Can Children Tell Us Something about the Semantics of Adjectives?

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Abstract. We propose to investigate the process of the acquisition of relative gradable adjectives by children in order to gather new evidence to evaluate the main two theories that have been proposed to account for the meaning of gradable adjectives, i.e. the degree-based analysis and the partial function approach. We claim that younger children start by assigning a nominal like interpretation to relative gradable adjectives (*tall* means "with a vertical dimension"), and only at a later stage, for informativeness reasons, they access the comparative reading (*tall* means "taller than a standard"). We present and discuss the results of an experimental study in which we aimed at "turning adults into children". We show that, when informativeness is not at stake, even adults seem to access the nominal interpretation of relative adjectives. We eventually argue that the transition from the nominal to the comparative reading of relative adjectives is easily accounted for by a partial function approach.

Keywords. Semantics of adjectives, language acquisition, experimental semantics and pragmatics.

1 The semantics of gradable adjectives

The class of adjectives is heterogeneous, and different subclasses can be identified. Focusing on the distributional pattern, a distinction is drawn between gradable adjectives (GAs, those adjectives that can enter into a comparative construction and be modified by degree expressions, e.g., *tall*, *intelligent*, *open*), and not-gradable adjectives (e.g., *Dutch*, *wooden*, *four-legged*). Ignoring so-called intensional adjectives (cf. [14]), not-gradable adjectives can be semantically viewed as referring to properties of individuals, that is, the meaning of the adjective *Dutch* can be identified with the set of individuals that are Dutch. The same meaning (function from individuals to truth-values) is not on the other hand straightforwardly attributable to gradable adjectives,[1] given that GAs exhibit context depend-

[1] Or, at least, to the subclass of *relative* gradable adjectives. *Absolute* gradable adjectives (*full*, *open*, *straight*, etc.) could in principle be analysed as denoting sets of individuals since they do not exhibit the same context dependency (cf. [9,16]). In this paper, however, for reasons

ency (the same individual, for instance Bart, who is 188 cm tall, can be judged as *tall* for being an Italian man, and as *not tall* for being a basketball player) and borderline cases (if Bart is Dutch, we wouldn't be confident in judging the sentence neither true nor false, since the average height for men in Netherlands is 185 cm).

To account for these facts, two main approaches have been proposed. The degree-based analysis (cf. the references in [8]) assumes that GAs differ from not-gradable ones in that they denote a relation between an individual and a *degree*, where degrees are conceived of as abstract entities ordered along a scale, associated with the dimension referred to by the adjective. Thus, the GA *tall* evokes a scale of degrees ordered with respect to the dimension of height, and a sentence containing *tall* is viewed as the assertion that an individual possesses the tallness property to certain degree. In fact, sentences involving bare uses of the adjective are analysed as concealed comparative sentences, thus "Bart is tall" gets interpreted as "Bart has a degree of height that exceeds a standard of comparison". For *relative* GAs, the standard of comparison has to be contextually retrieved, by making reference to the intended comparative class (e.g., Italian men or basketball players), or by taking into account other perceptually salient individuals (as in "tall compared to Leo").

Ewan Klein [10-12] on the other hand proposed a unified account for adjectives, viewing them as functions from individuals to truth values, with not-gradable (extensional) adjectives being total functions (thus corresponding to sets of individuals that share a property), and GAs being *partial* function. The idea is that, once we specify a particular domain of individuals that fall under the extension of a GA such as *tall*, the meaning of *tall* consists of a function that identifies the individuals who count as (definitely) tall, those who are (definitely) not tall, but for some individuals the function is undefined, i.e. it does not assign a value. Moreover, the restriction of the domain of application of the GA to particular subclasses (e.g., the set of Italian men or the set of basketball players) leads to different outputs of the value of the function (i.e., the same man can count as tall with respect to the class of Italian men, and as not-tall with respect to the class of basketball players). Thus, Klein accounts for the existence of borderline cases by means of the partiality of the GA function, and for the contextual variability of GAs by restricting their interpretation to different comparison classes.

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of space, we will restrict our attention to *relative* gradable adjectives (and thus, in the final part, we will only report the results concerning the interpretation of relative adjectives, even if the experiments we ran aimed at investigating the analysis of absolute gradable adjectives as well).

The degree-based account and the partial function approach have been compared on theoretical grounds (the partial function approach appears simpler and more in line with Frege's principle of compositionality, since it does not posit degrees as primitive entities, and it derives the meaning of the comparative construction from the meaning of the positive form, cf. [10]), and on empirical grounds (simplifying the question, adding particular constraints on the way individuals in the comparison classes are ordered, the two theories can be seen as nearly equivalent, cf. [15]). Our aim is to look for new evidence in favour or against these approaches by taking into account the process of language acquisition. Even if the proponents of these theories do not consider this question,[2] and thus they do not make explicit prediction about the way children ought to interpret gradable adjectives, we think that children's linguistic behaviour could open a window into the semantics of adjectives.

2 What children can tell us about the semantics of adjectives

The process of language acquisition typically passes through different phases in which children may exhibit a linguistic behaviour that does not conform to adults' competence. For instance, in the first phase of the acquisition of the meaning of common nouns, children often make errors of over-extension, labelling *daddy* any man, and this has been interpreted as evidence on the way children establish the mapping between words and objects. Our aim is to look at the way children understand and produce adjectives, focusing in particular on the errors they make, and then discuss how the two theories just discussed could account for these errors.

Even if adjectives are harder to acquire than nouns, children start using relative GAs as young as 2, and by the age of 3 they produce GAs such as *big/small(little)*, *tall/short*, *long/short*, *high/low*, *heavy/light*. As for their interpretation, in experimental settings children appear to access the normative reading (judging an object to have the GA-property with respect to a normative class of comparison, e.g. judging a mitten to be *big* or *small* "as a mitten") and the perceptual reading (fixing the standard of comparison relative to another object physically present, cf. a.o. [4-5])). Nevertheless, it has been noticed that children make a consistent series of errors:

[2] Except for Syrett's PhD thesis, which discusses children's interpretation of relative and absolute GAs. She adopts a degree-based account, and interprets children's performance under that perspective, even if she explicitly admits that some of children's unexpected behaviour would be straightforwardly explained assuming a kleinian-like semantics (cf. in particular [20], p. 41-42).

they make substitution errors (e.g., they judge an object that is meant to be *small* as *big*, cf. [3], or they substitute *tall* with *big*, cf. [1]), and they exhibit "extreme labeling": when they are presented with a series of seven items that decrease along a relevant dimension (for instance, seven blocks decreasing in size), they tend to label as *big* (or *small*) only the extreme item of the series (cf. [18, 20]), whilst adults tend to put the cross-over point around the mid of the series. Since the experiments designed to test children's comprehension of relative GAs explicitly provided them with a comparative class, or perceptual cues, it is hard to tell what kind of interpretation children might access, and which framework better accounts for the facts. This is why we decided to design a new experiment.

2.1 Experiment 1

In a previous study (see [6]), we tested a group of 20 3 year-olds, 20 5 year-olds and adults as controls. In a first experiment, a truth-value-judgment task we presented abstract objects in isolation, and asked subjects whether the description used by a puppet was correct, not correct, or whether they couldn't tell. Our experimental design aimed at not providing any contextual standard to judge relative GAs: the objects did not evoke any normative class, and were presented in isolation (without other perceptual cues) – for instance, we presented a 17,5 cm tall wooden rod describing it as "This is tall". Since the context did not provide any standard of comparison, we expected a prevalence of "I don't know" answers and/or chance distribution of "yes" and "no" answers. Our predictions were confirmed with adults: relative GAs received 60% of "I don't know", 30% of "yes", and 10% of "no"-answers. Quite surprisingly, 3 year-olds provided more than 88% of "yes"-answers (with "no" and "I don't know" at 6% each), accepting "This is rel-GA" (e.g. "This is big" or "This is small") applied to abstract objects in isolation. There seems to be a developmental trend, with 5 year-olds displaying 60% of "yes", and 20% each of "no" and "I don't know". Statistical comparisons by means of Fisher Exact Tests for count data revealed a significant general effect of Age in case of relative GAs ($p<.001$). A significant difference also emerged between 3 year-olds and 5 year-olds, between 3 year-olds and adults and between 5 year-olds and adults (all $ps<.001$). However, this effect might be partly due to the fact that children used the option "I don't know" much less than adults. Considering the proportion of "yes" answers over the total, the difference between the 3 and the 5 year-olds disappears ($p=.218$), while it does not comparing the 5 year-olds and the adults ($p<.01$). In Table 1 we plot the distribution of participants' judgments by Age and Adjective with

respect to relative GAs. Summing up, younger children tend to overwhelmingly accept descriptions of the form "This is rel-GA" applied to abstract objects in isolation (that is, when the context does not supply any standard of comparison), independently of the polarity of the adjective (i.e., they accept both antonyms).

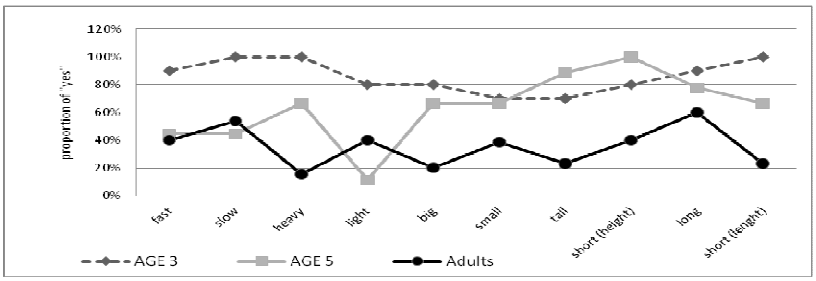

Table 1. Percentage of "yes" answers per Age of participants and Relative GA

We believe that this fact calls for an explanation, but we exclude the hypothesis that this high acceptance is simply due to the fact they do not know the meaning of the adjectives, and thus they opt for a "yes"-answer, because there's ample evidence in the literature that children know adjectives like the ones we tested from age 2 on (cf. the references in [20]), and moreover in a second experiment, a scalar judgment task, we presented a series of seven objects decreasing (or increasing) along a relevant dimension, and asked subject whether the description "This is rel-GA" could apply to each item (e.g., we presented a series of seven wooden rods ranging from 20 cm to 5 cm in height, and asked for each of them "Is this tall"?), and the group of 3 year-olds showed (the well-known phenomenon of extreme labelling, but also) a consistent behaviour – accepting the description for the first item of the series, and rejecting it for the last item, and thus we interpreted these results as evidence of the fact that children knew the meaning of the tested relative GAs. We also exclude the hypothesis that children are simply being extremely charitable, answering "yes" whenever they do not have strong reasons to reject the statement, because some of the fillers we tested were meant to prompt a "I don't know" response (e.g., a toy-zebra was described as "this is obedient", and, as expected, more that 90% of the adults reacted to these description using the option "I don't know"), and 3 year-old children split between a "yes" and a "no" answer: around 50% accepted the description but half of them didn't, thus children do not choose the more charitable option whenever they can.

Having excluded these simpler explanations, we propose to interpret the results assuming that there is a developmental trend in the interpretation of relative GAs: children start interpreting relative GAs as if they were referring to sets of individuals sharing a property (just like common nouns, and intersective adjectives), and only at a later stage they switch to the comparative-like reading. A similar hypothesis was proposed by H.H. Clark [2], who noticed that the positive relative GAs (*tall*, *long*, *heavy*…) are ambiguous between a nominal use and a comparative use. Thus, in (1) the relative GA *tall* is interpreted nominally, and the GA is neutral (that is, it does not imply that Lia is tall with respect to a standard of comparison), since it simply indicates that the dimension that is relevant for attributing a particular property to Lia is the vertical dimension; in (2), on the other hand, the relative GA is interpreted comparatively, and the reference to a contextual standard of comparison is necessary.

1. Lia is 156 cm tall.
2. Lia is tall.

If we assume that younger children firstly assign to relative GAs a nominal-like interpretation (and thus, *tall* would simply mean "that has a vertical dimension", *fast* "that has some speed", and so on) we could immediately account for the fact that younger children show a nearly at ceiling acceptance of the descriptions involving relative GAs, since, under this nominal interpretation, they would truthfully describe the objects presented. Only at a later stage, around 5 years of age, children would then realize that the nominal-like interpretation of relative GAs is highly underinformative in normal contexts, and would eventually realise that a comparative interpretation is needed.

2.2 Experiment 2

We are hypothesising that children start assigning to relative GAs a minimal interpretation (e.g. *tall* means "that has a vertical dimension"), that leads them to accept "This is rel-GA" referred to objects that do possess this minimal property even in the absence of a relevant standard of comparison that could trigger the comparative, stronger reading, and that they switch to the adult-like reading when they realise that in normal contexts such an interpretation would not add new information. This hypothesis assumes that there is contiguity between the nominal and the comparative interpretation, and that the latter is derived from the first one when informativeness is at stake. If this is correct, we should be able to detect the minimal, nominal-like, reading of relative GAs also in adults, once the

informativeness requirement is not playing a role.[3] In a novel experiment, our aim was to test adults' interpretation of relative GAs in a context that was manipulated in such a way to leave informativeness aside, in order to see whether in this new experimental setting adults would accept relative GAs the way younger children did in our previous study.

We tested 73 Italian adults, randomly assigned to one of two lists. Each list comprised a total of 29 items. Of these, fifteen were fillers: eight were clearly true, or clearly false, and the remaining seven were cases in which the adjective used was not applicable (NA) to the object, prompting a "no" response by the participants (for example, a toy plane was described as "This is vegetarian"). Differently from the first experiment, adults were given only two options of response: "yes" or "no", because children in the first study did not use the option "I don't know". In the second place, a training session was added, in which adults were asked to be as tolerant as they could with respect to the description provided by a puppet. The puppet was introduced as being an alien who had some hypotheses about the functioning of our language, and subjects were instructed to help him refining his hypotheses, correcting him when he was saying something clearly false, but accepting his sentences as long as they could apply in some way to the situation presented, even if his statements were not optimal. For instance, we presented a situation in which a toy-boy had four coins, and we recommended our subjects to reject clearly false sentences (e.g. the statement "The boy has seven coins"), but we also trained them to accept the alien's under-informative sentence "The boy has three coins", because even if the description was not optimal, correcting the alien could confound him because if he is told that it is false that the boy has three coins in a situation in which he actually has four, then the alien might think that the boy could not afford to buy an ice-cream that costs three coins. After this training session, we presented abstract objects in isolation, that were described by the alien as "This is adj", and asked the subjects to accept or reject these statements.

Compared to our previous study, on the basis of our hypotheses we predicted an increase of "yes" answers in case of Relative GAs, inasmuch as the adjectives could truthfully (even if not optimally) describe the objects under the minimal, nominal-like interpretation of the GAs. To make sure that adults were tolerant with critical cases only, we also predicted them

[3] In a recent paper [7], Katsos and Bishop argue that children's performance with scalar implicatures (i.e., the fact they seem not to compute them, accepting underinformative sentences) is not imputable to the fact that they are not aware of under-informativeness, but to the fact that they more tolerant of pragmatic infelicity. Even if the question is interesting and worth pursuing, we will not explore this issue here.

not to accept the descriptions in which the adjective used did not apply to the object, as it happened for the fillers classified as NA. For example, we expected adults to reject the description "This is vegetarian" referred to a toy-plane, on the basis that the property predicated by the adjective (i.e. "being vegetarian") cannot apply to a plane. Our results confirmed our predictions: adults' performance with fillers was at ceiling, and in particular, they did not hesitate in rejecting a description when the adjective used was not applicable to the object (cf. Filler-NA).

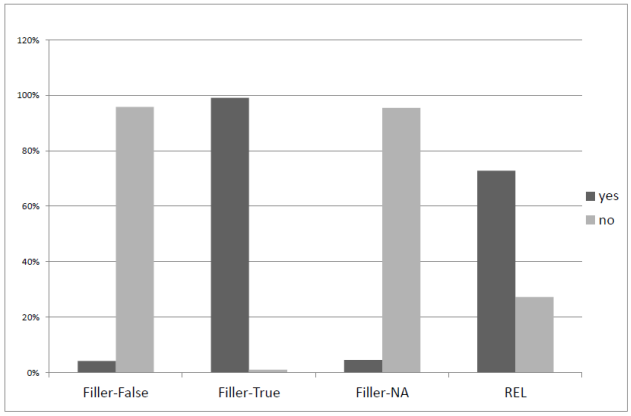

Table 2. Distribution of adult's responses in Experiment 2

Comparing adults' performance in the two studies in the interpretation of relative GAs, the increase of "yes" answer in this second experiment is significant, even taking into consideration the fact that in the second study the probability to answer "yes" was .50, while it was .33 in the first experiment, where three options of response were given (X-squared = 85.35, df = 2, p<.0001).[4] Comparing adults' performance in the second study with children's performance in the first one (see table 3), adult's performance in case of relative GAs does not differ from the younger children. Statistical analysis confirms that: (i) adults do not differ from 3 year-old and 5 year-old children in case of relative GAs (X-squared = 2.2709, df = 1, p-value = 0.1318; X-squared = 1.7691, df = 1, p-value = 0.1835). The aim of turning adults into children did work in the end.

[4] The proportion of "yes" answers in the second study is different from chance (X-squared = 46.2137, df = 1, p<.0001).

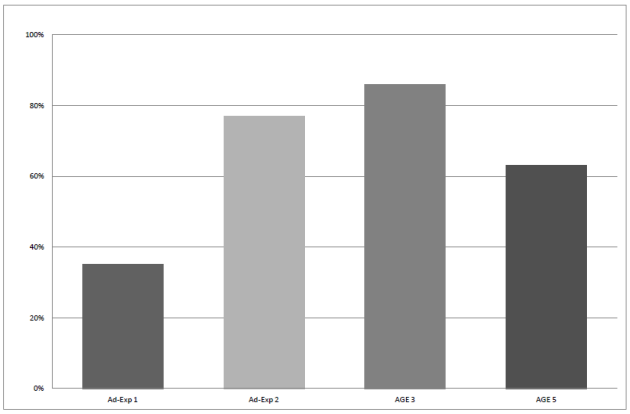

Table 3. Proportion of "yes" answers to rel-GAs: adults in Exp 1, Adults in Exp 2, 3 yo in Exp 1 and 5 yo in Exp 1

3 Conclusion

Summing up, we suggest that children start interpreting relative GAs as common nouns, and other not-gradable adjectives, that is as denoting sets of individuals, and by identifying their denotation with the domain of application of the GA. At a later stage, for informativeness reasons, they realize that a stronger meaning – that involves a comparison – is needed, and thus they have an almost adult-like performance in tests in which they are asked to choose the "GA X", where X comes also with the intended normative class or perceptual cues. We believe that these facts can be easily accounted for by a partial function analysis of GAs – as partial functions from individuals to truth-values – assuming that children start treating GAs as total functions, and the evolutionary step consists in realising that the function denoted by the relative GA exhibit truth-value gaps and needs to be contextually restricted to particular domains of individuals (that is, comparison classes). On the contrary, we don't see any easy way to account for these results in degree-based semantics, since it requires as a first step to comprehend GAs the ability to construct abstract representation of degrees (scales), and moreover relative GAs are analysed as the assertion that an individual possesses the gradable property to a degree that exceeds a contextually given standard – and in out experimental settings even if the standard was not provided, younger children and adults in the second experiment did accept the relative GAs and judged them as applicable to the given objects.

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