

# Size Matters: Effects of Relative Distance on the Acceptability of Spatial Prepositions

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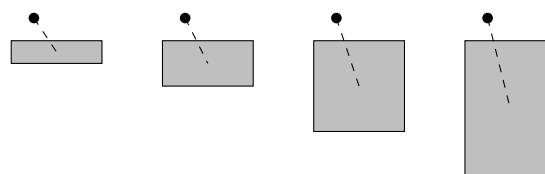
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For sentences such as “The circle is above the rectangle”, the geometric properties of the mentioned objects modulate participants’ sentence acceptability ratings (given object depictions; [2]). Among the geometric properties is the center-of-mass orientation, i.e., the orientation of an imaginary line between the centers-of-mass of two objects (dashed lines in Fig. 1a). [2] found that the more this orientation deviates from canonical upright, the lower people rate the acceptability of the spatial preposition *above*.

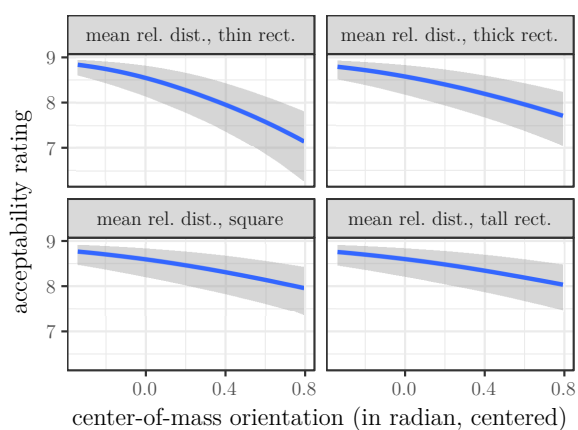
A computational cognitive model of this task (the rAVS model, [1]) assumes that the influence of the center-of-mass orientation reduces with lower relative distance. Relative distance is defined as the distance from the circle to the rectangle divided by the dimensions of the rectangles (with equal absolute circle placements: the taller the rectangle, the smaller the relative distance).

To test this assumption, we placed 18 circles above 4 rectangles with different heights (Fig. 1a) and asked people to rate the acceptability of the German sentence “Der Punkt ist über dem Objekt” (“The dot is above the object”). The taller the rectangles, (i) the *relatively* closer are the circles to the rectangles, and (ii) the less deviates the center-of-mass orientation from canonical upright.

Ratings did not differ across the (taller vs. shorter) rectangles but lower relative distance (cf. subplots of Fig. 1b) correlated with lower influence of the center-of-mass orientation on acceptability ratings (decreasing steepness of slopes). This confirms rAVS’s predictions and suggests that geometric properties of objects matter for relating spatial language to object depictions.



(a) Example stimuli used in our rating study. Dashed lines depict center-of-mass orientations.



(b) Effect of center-of-mass orientation on ratings conditioned on mean relative distances for the four rectangles (Bayesian regression model fits with 95% credibility intervals).

Figure 1: Stimuli (a) and results (b) of our study.

## References

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- [2] T. Regier and L. A. Carlson. Grounding spatial language in perception: An empirical and computational investigation. *Journal of Experimental Psychology: General*, 130(2):273–298, 2001. doi: 10.1037//0096-3445.130.2.273.