World Knowledge and the Interpretation of Relative and Absolute Adjectives

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We show that the effects of world knowledge, how familiar everyday objects are associated with particular thresholds of gradable properties, blur the absolute-relative distinction in an offline task, but reveal it during online processing.

Background. 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). To judge whether the sentence 'This vase is short' is true, you need to know the comparison set of other relevant vases to establish a **contextual threshold** for shortness. To judge a vase as 'empty' you only need to know if the **maximum threshold** of emptiness is reached, other vases are irrelevant. To judge whether a vase is 'spotted', you can take one spot as the **minimum threshold**. The shifting thresholds of absolute adjectives can be treated as a **pragmatic** phenomenon (Kennedy 2007, Leffel et al. 2016, 2017, a.o.) or a **semantic** one where the probabilistic knowledge of the threshold is derived from the prior degree distribution just like with relative adjectives (Lassiter & Goodman, 2013, 2015; Qing & Franke, 2014a, 2014b). Assuming that everyday objects are associated with a **typical threshold** of a property, e.g., all the skirts in Fig.1 can be described as 'short', do we find evidence for the absolute-relative distinction with offline and online measures?

Rating task. We followed the design of Kim et al. (2013, 2014), Leffel et al. (2017) who found that thresholds of relative adjectives are midway on the scale, but those of absolute adjectives are close to the endpoints. This effect was stronger for abstract 3D figures than everyday objects. We created 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 chose between *Yes*/*No*/*Don't Know* for each of the 5 pictures in a set, counterbalanced for left-right and 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. LMEMs reveal **no effect of adjective type** (Exp. 1, p=.95, Exp.2, p=.55), effect of degree (p<.0001, p<.0001) and a significant interaction (p<.0001, p<.0001) (significant for almost all levels of the degree and adjective variables, sum-coding). 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**. Cluster 3 contained most uniform profiles, spanning all 5 degrees, and the largest number of adjectives (13 relative, 14 absolute).

ERPs. From cluster 3 we selected 10 relative and 10 absolute (5 min, 5 max) adjectives that had 3 adjective-object pairs in the cluster. If these 60 items are visually similar and elicit similar rates of Yes/No responses, any differences in processing can be attributed to the differences in meaning. 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. 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 the 4 types of No-judgments. We analyzed ERPs for the adjective between 300-500ms post-adjective onset. Using LMEMs, crossing Adjective Type, Yes-No, Hemisphere and Saggitality, we find four main effects (all p<.0001) and significant interactions. Fig.6 shows the **differences between Yes and No conditions**. Looking at only matching Yes conditions, we find no main effect of Adjective Type (p=.11). For No conditions, there is an **effect of Adjective Type** (p<.0001), and 3 levels Absolute, Relative, Semantic are significantly different (p<.0001). The Semantic No condition elicited a clear N400 effect (Fig.7), while Absolute elicited positivity. Relative elicited a negative shift, 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. 1 Sample items in Exp 1-2

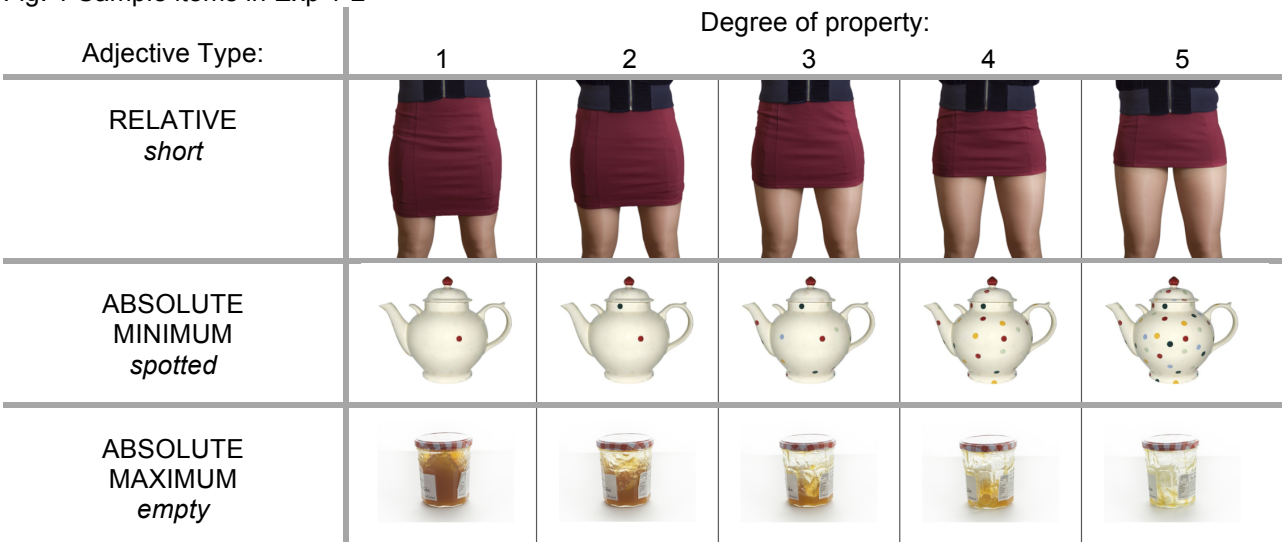


Fig. 2 Results Exp 1

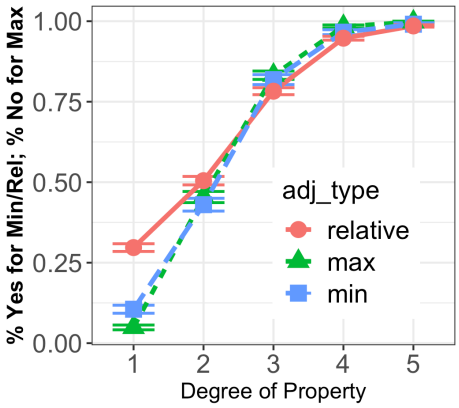


Fig. 3 Results Exp 2

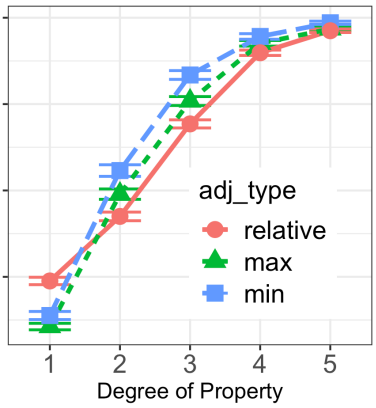
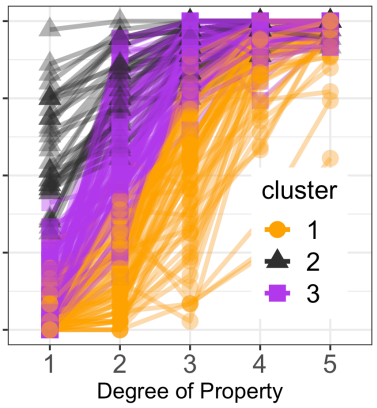


Fig. 4 Clusters from Exp 1-2



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

Fig. 5 Sample items from additional conditions in Exp 3

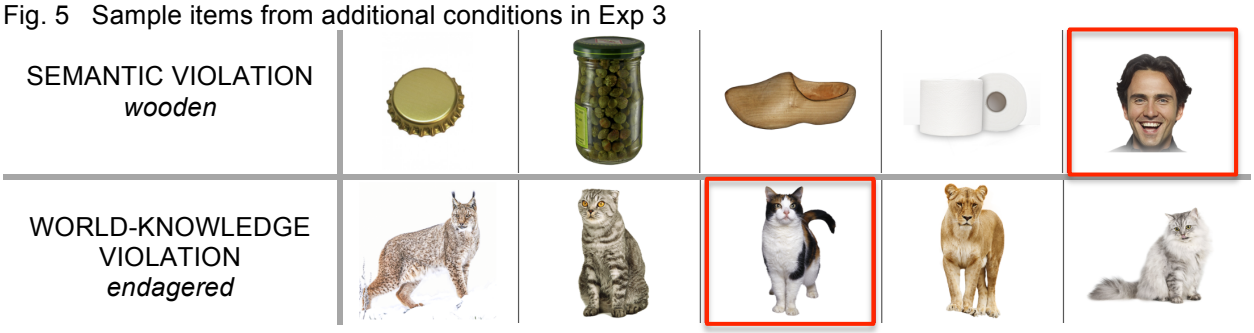


Fig. 6 Difference maps for the Yes vs. No condition

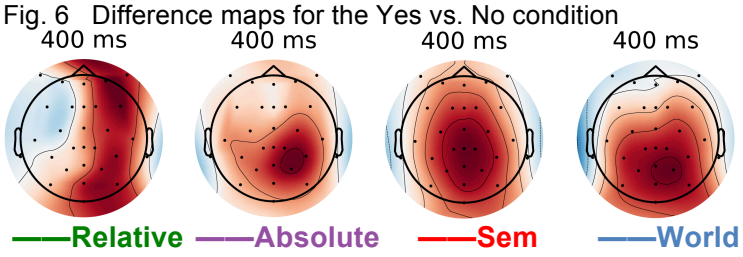


Fig. 7 No Responses