Classification under 'big'
The role of leaps in distributions and its delayed acquisition

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Introduction

What's BIG??

Every time a relative adjective such as 'big' is used, it divides the domain of discourse – from candles to mountains – into those items that may be called, e.g. BIG, and the rest of them.

To make communication possible, a speaker/hearer must know where the cutoff point between BIG and non-BIG entities—the membership standard—lies, or at least whether it lies above or below certain sizes in the domain.

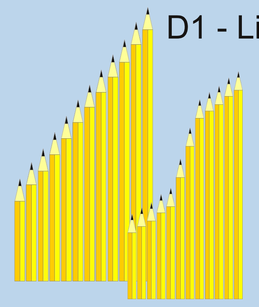
In testing whether there is evidence for leap-based standards, this study aims to contribute to the debate over the role of degrees vs. semi orders in the interpretation of adjectives, as well as in their processing. Leap effects would be in line with the view that degrees are only used if other strategies fail.

Methods

Two groups of Dutch-speaking subjects were tested:

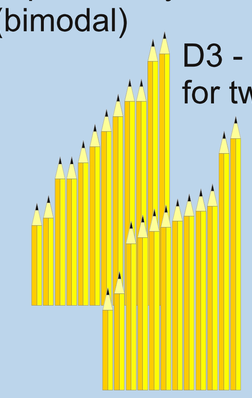
28 adults
14 men, 14 women
aged 50.9 ± 7.1
14.1 ± 2.7 years of formal education
14 native speakers + 4 fluent speakers

26 primary school children
13 boys and 13 girls
aged 8.1 ± 0.3 years
pupils of a Waldorf school in Amsterdam
24 native speakers + 2 fluent speakers



D1 - Linearly increasing

D2 - Clustered into two sets separated by a leap in the middle (bimodal)



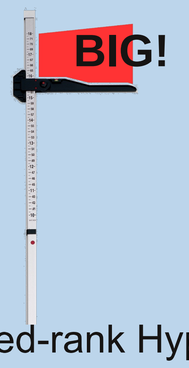
D3 - Like D1, except for two leaps.

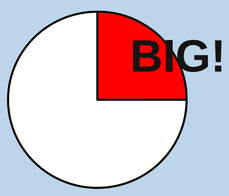
D4 - One large cluster in the middle

"Put the BIG pencils in the basket, please!"

H1: The Fixed-degree Hypothesis

Holds that a certain degree, dependent on range, but fixed across different distributions, is the standard. This standard is distribution-independent in the sense that the number of entities exemplifying each degree—out of the contextually relevant entities—doesn't affect standard-selection.



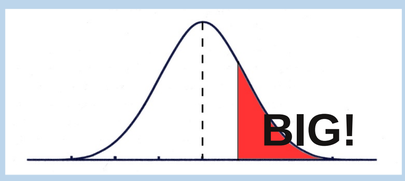


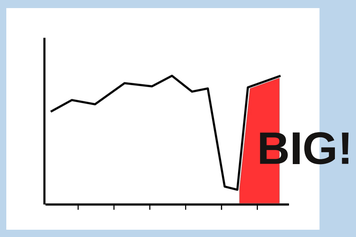
H2: The Fixed-rank Hypothesis

According to this hypothesis speakers use the rank ordering of entities by their length, selecting as BIG the n% biggest entities (Barner & Snedeker 2008).

H3: The M + a*SD Hypothesis

Holds that speakers make more complex calculations (Vennemann & Bartsch, 1972). The standard is based on the average in the domain, with a potential effect of the standard deviation as well (Solt 2011). Those entities are BIG which are bigger than the average length plus a certain proportion of the standard deviation.





H4: The Leaps Hypothesis

On a fourth option, leaps in the distribution trigger cutoff points.
Gaifman (2010) and Van Rooij (2011b) highlight the merits of leaps as means to avoid the Sorites paradox, by 'breaking' Sorites series.

Prediction 1

The transition midpoint* should be expected to be invariant across distributions with the same range

Prediction 2

The transition rank** must be expected to be relatively invariant across distributions.

Prediction 3

The transition midpoint* should be farther from the average when the standard deviation is bigger.

Prediction 4

Leaps in the distribution should enhance the likelihood for the transition midpoint to fall in that region.

* Transition midpoint := point in between the length of the first BIG pencil and that of the last non-BIG one
** Transition rank := Number / percentage of non-BIG pencils

Conclusions

- For adults, leaps were a predictor of cutoff.
- For children, a range-dependent, distribution-independent degree seems to be supported.
- A leap-based criterion may be helpful in minimizing communication errors.
- Children at the ages tested may have not yet developed this communicatively helpful tendency.
- These results shed light on the processing involved in the usage of relative adjectives
- Children may be using a fixed-degree ('mid-range') criterion, and their limited resources may prevent them from fully integrating this criterion with their world knowledge, ranks, averages, or contextual evidence for leaps.

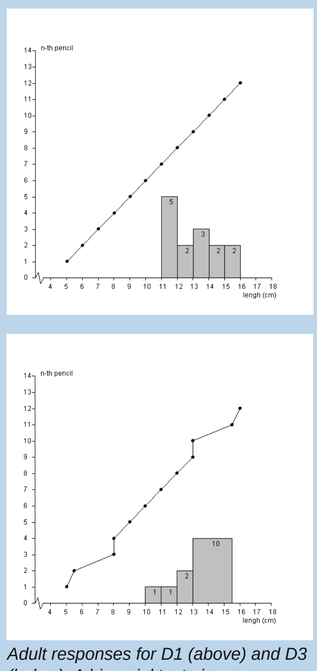
Results

Adults

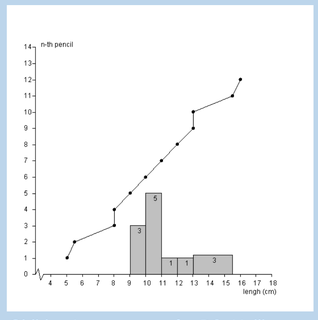
- With respect to the transition midpoint, the difference was significant for the combination D2-D4, with the big leap vs. cluster in the middle, contra Prediction 1.
- Except for the combinations D1-D3 and D3-D4, the differences between the transition ranks for the four distributions were highly significant ($p < .01$), contra Prediction 2.
- The transition midpoint was roughly closer to the average with bigger standard deviation, contra Prediction 3.
- The difference between D1 and D3 is of special interest because the mean and standard deviation of both are almost the same, but D3 has leaps, the rightmost of which is between 13 cm and 15.5 cm. A peak of respondents had their transition from non-big to big in this interval in accordance with Prediction 4.

Children

- The children, unlike the adults, in several cases showed a transition below the median/average length of the pencils.
- None of the comparisons of the transition midpoints/ranks in D1-D4 proved significant, in accordance with Predictions 1 and 2.
- Leaps did, however, trigger shifts in the transition rank, especially in D4 vs. D1, contra Prediction 2.
- Unlike the adults, children tended to locate the transition at the scale midpoint, in accordance with Prediction 1
- Leaps did not affect the transition midpoint, contra Prediction 4



Adult responses for D1 (above) and D3 (below). A binomial test gives a significance of $p < .054$ for the peak associated with the leap in D3.



Children's responses for D3. Unlike adults, children appear to ignore the leap.

Discussion

Non-parametric statistical criteria for standard selection capture human judgments regarding the standard across a wide array of distributions (Schmidt et al., 2009). As such, leaps probably provide an economic way to divide a domain into BIG and non-BIG items.

Distinctions related by adjectives should be worth making and easy to make. The first factor depends on many things. The second is strongly distribution dependent. Calculating the mean or the median is rather costly (averaging involves making a weighted sum of the sizes of all of the relevant entities) and it can only be done if degrees are available. Finding a leap is easy. Assuming semi-orders, degrees may not be encoded at all, yet there can be leaps (van Rooij 2011).

According to Gaifman (2010) and Van Rooij (2011b) semi-orders determine the use of positive forms of adjectives (e.g. entities stand in semi-order relation 'long-compared-to' iff one is significantly longer than the other). A standard for BIG is then found in the following way: choose the coarsest semi-order at your disposal, and switch to a finer one iff the former does not yield a standard. Hence, leaps will be naturally singled out as dividing lines.

According to Barner & Snedeker (2008), 4-year-olds select a standard for a size adjective based on the size distribution in a domain determined by the noun it modifies. Their results are compatible with a range-based, distribution-independent standard. Our findings confirm that children do not react to leaps in the same way that adults do, which suggests a delayed acquisition of the use of leaps.

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