

Granularity shifting: Experimental evidence from degree modifiers

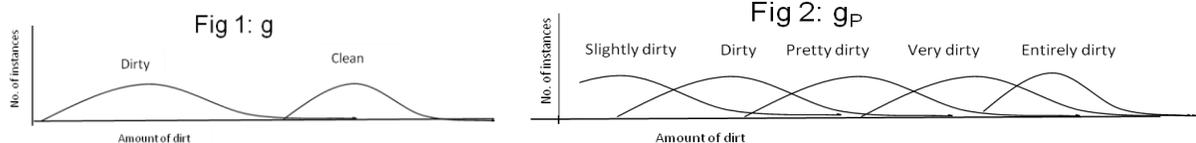
This paper presents an account of degree modifiers and two studies that test its predictions.

Objects count as *clean* iff they are free of dirt, and count as *dirty* iff they are covered with at least a minimum amount of dirt. Hence, *dirty* is a minimum-standard (‘partial’) adjective and *clean* is a maximum-standard (‘total’) adjective (Kennedy & McNally 2005). Supposing that modifiers like *slightly* (‘minimizers’) and *completely* (‘maximizers’) are not semantically vacuous, we hypothesize that they trigger a shift from a default coarse granularity level g to a finer level g_p , the one pedants use in judging cleanliness (Toledo & Sassoon 2011). For example, pedants consider every small grain of dust important. Non-pedants don’t. They consider easily visible dirt important, and ignore the rest (Lewis 1979). Hence, in contexts of utterances such as *The car is {dirty, clean}*, it is normally appropriate to ignore almost invisible dirt. However, an utterance of *The car is {slightly dirty, completely clean}* is appropriate iff the criterion for the application of the adjective is more pedantic: almost invisible dirt counts. It is true iff *The car is {dirty, clean}* is true given this pedantic criterion. On this account, *slightly dirty* conveys ‘almost invisible dirt and possibly more’ ($[\text{slightly dirty}]_g = [\text{dirty}]_{g_p} \supset [\text{dirty}]_g$), and *completely clean* conveys ‘free even of almost invisible dirt’ ($[\text{completely clean}]_g = [\text{clean}]_{g_p} \subset [\text{clean}]_g$).

For Kennedy & McNally (2005) and Kennedy (2007), the scale range denoted by minimizers begins at the scale minimum, while we hypothesize that it begins at the denotation minimum (see also Rothstein & Winter 2005). The difference shows up with total adjectives. On our account, minimizers/maximizers modifying total adjectives as in, for example, *slightly/completely full* render relevant previously ignored differences between denotation members (maximally full entities relative to g), and they typically pick the least full/fullest of them, respectively.

Krifka (1997, 2002) uses Bidirectional Optimality Theory (Blutner 1998, 2000) to model the coupling between round numbers and round interpretations, and more generally, between short expressions and coarse interpretations and between long expressions and precise interpretations. This account straightforwardly predicts that modified adjectives will be interpreted with higher standards of precision (finer scales) than unmodified (bare) adjectives (alternative accounts of imprecision are silent about the coupling between expression complexity and precision level).

Thus, inspired by Krifka’s (1997) analysis of numerals, we hypothesize that adjectives and their modifiers are associated with a probability distribution over the scale range they denote, representing the probability that they would reference each point in the scale (cf. fig. 2). Peaks represent typical contexts of use; e.g., maximizers typically pick the maximum. We propose that the denotation of adjectives modified by minimizers (henceforth ‘minimized’; e.g., *slightly dirty*) overlaps with (is a superset of) the range denoted by the bare adjective (e.g., *dirty*). Yet, we typically do not use minimized adjectives to refer to medium or high degrees because we rather use other expressions (*dirty*, *very dirty*, *entirely dirty*, etc.) Similarly, the denotation of bare adjectives like *clean* overlaps (is a superset of) that of their maximized forms, e.g., *completely clean*. Yet, we typically use bare adjectives to refer to lower degrees than maximized adjectives.



Therefore, we argue that, e.g., *slightly* has an ‘at least’ reading. Evidence comes from the fact that the typical intonation contour of utterances such as *The floor is not slightly dirty, it is very dirty* is characteristic of metalinguistic negation, suggesting that the logical negation of a minimized adjective cannot be used to refer to high degrees. High degrees are part of the

minimized adjective denotation (e.g., *slightly dirty*). Moreover, negated minimized adjectives such as *not slightly dirty* are a bit odd, except when modified with a marker of unexpectedness as in *not even slightly dirty*, which is perfectly felicitous. The reason is arguably that minimized adjectives refer to a wide range, covering up to a whole adjectival scale except for only the zero (lower closure). It is unlikely for an entity to fall outside this range.

Finally, we hypothesize following Lewis (1979) that a shift from default to finer standards of precision is a natural discourse move, but the opposite shift is not. For example, we may state that the Netherlands is flat, presupposing default coarse granularity, and then point out that it is actually a bit bumpy by shifting to a finer criterion, taking as evidence bumps we previously ignored. However, we cannot state that the Netherlands is bumpy and smoothly proceed to say that it is actually flat, thereby ignoring bumps that we previously regarded as relevant evidence.

Two studies of inferences from modified to bare adjectives and vice versa provide experimental evidence for the granularity shifting account of degree modifiers presented above.

Exp1 tested two context types, e.g., (C1) *Nick thinks that x is dirty. Nick's mother thinks that x is slightly dirty. Would Nick agree that x is slightly dirty?* and (C2) *Nick thinks that x is slightly dirty. Nick's mother thinks that x is dirty. Would Nick agree that x is dirty?* Participants were asked to provide an answer on a scale ranging from 1 (certainly not) to 5 (certainly yes). Items included 17 partial adjectives \times 3 minimizers (*slightly, somewhat, a bit*), 17 total adjectives \times 3 maximizers, and as many fillers as target items, with 25 English speaking participants per item.

The results confirmed our expectations. First, all mean answers per item were in the positive range (above 3), suggesting that the range denoted by modifiers begins at the denotation minimum. This also shows that 'at most' implicatures are relatively minor. Significantly more negative than positive answers would have supported the view that *slightly dirty* is interpreted as conveying "at most slight amount of dirt" (*dirty* only given fine-grained granularity: [*dirty*]_{gp} & [\neg *dirty*]_g), and the view that *clean* is interpreted as "at most clean" (*clean* only given coarse granularity: [*clean*]_g & [\neg *clean*]_{gp}). A majority of positive answers speaks against these views.

Second, the mean answers for items of C2 ($M=4.6$, $SD=.32$) were significantly more positive than those for C1 ($M=4.1$, $SD=.26$; non parametric Wilcoxon signed-ranks test yields $W=-4959$, $n_{s/r}=101$, $z=-8.4$ $p<.001$), supporting the granularity shifting account. C1 involves moving from coarse (*dirty/clean*) to pedantic (*slightly dirty/completely dirty*) granularity. Speakers directly infer from an utterance of *the floor is dirty* the entailment that *the floor is slightly dirty*. However, since the floor could be dirtier than a floor that Nick would typically call *slightly dirty*, the answers for C1 are only weakly positive ("maybe/probably yes"), because there is room for doubt; a "certainly yes" answer would suggest that Nick uses the words in an atypical way. By contrast, in the reversed context C2, since shifting from pedantic to coarse granularity is not acceptable, *slightly* triggers an irreversible shift to finer granularity. Hence, in support of Lewis (1979), the bare adjective *dirty*, affected by the shift, is interpreted pedantically too; it is interpreted as equivalent to its minimized form. So speakers infer from *the floor is slightly dirty* that *the floor is dirty* with greater certainty than vice versa. The answers for C2 are "probably/certainly yes" (4-5). Similar reasoning holds for, e.g., *clean* and *completely clean*.

Exp2 focused on *slightly* and *completely* with a 7-point scale, and 5 groups of 6 adjectives differing by their standard and scale type (partial \pm max, total \pm min, and relative). Exp2 replicated the significant results of Exp1. In addition, the answers for *slightly* were less positive with total than partial adjectives ($U=12.5$, $z=3.4$, $p<.001$). Still, all answers were (weakly) positive ($M=5.5$, $SD=.99$ for total items), supporting a denotation-minimum account where, e.g., *slightly full* implies *full*. We will also discuss results for *slightly* vs. *completely* and adjectives vs. numerals.