Deafness, Not Sign Language, Enhances Peripheral Visual Attention

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Eye Gaze and Sign Language Comprehension

❑ Where do signers look when perceiving a signed language? Eye tracking studies have now empirically established that a signer focuses on the face rather than the manual gestures of their communication partner [1-3].

❑ Although the point of fixation on the face is still unclear and will likely vary as a function of production characteristics and signer skill, it has led authors to suggest that a large amount of information in signed utterances must therefore be processed in peripheral vision [4].

❑ Given the established impact of signing on a range of cognitive skills [5], it therefore makes sense to ask whether proficient signing results in an enhanced ability to process information in the visual periphery, regardless of whether the signer is hearing or deaf.

Visual Attention

❑ If a person focuses upon the face of a signer, then some linguistic information will fall within peripheral vision. Visual acuity is poorer within this region. How then can someone process sign language information in the visual periphery?

❑ One possibility is an enhancement in peripheral visual attention. This would allow more information to be extracted from peripheral vision without the need to make overt eye movements.

❑ Increasing visual attention to a peripheral spatial location results in information presented there being processed more efficiently. One way in which this can be measured is to present objects in peripheral vision and ask people to make a decision about the object.

Useful Field of View (UFOV)

❑ The UFOV task measures the allocation of attention to peripheral vision, and was developed to assess visual skills in elderly drivers [6].

❑ It consists of three tasks:

- ❑ Central visual discrimination
- ❑ Central visual discrimination plus peripheral target localization
- ❑ Central visual discrimination plus peripheral target localization in the presence of visual distractors

❑ All participants in the research reported here performed equally well on the first two tasks. This suggests that none of the groups tested differed in their ability to discriminate objects they were fixating, nor in their sensitivity to objects suddenly appearing in their peripheral vision.

❑ The third task requires the peripheral target to be localized in the presence of distractors and provides a measure of how much visual attention is allocated to the peripheral visual field (see figure, left).

❑ On each trial, a visual image similar to this is presented, followed by a white noise mask to wipe out any retinal after-image. The participant is required to:

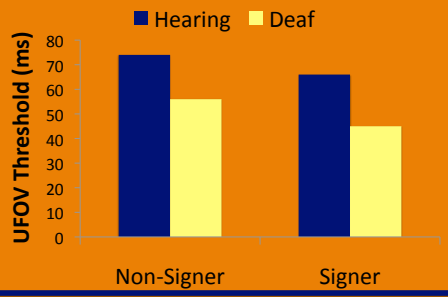
- ❑ Indicate whether the central target is a smiley face with "short" or "long" hair
- ❑ Decide which of the eight objects on the edge of the circle was the target (the "sheriff's badge")

❑ The studies reported here used an adaptive staircase procedure. If the participant was correct 3 times in a row, then the next presentation was faster by 16 milliseconds. If they were incorrect just 1 time, then the next presentation was slower by 16 milliseconds.

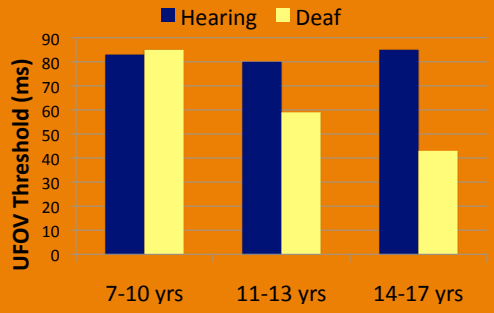
❑ In this way, we measured how much presentation time a participant required to be ~79% accurate at identifying the central target and discriminating the peripheral target from the distractors.

❑ A low threshold (in milliseconds) represents better performance, suggesting that more attention was allocated to peripheral visual space and allowing more rapid localization of the target object.

UFOV Threshold Data - Adults



UFOV Threshold Data - Children



Conclusions

❑ Audiological deafness – i.e. auditory (de)privation – results in enhanced peripheral visual attention. Use of a signed language has no effect, even for native signers.

❑ This redistribution of visual attention resources is a slow, developmental process. Little enhancement is seen in young (7-10 year old) deaf children, with progressive improvement from age 11 years onwards.

Implications

❑ Sign language does not necessarily enhance cognitive functions, even when doing so may be thought to bring about a language processing advantage.

❑ As "Deaf languages", signed languages may have evolved and changed historically to conform to take advantage of enhanced peripheral attention in deaf individuals.

❑ More studies are required of eye gaze fixation during sign language comprehension in hearing native signers and young deaf children. The lack of a peripheral processing advantage may interact with sign language acquisition and language processing abilities in these populations.

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