A dichoptic analog to the Bergen dichotic listening paradigm: A pilot study.

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Introduction

Hemispheric asymmetries can be studied both using tasks based on auditory and visual stimulation techniques. In the auditory domain, dichotic listening paradigms are frequently used for the assessment of brain asymmetry; and the typically observed right ear advantage is taken as indicator of the left-hemispheric dominance for language processing. Comparably, in the visual domain, the right-visual field advantage as revealed with various verbal visual half-field (VHF) paradigms, has been taken to reflect leftward hemispheric asymmetry.

Objective

To compare behavioral asymmetries as assessed with auditory and visual tasks in the same participants.

Material & Methods

Participants Ten healthy volunteers (all male, right-handed) were tested with both tasks.

Paradigm A visual analog to the Bergen dichotic listening test (a consonant-vowel dichotic listening paradigm) was developed: Pairs of consonant-vowel syllables (e.g. ba – ga) were presented simultaneously (one in each VHF; 80 ms duration; visual angle ~2°) and masked at offset. The distance from the two syllables to the center of the screen was systematically varied, in order to control for a potential bias caused by reading direction. In both tasks, three attention conditions were used (non-forced, forced right and forced left attention) and presented in a pseudo-randomized order and indicated by a visual symbol at the center of a computer screen.

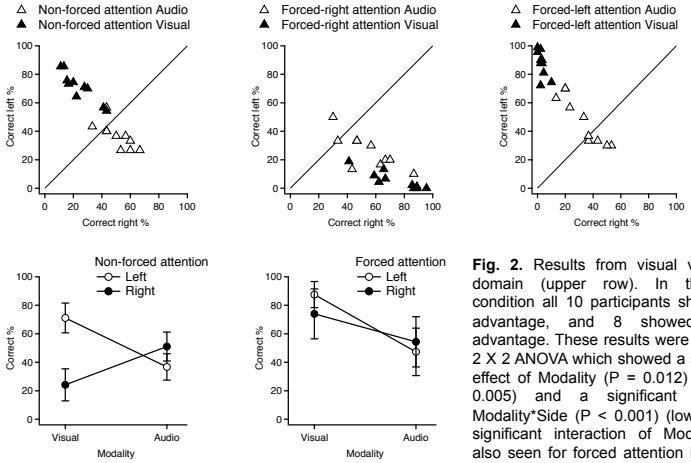

Fig. 2. Results from visual versus auditory domain (upper row). In the non-forced condition all 10 participants showed left VHF advantage, and 8 showed a right-ear advantage. These results were confirmed by a 2 X 2 ANOVA which showed a significant main effect of Modality (P = 0.012) and Side (P = 0.005) and a significant interaction of Modality*Side (P < 0.001) (lower row, left). A significant interaction of Modality*Side was also seen for forced attention instruction (P = 0.005) (lower row, right).

Results

As expected, the dichotic listening task revealed a significant right-ear advantage in the non-forced condition (36.7 ± 9.3 % versus 51.0 ± 10.2 %; P = 0.03; for left and right ear, respectively). In contrast, the corresponding results for the visual analog were opposite; 71.1 ± 10.5 % versus 24.1 ± 11.3 %; P < 0.001; for left and right VHF, respectively. Thus, for the visual analog, an advantage of the left VHF was observed. Statistical analysis revealed a significant interaction between modality (audio, visual) and side (left, right) for both the non-forced (P < 0.001) and forced (P = 0.005) attention instructions.

LVF RVF

6	5	4	3	2	1	*	1	2	3	4	5	6
	B	A				*				B	A	
		B	A			*					B	A
	B	A				*					B	A

Fig. 3. Position of syllables was systematically varied to control for reading direction. Subjects did not notice that the position of syllables on the screen was varied.

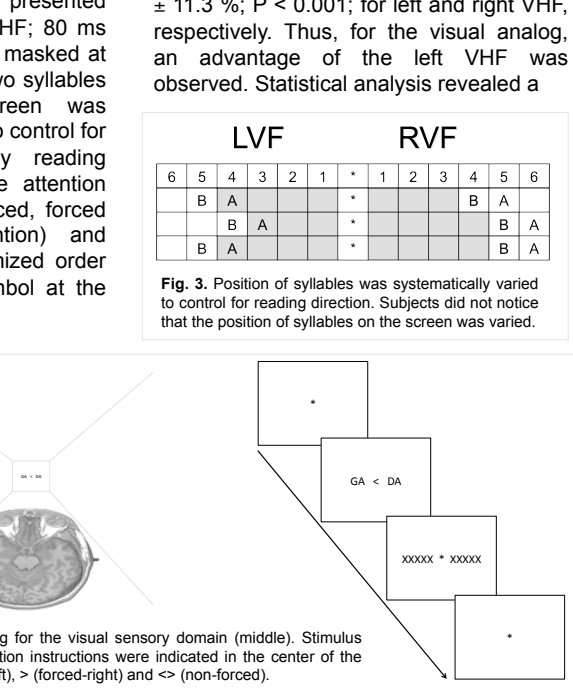

Fig. 4. Effect of syllable position on the proportion of correct reports. No apparent difference was observed.

Discussion

As expected, the dichotic listening task revealed a significant right-ear advantage in the non-forced condition.

For the visual analog, an advantage of the left VHF was observed.

The results may suggest that hemispheric dominance in theses dicho(p)tic tests could be dependent on the sensory modality. A possible explanation could be that syllables are processed as language (sounds) in the auditory domain while their lack of semantic meaning causes them to be perceived as objects in the visual domain.

Fig. 1. Dichotic listening (left) and analog for the visual sensory domain (middle). Stimulus paradigm (right). In both tasks, the attention instructions were indicated in the center of the computer screen by symbols: < (forced-left), > (forced-right) and <> (non-forced).