Quantity and gradability across categories

M. Ryan Bochnak, University of Chicago

Introduction. The goals of this paper are twofold: (a) use the distribution of the scalar modifier *half* in English as a window into the presence and types of scales found across categories; (b) extend a degree-based analysis that has become standard for gradable adjectives to the nominal and verbal domains. The proposed analysis captures the similarities between the different readings of *half* in two distinct syntactic/semantic environments:

(1) Half of the books are on the table. (*partitive* reading)

(2) Mary half washed the dishes. (*eventive* reading)

I argue that *half* always has a scalar meaning across these readings, and in particular targets an open degree argument in (1) and (2), parallel with the modifier's function with gradable adjectives. I also show that the scale structures in the partitive and eventive environments crucially depend on the part structure of an embedded nominal argument.

Scalarity and *half*. Following Kennedy and McNally (2005) I take *half* to be a degree term that modifies only gradable predicates with fully closed scales. Thus the acceptability of (3) and the infelicity of (4) can be ascribed to the scale structures associated with the gradable adjectives:

(3) The glass is half full. / The door is half open. (fully closed scales)

(4) ?? Taylor is half tall/old. (open scales)

Intuitively, *half* selects the midpoint of the closed scale and supplies the open degree argument with that value. I assume the following semantics for *half* as a function from gradable properties to properties of individuals, where **mid**(S_G) returns the midpoint of the scale S associated with G:

(5) $[\![\ \textit{half}\ ]\!] = \lambda G_{\langle d,et\rangle}\lambda x_{\langle e\rangle}.G(x)(\textbf{mid}(S_G))$

In the absence of a degree modifier, a null degree morpheme *pos*, of the same semantic type as *half*, values the degree argument based on a contextual standard of comparison. For adjectives with upper-closed scales, *pos* returns the maximal value of the scale as the standard value, which follows from a principle of interpretive economy (Kennedy, 2007). As has been demonstrated by Kennedy and McNally (2005, 2009) gradable adjectives may take on a closed scale of QUANTITY, e.g. (6) may refer to the degree to which the meat is cooked (cooked-ness scale) or the proportion of meat that is cooked (quantity scale):

(6) The meat is half cooked.

Importantly, it is the part structure of the bounded nominal argument that imposes the (closed) quantity scale onto the gradable adjective.

Partitives. For partitives such as (1), *half* measures the proportion of the quantity of the embedded nominal argument. Just as in the adjectival case, the part structure of the nominal argument affects scale structure and crucially must be bounded to induce a closed scale over which *half* can operate (note: **half of books*, **half of applesauce*). I follow Schwarzschild (2002, 2006) in his analysis of measure phrases in partitives in relying on a function that maps entities onto intervals of a scale. The relevant scale for *half* in partitives is one of quantity, and I propose that the mediation between the part structure of the nominal and the quantity scale is a silent head μ_{PRT} (for *measure*) that formally introduces a degree argument above *of* that may be saturated by *half* (or other upstairs modifiers such as numerals or *most*), yielding the semantics in (8) for *half of the books* after existential closure (assuming a traditional semantics for partitive *of* (e.g. Ladusaw, 1982)):

(7) $[\![\mu_{PRT}]\!] = \lambda P \lambda d \lambda x.P(x) \wedge \textbf{quantity}(x) = d$

(8) $[\![\exists [\text{ half } [\mu_{PRT} [\text{ of } [\text{ the books }]]]]]\!] = \exists x.x \leq the.books \wedge \textbf{quantity}(x) = \textbf{mid}(S_{of.the.books})$

Degrees and events. The function of *half* in (2) has been analyzed as delimiting the extent to which an event is realized (Moltmann, 1997; Piñón, 2008). I follow Caudal and Nicolas (2005) who propose a mapping from degrees to events in order to capture the relation between scale structure and aspectual composition, replacing Krifka's (1992) classic mapping between objects and events. Yet again, it is the part structure of the internal nominal argument of the VP that has an effect on scale structure, such that only bounded, telic events can be modified by *half*, i.e. events that have a bounded incremental theme argument that 'measures out' the event (following Tenny, 1994). Some recent proposals have been put forward on how to incorporate degree semantics into aspectual composition. Kennedy and Levin (2008) propose that degree arguments are part of the lexical meaning of degree achievements. For other verb classes, Piñón (2000) proposes a degree function δ that allows verbs that lack a degree argument to acquire one. However, since δ applies directly to verb meanings, Piñón's analysis fails to capture the generalization that the incremental theme argument plays a crucial role in determining scale structure. Note that, like in the case of partitives, *half* is only felicitous with fully closed scales derived from bounded internal arguments:

(9) John half ate the apple.

(10) ?? John half ate apples / applesauce.

To formalize the link between the part structure of the nominal argument and the corresponding quantity scale over which *half* operates, I propose μ_{VP}, a variant of μ_{PRT}, whose semantics is given in (11). Like Piñón's δ degree function, μ_{VP} introduces an open degree argument that can be modified by *half* or other aspectual modifiers. However, since μ_{VP} also syntactically introduces the incremental theme argument, we are able to capture the fact that the part structure of the internal nominal argument plays a crucial role in determining scale structure. As the semantics for the VP *half wash the dishes* in (12) shows, the quantity scale targeted by *half* is based on the bounded incremental theme *the dishes*, yielding an event description that is true of an event of washing that is realized to the midpoint of the quantity scale.

(11) $[\![\mu_{VP}]\!] = \lambda x \lambda P \lambda d \lambda e.P(e) \wedge \textbf{theme}(e)(x) \wedge \textbf{quantity}(x) = d$

(12) $[\![[\text{ half } [\text{ wash } [\mu_{VP} [\text{ the dishes }]]]]]\!]$
$= \lambda e.\textbf{wash}(e) \wedge \textbf{theme}(e)(\text{the dishes}) \wedge \textbf{quantity}(\text{the dishes}) = \textbf{mid}(S_{wash.the.dishes})$

In the absence of a degree modifier, a *pos* morpheme provides a value for the degree argument, defaulting to a maximal interpretation given an upper-closed scale.

Conclusions. As is the case for gradable adjectives, nominal arguments in partitives and event-denoting VPs play a crucial role in determining a scale structure that tracks quantity. For partitives and incremental theme verbs, a bounded nominal argument induces a fully closed scale over which *half* and other modifiers operate. In these two environments, the functions μ_{PRT} and μ_{VP} provide a formal mapping from nominal part structures to quantity scales. Moreover, since μ_{VP} can be derived from μ_{PRT}, this analysis appeals to a more basic notion of partitivity and measurement that is linked to gradability in both true partitives and event-denoting VPs, revealing further semantic parallels between the nominal and verbal domains.