

TWO=2? MENTAL NUMBER PROCESSING IN GERMAN SIGN LANGUAGE  
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The talk addresses the question whether the material form of numerals influences mental number processing or not. To examine this research question cross-linguistic studies with deaf sign language users and hearing participants were conducted. The number lexicon in German Sign Language differs from that for oral spoken German number words in two important ways: First the modality of Sign Languages is visual-gestural and second the 10 fingers of both hands are used to perform number signs causing a one-to-one correspondence of the amount of fingers and the number expression for number signs from 1-10. The use of a two-handed system results in a base-5 sub-system for DGS numbers since the non-dominant hand maintains the 5-handshape while the dominant hand repeats the hand configurations from 1 to 5. These differences were predicted to affect the way in which signers make mental judgements about number parity.

Some aspects of mental number processing appear to be independent of language, for example, the relationship between number size and response hand. Speakers of French, German, English as well as signers of DGS, all make parity judgements more quickly with the left than the right hand to smaller numbers (1-5), while responses to larger numbers (6-9) are faster with the right hand (Dehaene et al. 1993, Iversen et al. in press, Nuerk et al. in press). This Spatial Numerical Association of Response Codes (SNARC) effect indicates that a number magnitude representation is invoked automatically within parity tasks independent of the specific language in which the numbers are represented.

In contrast, the relationship between parity and response hand appears to be language-specific. Namely, Willmes & Iversen (1995) found that speakers of German identified odd numbers more quickly when responding with the left hand, and even numbers more quickly when responding with the right hand for both Arabic numerals and number words (in German, e.g., "eins", "zwei", etc.). This linguistic Markedness Association of Response Codes (MARC) effect (Willmes and Iversen 1995, Nuerk, et al. in press) indicates that parity retrieval is modulated by linguistic markedness: The congruent association among marked (left- odd) and unmarked (right-even) lexical entries leads to faster responses than the incongruent association between a marked and an unmarked lexical entry (left-even, right-odd). In contrast, signers of German Sign Language identified odd numbers more quickly with the right hand, and even numbers more quickly with the left hand for Arabic numerals. A tentative explanation is that the German sign "right-side" is made with the left hand acting on the right arm. This may influence the markedness of the antonyms "right" and "left" (Iversen et al. 2003).

When presented with DGS number signs and written German number words, the same deaf participants showed a reverse MARC effect for numbers from 1 to 5, but not for two-handed signs (6-9) (Iversen et al. submitted). Thus in both DGS and German, the reverse MARC-effect was inverted for all numerals larger than 5, indicating an impact of the base-5 number subsystem in DGS. The presence of the non-dominant hand indicates whether a numeral is larger than 5 or not. The exact value is specified via the dominant hand. The MARC results are influenced more by the dominant handshape, than by the non-dominant one. It seems as if parity is at least in part represented in a base-5 (sub)system in German signers. This effect is format specific, since the influence of Sign Language properties was only found for linguistic numbers (German Sign Language and German written number words), not for Arabic digits. This means the material form of the semiotic sign affects mental processing even in basic number operations, like parity judgements.

## References:

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