	0.28044	
relative frequency	0.005728	0.018199	0.315	0.75409	
LSA	-0.131505	0.091573	-1.436	0.15645	
cloze probability	0.494745	0.222365	2.225	0.03006	*

Selected References Horn, L. (1989). *A natural history of negation*, University of Chicago Press. Van Tiel, B., Van Miltenburg, E., Zevakhina, N., & Geurts, B. (2016). Scalar diversity. Journal of Semantics, 33(1), 137-175.