Measuring Visuospatial Memory Span in Signers: Differences in the Manual and Computerized Corsi Block Tapping Tests

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ABSTRACT

- In signed language, space is used by signers to represent grammatical relations between objects and images. Due to language experience, **visuospatial memory** capabilities may differ between signers and nonsigners, or deaf and hearing people.
- Deaf signers demonstrate greater visuospatial memory spans compared to hearing nonsigners.[1,2] on the **Corsi Block Tapping Test**, a common measure of visuospatial memory, and traditionally adminstered using a 3-D board. [3]
- However, when using computerized versions of the Corsi test, researchers fail to detect differences in visuospatial span between deaf signers and hearing nonsigners.[4,5]

QUESTION

Is the type of Corsi Block Tapping Test a possible factor for discrepancies in signers' spatial memory span seen throughout the literature?

Findings will inform our understanding of the unique role of early visual language experience on the development of visuospatial skills.

METHODS

Participants

- 45 Deaf adults
  - The VL2 Toolkit Psychometric Study

Corsi Block Tapping Test (forward and backward)

- **Manual Version**
  - Three-dimensional board with 9 identical (color, shape, size, etc.) cubes placed in different locations.
  - The experimenter taps a sequence of cubes in front of a participant.
  - The participant then touches the identical sequence of cubes in the same sequence.
  - *Backward: The participant must tap the same sequence but in reverse order.*
- **Computerized Version**
  - A computer monitor displays nine two-dimensional squares of identical color laid out in neutral space.
  - As the participant watches the screen, the squares light up one after in sequence.
  - Participants use the mouse cursor to "tap" the blocks in the same sequence
  - *Backward: The participant must click each block but in reverse order*

HYPOTHESES & PREDICTIONS

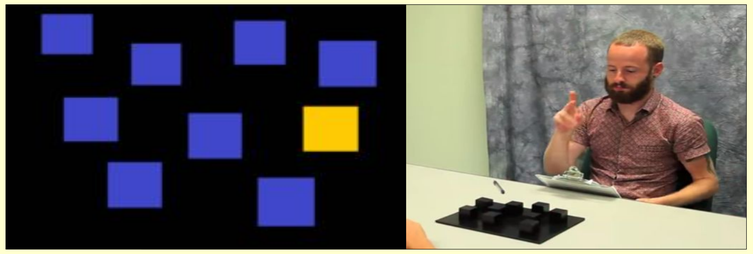
Hypothesis (H1): The discrepancy between manual and computerized test scores is due to the involvement of the experimenter's hands and arms during the manual Corsi Test, allowing signers' **linguistic encoding** of the spatial relations between blocks.

Prediction: Deaf signers, as a result of their added use of linguistic coding, will perform differently on the manual version as compared to the computerized version in both the forward and backward conditions.

Alternative Hypothesis (H2): Deaf signers use only non-linguistic (visuospatial) capabilities when performing the Corsi Test

Prediction: Deaf signers do not perform differently on the manual version as compared to the computerized version in either the forward or backward conditions.

Computerized **Manual**



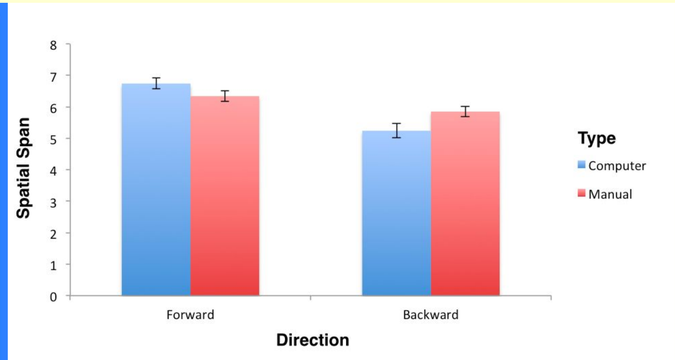
RESULTS

Two-way repeated measures ANOVA

Main effect of direction
$F(1,45) = 38.29$, $p < .0001$

No main effect of type
$F(1, 45) = 0.33$, $p = 0.57$

Direction x Type interaction
$F(1, 45) = 11.20$, $p = 0.002$



Forward condition: No difference found between manual and computerized types (paired t-test, $t=1.721$, $p = .092$).

Backward condition: Significant difference found between manual and computerized types (paired t-test, $t=-2.813$, $p=.007$, $r=.39$).

DISCUSSION

- H1 is partially supported: Signers performed differently based on the *type* of test (manual vs. computerized).
- However, only the backward condition revealed differences based on test type.
- **We believe that the difference suggests sign language experience permits nonlinguistic spatial relations to be encoded into linguistic representations, thus impacting signers' visuospatial memory span.**

TRANSLATIONAL IMPLICATIONS

Our finding has high relevance to the design and implementation of assessments investigating visuospatial memory in signers, with special attention paid to the role of hands and arms, which function as articulators in sign language, during task administration. Any type of cognitive assessment that involves pointing and other manual gestures may offer deaf signers a performance advantage due to the opportunity to recruit added brain sites and systems in order to linguistically encode spatial relations.

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