



Influence of near and far spaces in categorization of lengths and numerosities

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Background

1. Perception mechanisms of numbers, space, time, and other magnitudes could be deeply linked. (Buetti & Walsh, 2009)
2. Neuroimaging studies show that different brain areas are involved in bisection and pointing task for near VS far space (Weiss et al., 2000)
3. In a physical lines and number pairs bisection task, a rightward shift is observed proportionately to the distance between the subject and the stimulus. (Longo & Lourenco, 2006)

Research Questions

1. Will the distance of the stimulus location influence participant's categorization?
2. Will the same effects be present in the two magnitudes?

Hypotheses

We expect to find in both lengths and numerosities

- Over-categorization in far space
- Under-categorization in near space

Methods

Participants:

- * 20 students from Louvain-la-Neuve University (8 males).

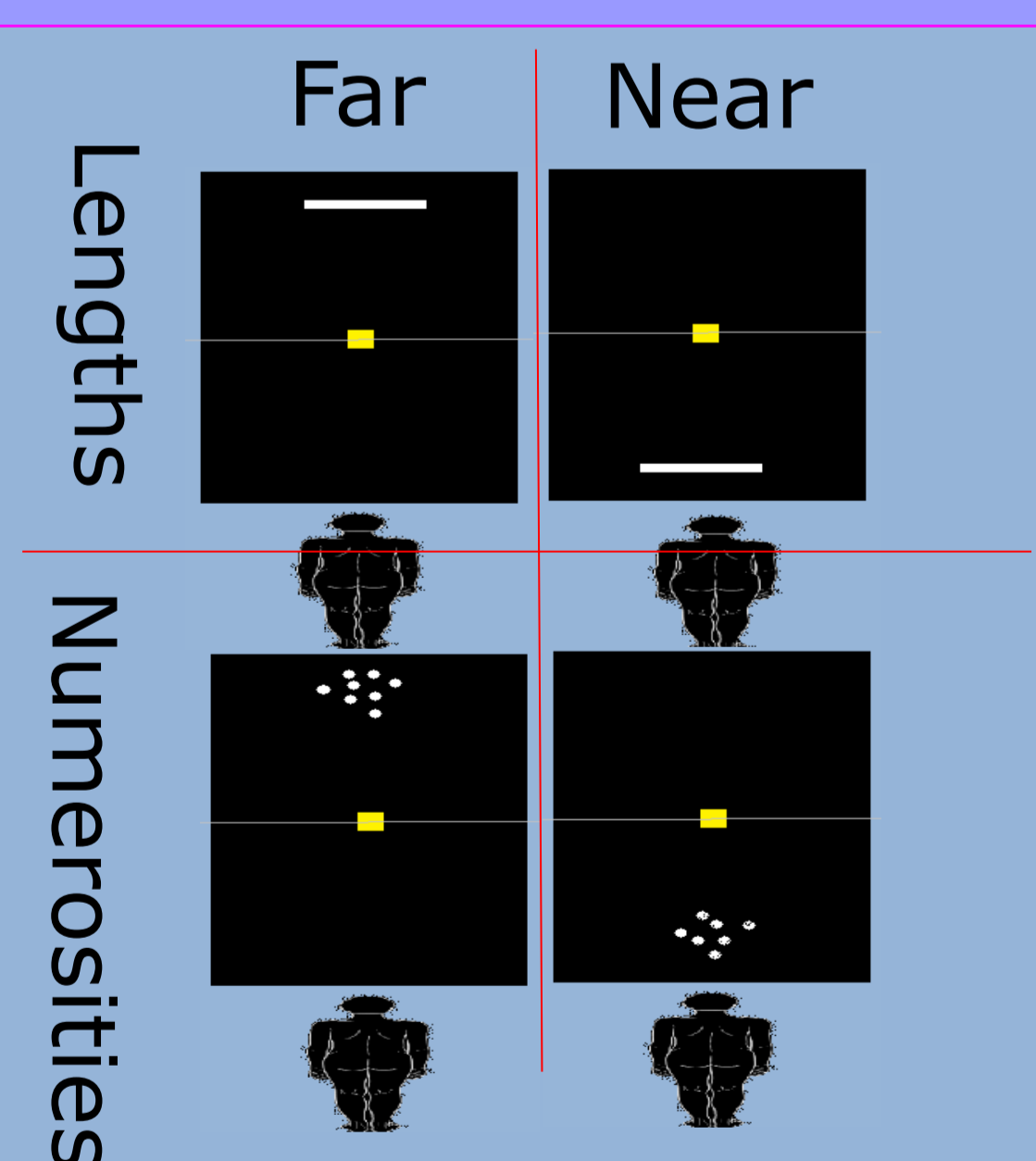
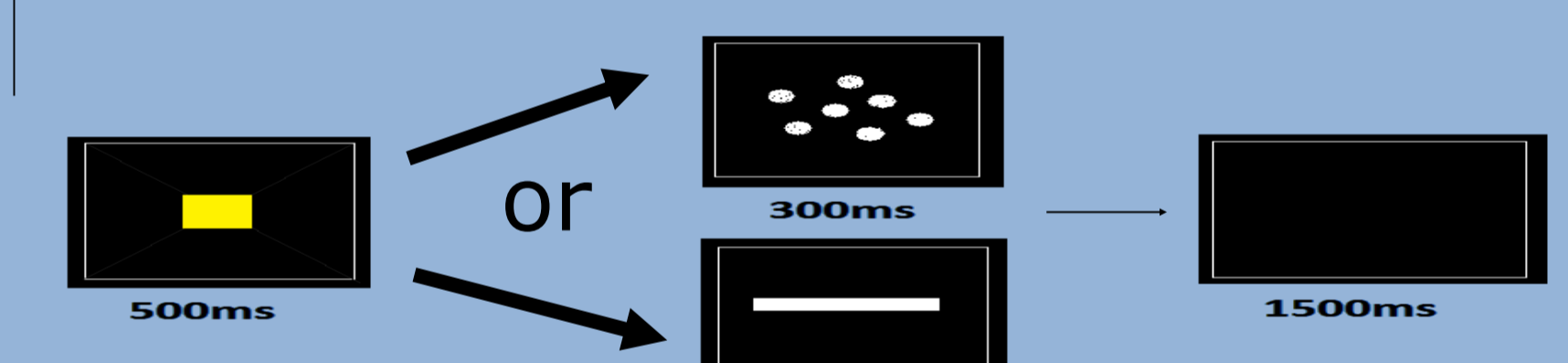
Stimuli:

- * Stimuli projected on a table (260 x 120cm)
- * 13 lengths/numerosities : 8-12-16-20-24-28-32-36-40-44-48-52-56 dots/cm
- * Little stimuli = 8-12-16 dots/cm Big stimuli = 48-52-56 dots/cm
- * Lengths represented by rectangles
- * Numerosities represented by dot collections
- * Two kind of dots collection :
 1. Intensive = size of dots and empty space stay constant
 2. Extensive = Luminance stays constant
- * Sequential numerosities were represented by dots flashed one by one
- * Subjects have to respond « short » or « large » with a four buttons box

Tasks:

- * Exposition: 18 short items/18 large items
- * Training: categorization of 12 short items/12 large items + Feedback
- * Experience: categorization of 2 x 156 controlled stimuli
- * Stimuli were presented at 42cm from the subject for near space condition
- * Stimuli were presented at 142cm from the subject for far space condition

Presentation time of one item



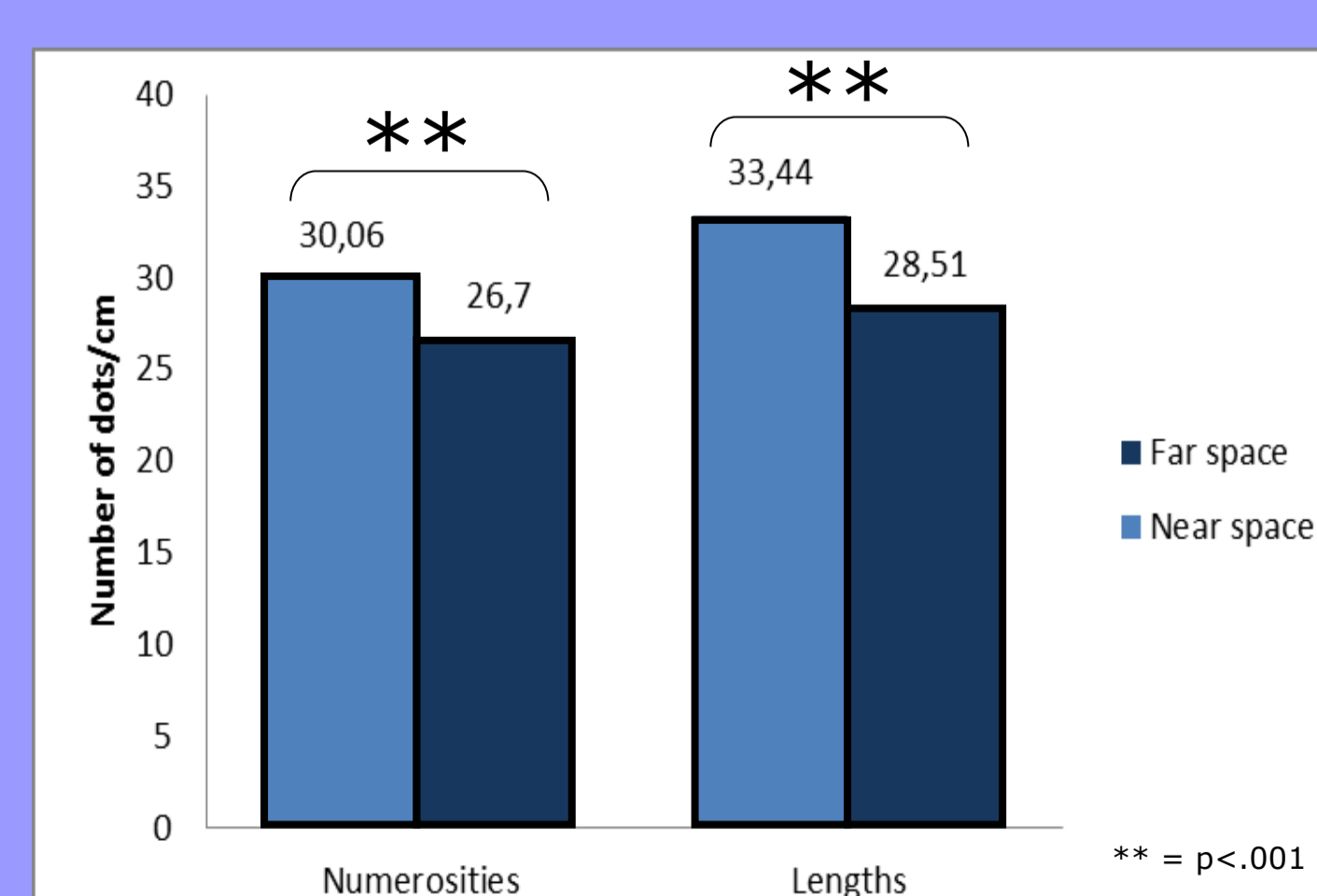
Results

Bisection points

= Moment where the responses of the subject is 50% large and 50% small (When $y=50$) (Droit - Volet, 2008)

Lengths and Numerosities

The results show more accuracy for the near condition and a nonsignificant under-categorization. In the far condition a significant over-categorization is shown.



Sequential numerosities

There are no significant results in this condition

Conclusion

- Similar results were obtained in the lengths and numerosities conditions.
- The findings demonstrate that these two magnitudes are perceived in the same way and could thus involve the same cognitive process.
- The non-significant results of the sequential numerosities show that surface area could help the categorization in the numerosities with dot collections

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Droit-Volet, S., Clément, A., & Fayol, M. (2008). Time, number and length: similarities and differences in discrimination in adults and children.

Longo, M. R., & Lourenco, S. F. (2010). Bisecting the mental number line in near and far space. *Brain and Cognition*, 72(3), 362-7. <http://doi.org/10.1016/j.bandc.2009.10.016>

Weiss, P. H., Marshall, J. C., Wunderlich, G., Tellmann, L., Halligan, P. W., Freund, H. J., ... Fink, G. R. (2000). Neural consequences of acting in near versus far space: a physiological basis for clinical dissociations. *Brain: A Journal of Neurology*, 123 Pt 12, 2531-2541. <http://doi.org/10.1093/brain/123.12.2531>