Is Vision important in the production of Sign Language?

A BSL study in people with Usher Syndrome exploring changes in the use of space during signing

Valentina Arena PhD student at City University. Department of Language and Communication Science, City University London and DCAL, Deafness and Cognition Centre, UCL.

Email: v.arena@city.ac.uk

Sign languages are visual-gestural systems: they are perceived visually and produced by means of body gestures. This means that vision is essential to be able to understand sign language. But how important is vision in producing sign language? If we ask a Deaf signer to sign with his eyes closed, he may say that it is weird, but possible. That is because the production of movements is controlled by a function of our brain, called "proprioception", which allows us to have an idea of the movements of our body in space without looking at our body. To find out about whether signers need to see themselves sign we designed an experiment which explores the changes in the signing space in people with Usher Syndrome.

Usher Syndrome (US) is an inherited condition which combines deafness and Retinitis Pigmentosa (RP). In the retina, the membrane that lies at the back of the eyeball, there are two types of cells that are responsible for catching the light and transferring it to the brain as vision information. These are called cones and rods: cones are responsible for vision during the day and they are concentrated mainly in the centre of the retina; rods are spread around the edges of the retina and help us to see at night. In RP, rods deteriorate first so people with US experience night blindness and tunnel vision. At first they lose cells in the periphery of the retina, and slowly their remaining vision around the edges narrows to tunnel vision; as a result only a little spot of central vision may remain.

At least three types of Usher Syndrome have been described (Type I, II and III), each caused by different genes located on different chromosomes. In this study we are testing only people with Type I. They are born deaf and are native or near-native BSL signers. People often comment that signers with US Type I sign in a reduced

space and closer to their body than other Deaf signers without vision problem do, but we don't know why.

The reduction of signing space could reflect:

1. an attempt to get their conversational partner to make their signing space smaller so that the person with US can see it better
2. the need to see one's own hands when signing (even if not looking directly at the hands

In order to find out which one of those explanations is true, we designed an experiment with four groups of volunteers: people with Usher Syndrome Type I (US), Deaf normally sighted (DNS), hearing normally sighted (HNS), and hearing people with RP. People have to describe pictures of dolls' house furniture arranged in different ways to a conversational partner, who has to arrange the actual toys to match the description. The volunteer's hand movements are recorded with special cameras using little markers on the hands and head of the subject. This experiment allows us to measure the space used by Deaf people and people with US for signing (Signing Space) and the space used by hearing people and people with RP for gesturing (Gesture Space). We also measure everyone's Visual Field with a standard clinical instrument (Goldmann perimeter). The Visual Field is the area of space in which all objects are visible simultaneously, when someone is looking straight ahead. We can then map each person's Visual Field against their gesture or signing space. In this way we are able to see how closely Visual Field and Signing/Gesture Space match each other, and therefore see if a reduction in the Visual Field leads to a reduction in Signing/Gesture Space.

The subject is describing the picture to another person while the cameras on her back are recording her hand and head movements. The person sat in front of her has to arrange the actual toys to match the description. His movements are not recorded.

The analysis of the data obtained so far tells us that both hearing people with RP and deaf people with US show a reduction of their signing/gesture space, compared to normally sighted people. This may confirm the idea that being able to see your own hands is important in determining the size of signing and gesture space. Since people with RP use speech to communicate, any reduction in their gesture space doesn't help communication directly. We have not completed our analysis yet but we are very excited so far as this research helps us understand how sign language is produced and how our brain combines information coming from different channels.

One of the pictures used by the subjects for the "description task".

Same as above but from the subject's point of view.

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