The SNARC effect relies on an allocentric frame of reference

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BACKGROUND

- According to the *mental number line (MNL)* hypothesis, small numbers are represented on the left and large numbers on the right (Dehaene et al., 1993).
- Participants react faster to small numbers on their left side and to large numbers on their right side (spatial-numerical association of response codes (SNARC) effect).
- Our study investigated the reference frame the SNARC effect relies on (Klatzky, 1998).

Hypotheses:

- If the SNARC is body-centered (egocentric), then it will reliably emerge regardless of the spatial relation between the participant's body and the numerical referents.
- If the SNARC is world-centered (allocentric), it will be smaller if an individual's body is misaligned relative to those referents (cf. studies about number production, e. g. Göbel et al., 2015)

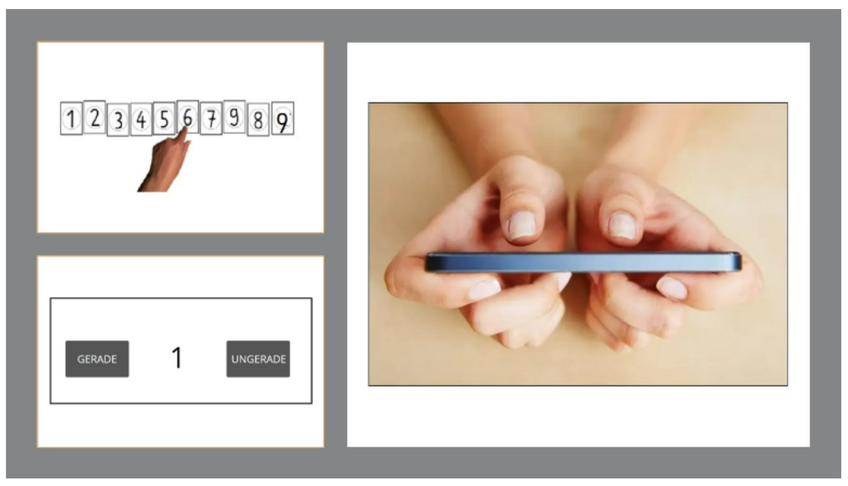
METHODS

N = 28 right-handed native German speakers (M_{age} = 23 years, SD_{age} = 5)

PROCEDURE:

- **MNL saliency:** Participants placed paper cards with numbers 1 to 9 on a pinboard, from left to right.
- **Parity judgment, direct (Block 1):** Participants sat, *facing the pinboard*, and decided whether the number on the screen was even or odd, by pressing either the left or the right button on an iPad touch screen.
- **MNL saliency:** Participants had to read the numbers from the pinboard out loud *during the break in the middle of the block.*
- **Parity judgment, reverse (Block 2):** Participants repeated the parity judgment task *with their backs to the pinboard*.
- **MNL saliency:** Participants had to turn back to the pinboard and read the numbers out loud *during the break in the middle of the block.*

The order of the blocks (direct, reverse) was not counterbalanced.



RESULTS

- Mean accuracy was 97% in both blocks.
- In both conditions, we found a reliable SNARC effect, reflected in faster reaction times to small numbers on the left side, and to large numbers on the right side.

- In *Block 2* (reverse condition) the effect was decriptively weaker (F(2, 221) = 5.66, **b = -5.27**, SE = 1,57, R^2 = 0.05, p < .001 vs.(F(2, 221) = 5.72, **b = -2.96,** SE = 1.38, p < .05). The effect of block was marginally significant (F(2, 444) = 5.66, b = 10.18, SE = 5.74, R^2 = 0.05, p = 0.08).

RESULTS

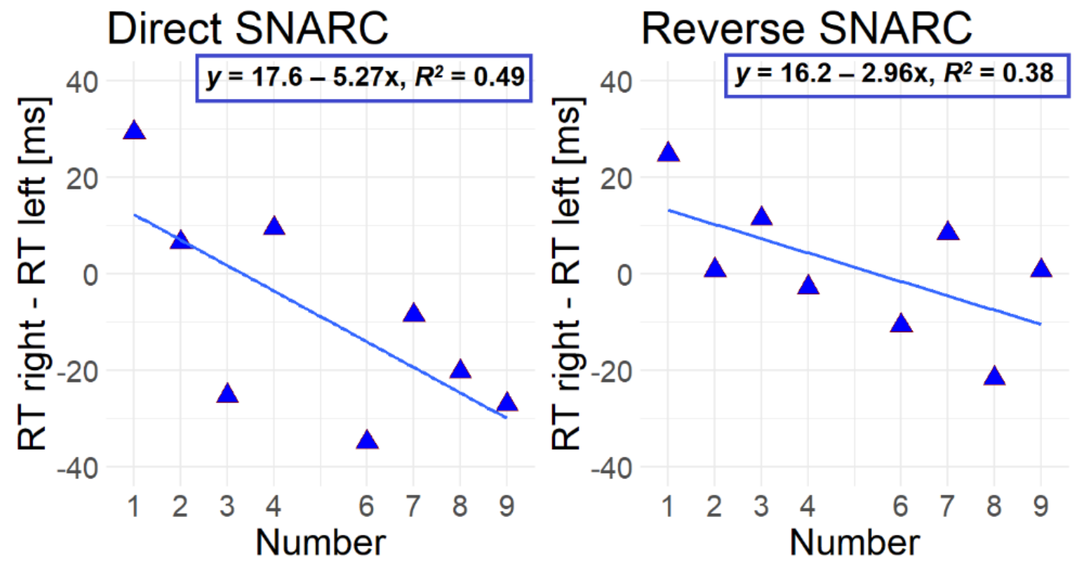


Figure 1. Participants reacted faster to small numbers on their left side and to large numbers on their right side (the SNARC effect). This effect was smaller in the reverse condition with the mental number line behind their backs.

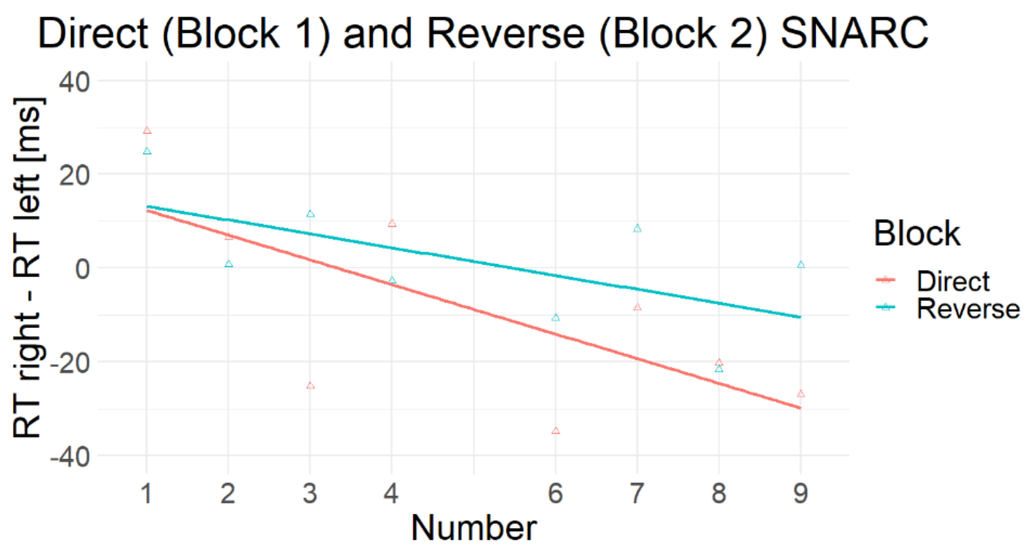


Figure 2. The slopes of the SNARC effect in the direct block and in the reverse block.

DISCUSSION

These preliminary results suggest that the SNARC effect has an allocentric frame of reference. With the MNL behind the back, the effect was smaller because the external numerical referent was not salient. Further research manipulating bodily position in space, e. g., by walking, is needed.

Limitation:

- If order was confounded, the results could just reflect a diluted SNARC when activating more than one frame of reference in short sequence (spill-over) -> *to be controlled in a follow-up experiment*
- *However:* slope reduction only for big numbers

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