
















World knowledge and the absolute-relative distinction in adjectives in offline and online processing

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Gradable adjectives fall into two classes: **relative** adjectives, such as ‘short’, that require context for their interpretation, and **absolute** adjectives, ‘empty’, ‘spotted’, that can have context independent meanings (Rotstein & Winter 2004, Kennedy & McNally 2005, Kennedy 2007). We show that the absolute-relative distinction is blurred in an offline rating task, but emerges during online processing.

The interpretation of both relative and absolute adjectives is subject to the effects of world knowledge, i.e. to what extent familiar everyday objects are associated with particular thresholds of gradable properties. To judge whether the sentence ‘This glass is short’ is true, you need to know the comparison set of other relevant glasses to establish a **contextual threshold** for shortness. To judge a glass as ‘empty’ you only need to know if the **maximum threshold** of emptiness is reached; other glasses in the context are irrelevant. However, your world knowledge still affects interpretation, e.g. how empty the glass should be. Similarly, the **minimum threshold** for ‘spotted’ can shift (but doesn’t have to) depending on the context. The shifting thresholds of minimum and maximum absolute adjectives can be treated as a **pragmatic** phenomenon (Kennedy 2007, Leffel et al. 2016, 2017, a.o.) or a **semantic** one where world knowledge determines the threshold just like with relative adjectives (the probabilistic knowledge of the threshold is derived from the prior degree distribution) (Lassiter & Goodman, 2013, 2015; Qing & Franke, 2014a, 2014b). On the latter account, the difference in context sensitivity results from the difference in the stability of the optimal threshold. Assuming that everyday objects are associated with a **typical threshold** of a property (e.g., all the scarves in Fig.1 can be described as ‘short’) do we find evidence for probabilistic uses of both types of adjectives or is there a clear absolute-relative distinction with both offline and online measures?

Fig. 1 Sample items in Exp 1-2

Adjective Type:	Degree of property:				
	1	2	3	4	5
RELATIVE <i>short</i>					
ABSOLUTE MINIMUM <i>spotted</i>					
ABSOLUTE MAXIMUM <i>empty</i>					

Exp 1-2. Ratings. We followed the design of Kim et al. (2013, 2014), Leffel et al. (2017) who found a distinction: the thresholds of relative adjectives were midway on the scale, those of absolute adjectives close to the endpoints. We created substantially more items: 187 adjective-object pairs in photographs of 5 degrees of a familiar property (Fig.1) for 14 relative and 14 absolute (8 max, 6 min) adjectives. In an offline task (in German), participants evaluated the goodness of fit of adjective and photograph by choosing between *Yes/No/Don't Know* for each of the 5 pictures in a set, counterbalanced left-right/right-left order (Exp.1, $n=72$, 84 targets, Exp.2, $n=72$, 103 targets). Averaging over the 5-point scales for each adjective-object pair, we obtain the curves in Fig.2-3. In Exp1-2, there is an effect of degree, a significant interaction, but no effect of adjective type. The averages hide a great underlying variability, therefore, we ran a clustering algorithm revealing 3 clusters (Fig.4). Each cluster contained adjectives from all classes (see table). This result supports **the probabilistic approach**.

Fig. 2 Results Exp 1

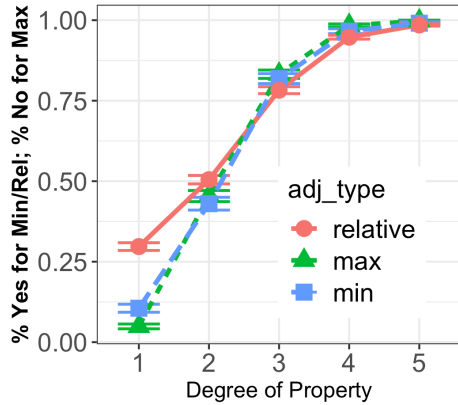


Fig. 3 Results Exp 2

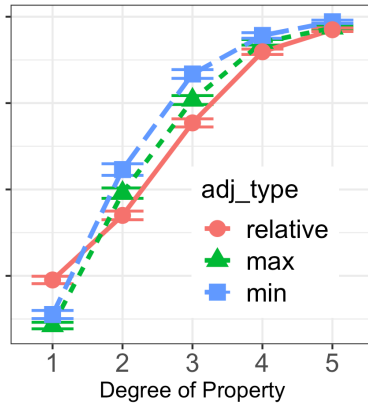
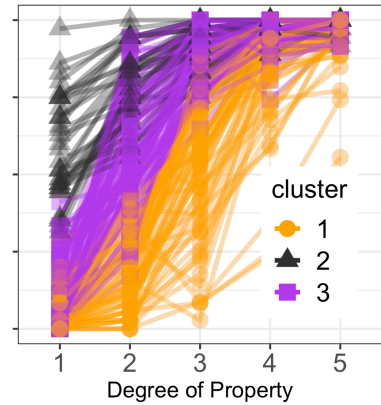


Fig. 4 Clusters from Exp 1-2



No. of adjectives in:	Relative	Absolute Min	Absolute Max	Total
Cluster 1	14	4	7	25
Cluster 2	11	3	2	16
Cluster 3	13	6	8	27

Exp 3. ERPs. Cluster 3 in Exp 1-2 contains the most uniform profiles, spanning all 5 degrees, and the largest number of adjectives (13 relative, 14 absolute). From cluster 3 we selected 10 relative and 10 absolute (5 min, 5 max) adjectives that each had 3 adjective-object pairs in the cluster. We predicted that differences in processing can be attributed to the differences in meaning, i.e. optimal thresholds. In an EEG study (in German), participants ($n=30$) first saw a set of 5 pictures (as in Fig.1), then a red frame appeared selecting degree 2 or 4 (counterbalanced order), followed by a serial presentation of a sentence, e.g., ‘This / is / short’. The adjective either matched or mismatched the selected degree. In addition to absolute and relative adjectives, we added two conditions for which mismatches resulted in semantic and world knowledge violations (Hagoort et al. 2004), Fig.5, to compare the cognitive mechanisms underlying adjective interpretation. The relative adjectives required the assessment of the relation between the marked object and its comparison set. The absolute adjective didn’t; the marked object was never the max/min of the scale. But if absolute adjectives relied on probabilistic thresholds like relative adjectives, both classes should pattern together with the world knowledge condition, which was not confirmed. Analyses revealed a reliable effect of condition between 300-500ms. The semantic mismatch elicited a clear N400 effect (Fig.6). The relative condition also elicited a negative shift, like the world knowledge condition, indicating that during online processing **relative thresholds are probabilistically resolved**, while absolute thresholds are stable. This result is compatible with both pragmatic and probabilistic accounts.

Fig. 5 Sample items from additional conditions in Exp 3



Fig. 6 Mismatching conditions in Exp 3 (negativity is plotted down)

