Verbal and Nonverbal Intelligence Show Different Patterns of Hand Movement

Daniela Dvoretska and Hedda Lausberg
German Sport University Cologne, Germany

Deutsche Sporthochschule Köln
German Sport University Cologne

INTRODUCTION

Previous research shows a distinct gesture use in individuals with superior versus average fluid intelligence, but no difference for different levels of crystallized intelligence (Sassenberg et al., 2011; Wartenburger et al., 2010). In this study we investigate whether verbal intelligence (VIQ) and nonverbal intelligence (PIQ) are related to different patterns of hand movement behavior.

METHODS

Sample
- 11 right-handed participants
- 6 males and 5 females, mean age: 41.7 ± 12.3 years
- mean IQ: 100,6 ± 12,9 (WAIS-R)

Procedures
Two experimental settings to elicit competences corresponding to the different intelligence types. No specific instructions concerning the gesturing.

- **Verbal Condition (VC)** - An intelligence test was administered as an interview to challenge verbal intelligence.

- **Nonverbal Condition (NC)** – A narration of an animated cartoon with no speech was used to challenge nonverbal intelligence.

Coding procedure: segmentation and annotation of the nonverbal behavior
- NEUROGES-ELAN coding system (Lausberg & Sloetjes, 2009)
  - Module I (Activation, Structure, StructureFocus)
  - Module II (Contact, Formal relation)
  - Module III (Function, Type)
- Interrater agreement was established on 25% of each video

Statistical Analyses
- The frequency of the hand movements in each category was correlated with the VIQ and the PIQ scores.

RESULTS

- As expected, the IQ type correlated mostly with the hand movement behavior in the corresponding experimental condition (VIQ – VC, PIQ – NC) .
- In **Module I** a right-hand preference was associated with VIQ, and a left-hand preference with PIQ.
- In **Module II** VIQ was positive correlated with *act as a unit* and *act on each other* movements , and PIQ with *act apart* movements. Both IQ types were related to symmetrical gesturing, but PIQ was also related to a left-hand dominance.
- In **Module III** both intelligence types were positively associated with *emotional* and *self-regulative* gestures (*back toss, closing, bodily regulation*), and negatively associated with *spatial relation presentational* gestures (*positioning*).
- VIQ correlated positively with *emphasis* gestures (*baton, superimposed, palm-out*), *self-deictic*, and *object-oriented* actions.
- PIQ correlated with *deictic* (*external target deictic, you deictic*), *form presentation* (*shape, size*), and with *motion quality presentation* (*manner, dynamics*).

DISCUSSION

- VIQ correlated positively with frequency of right hand movements, whereas PIQ was positively associated with frequency of the left hand gestures and a left *hand dominance* in bimanual movements. These findings are in line with a cortical lateralization for different competences. The left hemisphere, dominant for processing speech, controls the right hand, whereas the right hemisphere, which is competent in processing nonverbal aspects, controls the left hand.

- VIQ was positively associated with hands acting in touch (both hands *acting as a unit* or *acting on each other*), which is a lower developmental level from a neurological perspective. In contrast, PIQ was related to frequency of bimanual movements in which the hands *act apart* from each other. This is the most complex level of bimanual gesturing in the Contact category. This can be explained with the differences in the experimental settings. In the verbal condition the content is primarily communicated through speech and the gestures have a supporting role. In the cartoon narration condition, in order to display the pictorial content, more complex gestures are used to complete and expand the verbal message.

- The gestures related to VIQ show one more self-related perspective (*emphasis* gestures, *self-deictic*), whereas the gestures associated wit PIQ (*form and motion quality presentation, external target deictic, you deictic*) revealed a more non-egocentric cognitive perspective. The different perspective is presumably provoked by the stimulus material. In an intelligence test situation people are concentrated on their performance, which evokes an egocentric viewpoint. In the cartoon narration situation the focus lies on describing the characters' actions, which proceeds from a non-egocentric perspective.

CONCLUSION

Our data indicate that the two intelligence types are related to distinct hand movement use. The differential hand preference suggests a hemispheric specialization in the hand movement production. Furthermore, it was shown that in specific situations different cognitive process are induce, which determine a distinct gesture use.

REFERENCES

1. Sassenberg U., Foth M., Wartenburger I., van der Meer E. (2011). Show your hands – are you really clever? Reasoning, gesture production, and intelligence. Linguistics 49, 105–134.
2. Wartenburger, I., Kühn, E., Sassenberg, U., Foth, M., Franz, E.A., van der Meer, E. (2010). On the relationship between fluid intelligence, gesture production, and brain structure. Intelligence, 38: 193-201.
3. Lausberg, H., & Sloetjes, H. (2009). Coding gestural behavior with the NEUROGES-ELAN system. *Behavior Research Methods, 41*(3), 841-849.

CONTACT

Daniela Dvoretska
email: d.dvoretska@dshs-koeln.de