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Introduction

- Quantifiers — linguistic expressions that convey information about quantities and amounts.

- Depending whether the expression contains cardinals or not:

NUMERICAL QUANTIFIERS or **NON-NUMERICAL QUANTIFIERS**

Number words: «two», «four» «some», «many», «few»

- The mental representation of numerical quantifiers is systematically associated with space (Dehaene et al., 1993; Winter et al., 2015). — **SNARC effect**

“Mental number line” on which small numbers are spatially represented on the left and large numbers on the right.

- Does the mental representation of non-numerical quantifiers show some analogies with the spatial representation of number words?
- The present study aims at exploring whether non-numerical quantifiers are represented in spatial terms in the human mind.

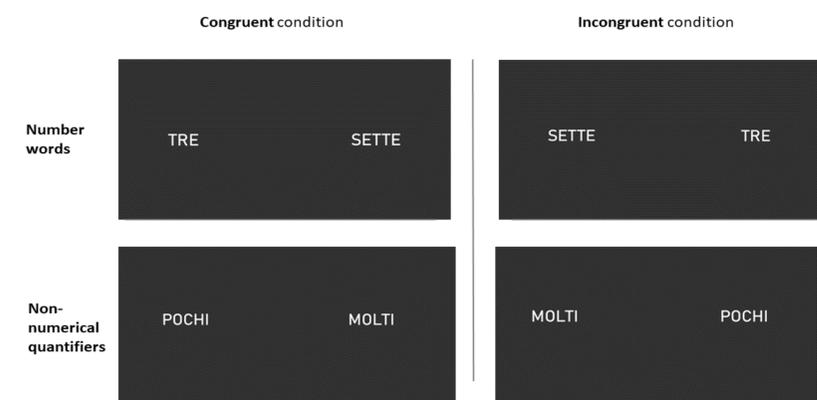
Materials and Methods

- Two comparison tasks:

- Non-numerical quantifiers (NNQ) task:** 5 “small” quantifiers (*nessuno* “nobody”, *niente* “nothing”, *pochi* “few”, *alcuni* “some”, *qualche* “some”) and 5 “large” quantifiers (*molti* “many”, *tanti* “many”, *parecchi* “several”, *tutti* “all”, *ogni* “each”)
- Number words (NW) task:** 5 “small” nw (from “zero” to “four”) and 5 “large” nw (from “five” to “nine”)

- Task: compare two words presented simultaneously on the basis of their magnitude

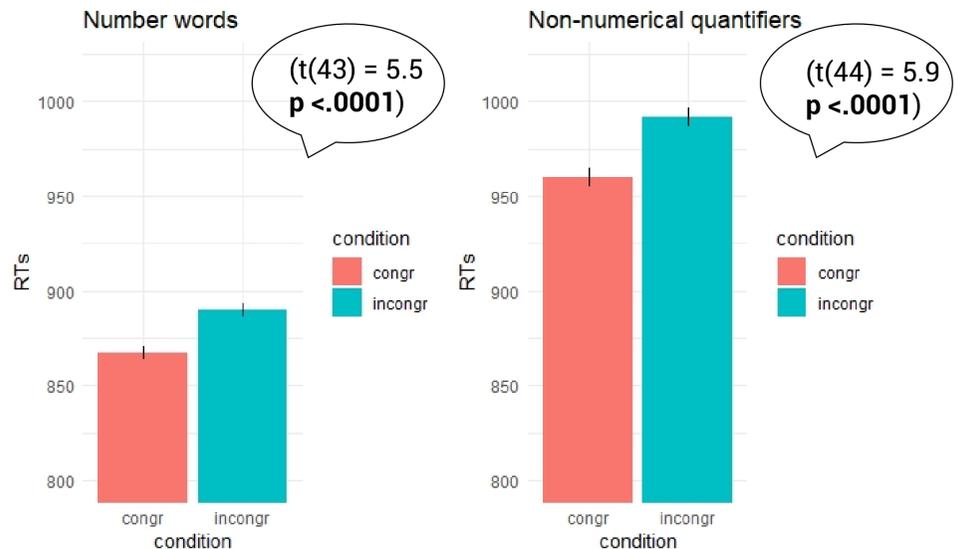
- Congruent condition:** “small” NW and NNQ on the left of the pair and “large” NW and NNQ on the right.
- Incongruent condition:** “large” NW and NNQ on the left and “small” on the right



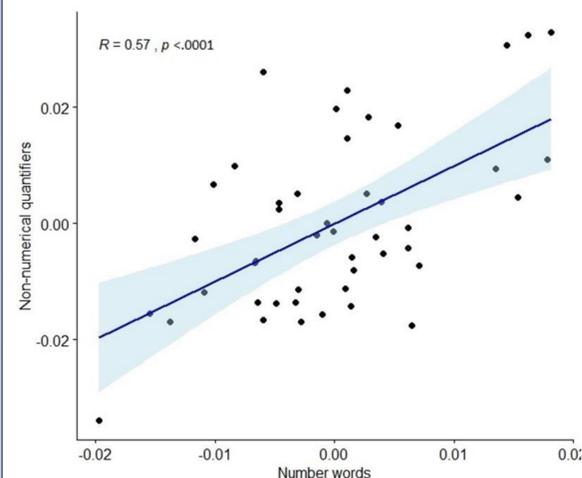
- 52 native speakers of Italian participated in the study.

- Participants first completed the NNQ comparison task and, subsequently, the NW comparison task.

Results



- Established that our participants showed a SNARC-like effect for both NW and NNQ, we tested to what extent the performance in the two tasks was related:



The individual random-slope parameters from the NW task and the NNQ task were found to be significantly correlated ($r = .57$, $p < .0001$)

Discussion

- We found a **response-side compatibility** effect for both number words and non-numerical quantifiers.
- SNARC-like effects can be observed within a range of different types of stimuli (Macnamara et al., 2018).
- The higher the sensitivity to the SNARC-like effect in the NW task, the more a similar effect was detectable in the NNQ task.
- The processes underlying the mental representation of exact (“four”) and non-precise (“some”) numerical information have robust connections.
- Our findings add knowledge about the tendency of humans to **align magnitude information** (and not only numbers) on a spatial continuum (Ishihara et al., 2008; Holmes & Lourenco, 2011; Helmreich et al., 2011)

References

- Dehaene, S., Bossini, S., & Giraux, P. (1993). Journal of Experimental Psychology: General, 122(3), 371–396. Helmreich, I., Zuber, J., Pixner, S., Kaufmann, L., Nuerl, K. C., & Moeller, K. (2011). Journal of Cross-Cultural Psychology, 42(4), 598–613. Holmes, K. J., & Lourenco, S. F. (2011). Brain and Cognition, 77(2), 315–323. Ishihara, M., Keller, P. E., Rossetti, Y., & Prinz, W. (2008). Cortex, 44(4), 454–461. Macnamara, A., Keage, H. A., & Loetscher, T. (2018). Experimental brain research, 236(2), 335–346. Winter, B., Matlock, T., Shaki, S., & Fischer, M. H. (2015). Neuroscience & Biobehavioral Reviews, 57, 209–219.