

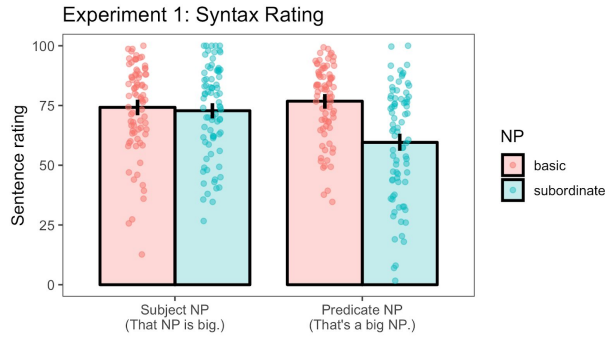
## Inferring comparison classes from syntactic cues and world knowledge

Most Great Danes are big dogs, but some are also big Great Danes. Understanding a gradable adjective (e.g., “big”) requires making reference to a *comparison class*, a set of objects or entities against which the referent is implicitly compared (e.g., big for a Great Dane), but how do listeners decide upon a comparison class? Standard theories of semantic composition stipulate that the adjective combines with a noun, which necessarily becomes the comparison class (e.g., “That Great Dane is big” means big for a Great Dane). We investigate an alternative hypothesis: the noun in a sentence is a cue to the comparison class, which must be integrated with other cues, like syntax, for a listener to infer the intended comparison class. We theorize that the utility of a noun in an adjectival utterance can be either for reference (getting the listener to attend to the right object) or predication (describing a property of the referent; in the case of adjective understanding, this amounts to setting the comparison class). Therefore, we hypothesize that when nouns are in the subject position (“That NP is big”), they are more likely to be used for reference (e.g., via composition with the deictic ‘That’) and hence, less likely to set the comparison class; in contrast, nouns in the predicate position (“That’s a big NP”) are less likely to be used for reference and more likely to set the comparison class.

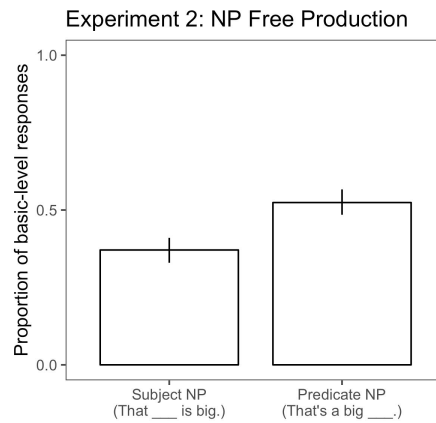
Across three pre-registered experiments (E1: Syntax Rating; E2: Noun Production; E3: Comparison Class Inference; [tinyurl.com/vyzs77q](http://tinyurl.com/vyzs77q)), we find consistent evidence that listeners integrate the noun of a sentence with syntactic information and world knowledge to infer comparison classes. In all experiments, referents are either normal-sized (E1, E2) or unknown-sized (E3) members of an saliently-sized subordinate category (e.g., the referent is a Great Dane, which is big for a dog, though not obviously big for a Great Dane).

In E1 (n=80), participants rate how well two sentences, which differ in the syntactic position of the NP, describe the referent (“That NP is big” [subject] vs. “That’s a big NP” [predicate]); on each trial, the referent appears in a visual context of other basic-level members (other dogs) and participants rate both syntactic frames with an NP that is either the subordinate or basic-level label (“Great Dane” or “dog”, within-participants). Participants show a significant dispreference for the subordinate-NP in the predicate position (“big Great Dane”; Fig. 1), as measured by a syntax by NP interaction ( $\beta = -4.0$  [-5.8, -2.3]). In E2 (n=190), participants fill-in a sentence frame which lacks an NP; the referent is presented in a visual context of basic-level distractors (a Great Dane among other dogs). Sentence frames differ in the syntactic position of the NP (between-participants): “That \_ is big” (subject) or “That’s a big \_” (predicate). Consistent with our hypothesis, participants produce more subordinate labels in the subject than predicate position (Fig. 2;  $\beta = 2.0$  [0.5; 3.6]). In E3 (n=200), we manipulate the syntactic frame (subject vs. predicate NP), visual context (other dogs vs. other Great Danes), and NP (“dog”, “Great Dane”, and “one” as a visual-context baseline), all within-participants, to test their influence on comparison class inferences. Participants paraphrase an adjectival utterance (e.g., “That Great Dane is big”) with an explicit comparison class (“...big relative to other \_\_\_\_”). We find substantial flexibility in comparison class inferences by NP, syntax, and context (Fig. 3): In a preliminary analysis, we find a main effect of context ( $\beta = -3.0$  [-3.9; -2.1]), subordinate NP vs. “one” ( $\beta = -1.0$  [-1.4; -0.5]), and subordinate-NP by syntax interaction ( $\beta = -0.83$  [-0.03; -1.64]).

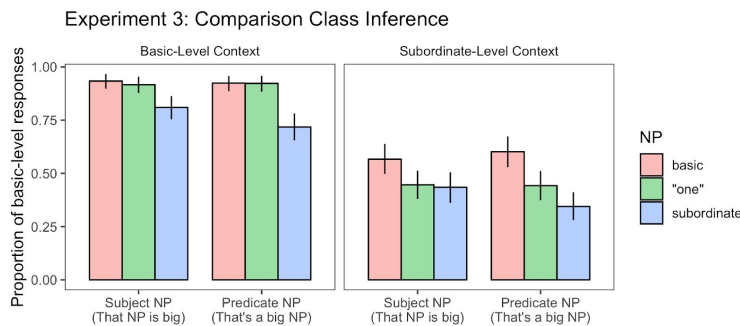
These results broadly support a view of comparison classes as an underspecified aspect of context that must be pragmatically inferred. World knowledge (e.g., that a Great Dane is a big dog) combines with lexico-syntactic cues to help listeners recover the intended comparison class. The way in which the noun phrase influences the comparison class is consistent with listeners assuming a trade-off between referential and predicative utility in using a noun phrase: A noun’s utility in reference explains away its potential usage to convey the comparison class.



**Figure 1:** Means and 95% bootstrapped confidence intervals of ratings for how well a sentence with the adjective “big” (or, “small”) describes a normal-sized member of a subordinate category that tends to be big (or small) relative to a basic-level category, when different nouns (color) appear in different syntactic frames (x-axis). Scale ranges from “very bad” [0] to “very well” [100]. Points represent participant means within condition.



**Figure 2:** Means and 95% bootstrapped confidence intervals of basic-level referent label productions (e.g., “dog” when the referent is a normal-sized Great Dane) in different syntactic frames (x-axis).



**Figure 3:** Means and 95% bootstrapped confidence intervals of inferred basic-level comparison classes (e.g., “...big relative to other *dogs*”) when the referent (e.g., a Great Dane) appears in basic-level visual context (e.g. other breeds of dogs, left panel) or in subordinate context (other Great Danes, right panel) from a sentence where the NP is “one”, the subordinate (‘Great Dane’) or the basic-level (‘dog’) label of the referent (colors), appearing in different syntactic positions (x-axis).