

# LEFT-RIGHT ASYMMETRY OF SUBJECTIVE VISUAL SPACE IN LEFT-HANDERS WITH LEFT EYE DOMINANCE AND RIGHT-HANDERS WITH RIGHT EYE DOMINANCE

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## ABSTRACT

Data of experimental studies and clinical investigations evidence about different actuality of the left and right half of subjective perceptive space and different contribution of left and right hemispheres in the process of sustaining the attention towards both parts of the space. Relatively less is known about the expression of these principles in left- and right-handers and in subjects with different combination of lateral preferences. Aim of this study was to find out differences between left-handers with left eye dominance and right-handers with right eye dominance in the actuality of the right and left parts of the subjective extrapersonal visual space. A total of 24 left-handers with left eye dominance (LH-LESs) and 24 right-handers with right eye dominance (RH-RESs) was studied. The bilateral organization of subjective extrapersonal visual space was estimated by the results of a complicated geometrical constructive task performed by Sander's parallelogram. In the two groups were compared: a) preferred initial staring position; b) directional exactness, and c) number of performances with left deviation, right deviation and correct fulfillment. As a whole in all the tested parameters RH-RESs demonstrate an expressed left tendency and preference to operate in the left part of the visual space. LH-LESs prefer right starting position, perform higher number of precise answers and deviations to the right, which reflects in the directional exactness of their results. It may be concluded that the individual type of lateral preferences, in particular the combination handedness- eyedness, is significantly reflected in the bilateral structure of the subjective visual space, possibly in connection with the distribution of the spatial visual attention. Based of the differences of cerebrolateral organization at LH-LESs and RH-RESs, rather possibly, a different type of egocentric co-ordinate system is formed. Furthermore, different strategy of extrapersonal space scanning characterized by higher actuality of its right or left part is applied.

**Key words:** subjective visual space, left-handers, right-handers, eye dominance, attention

## INTRODUCTION

Data of numerous experimental clinical investigations evidence about different actuality of the left and right half of subjective perceptive space and different contribution of left and right hemispheres in the process of sustaining the attention towards both parts of space. It is commonly accepted that the right hemisphere is responsible for the attention towards the two halves of the space and contains mental image of bilateral space, while the left hemisphere is responsible only for the contralateral right half and supports mental image only of the right half of the space (4,11-14). Relatively less is known about the expression of these principles in left- and right-handers and in subjects with different combination of lateral preferences. Moreover, there are

still uncertainties about eyedness, combination eyedness-handedness, and their expression in different aspects of brain functions lateralization (1,8,10,17).

Aim of this study was to find out differences between left-handers with left eye dominance and right-handers with right eye dominance in the actuality of the right and left parts of the subjective extrapersonal visual space.

## MATERIAL AND METHODS

### *Subjects*

A total of 24 left-handers (12 males and 12 females) with left eye dominance (LH-LESs) and 24 right-handers (sex matched) with right eye dominance (RH-RESs) aged between 18 and 30 years was studied. Handedness assessment was done by means of Edinburgh Inventory (16) and manipulative tests (2). The dominant eye (sighting or motor dominance) was estimated by the tests of: a) Rosenbah and its modification "card with a window"; b) "aiming and blinking with one eye"; c) "telescope" (2,3). All the tested

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individuals where with normal or corrected-to-normal vision.

### Procedure

The bilateral organization of subjective extrapersonal visual space was estimated by the results of a complicated geometrical constructive task performed by Sander's parallelogram (manufactured by 'H. Diel', Leipzig, Germany). The tested individuals under binocular condition were asked to construct an equilateral triangle with an apex pointing down on a rhomboid screen modulating laterally the position of the apex. The task was complicated by an additional synchronously moving line connecting the base and the apex of the triangle and the co-emerging illusion of gestalt perception (Fig. 1).

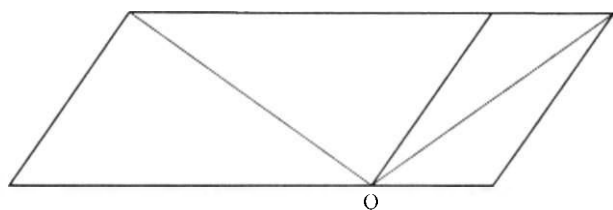


Fig. 1. Sander's parallelogram

Every participant in the investigation fulfilled the task 10 times, choosing alone the initial starting position (left or right) and consequently alternating left and right initial position. In both groups were determined and compared: a) preferred initial starting position; b) precision (exactness) (to 0,5 mm) of the performance with directional detection of the deviation (directional exactness); the deviation to the left from the proper position (O) was signed as (-), deviation to the right - as (+); c) number of performances with left deviation, right deviation, and correct fulfillment.

Statistical significance was estimated by Fisher's test, Student's t-test and chi-square test.

## RESULTS AND DISCUSSION

The results are presented in Table 1 and Fig. 2.

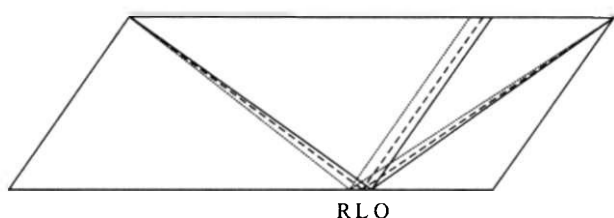


Fig. 2. Solving of the task from both groups (average values; O - correct decision; L - decision of LHxLE - sub; R - decision of RHxRE - sub)

The general estimation of these data shows that as a result of manifested illusion of gestalt perception the apex of the triangle as a rule (in 81 % of the fulfilled tasks) is transferred to the left (see Table 1 and Fig. 2). The browsing of the data

of the two groups investigated impresses with the fact that the mean amplitude of deviation is almost by two times less in LH-LESs in comparison to RH-RESs, respectively, -2.3 mm and -4.5 mm ( $p < 0,01$ ). As a whole in all the parameters RH-RESs demonstrate an expressed left tendency and preference to operate in the left part of the visual space. LH-LESs prefer right starting position, perform higher number of precise answers and deviations to the right, which reflects in the directional exactness of their results. These data, according to our concept, prove differences in the actuality of the left and right parts of the subjective visual space. LH-LESs show higher actuality of their right part compared to RH-RESs. We are inclined to accept these differences of actuality as a function of the orientation of the visual attention to the left and the right part of the space. Our speculations in this direction are inspired either by the intriguing differences of the preferred initial starting position and by already known connection between preference or negligence of certain regions of space and direction or deficiency of attention towards them (5,11).

Earlier we have already discussed the role of the right hemisphere which is closely involved in vigilance, synthesis of spatial information, creation and storage of internal model of surrounding world and capable to direct attention to the right and left visual fields, while the left hemisphere is only capable to control attention to the right visual space. In this context our data correspond to other results (4,5) reported in patients with transitorily depressed function of left or right hemisphere fulfilling graphical-drawing test on dot raster. It has been found that in control studies and in patients with depressed left and normally operating right hemisphere test performance is preferred from left initial position and a higher actuality (more active operation) of the left part of the visual space is presented. By depression of the right hemisphere and functioning of the left one, right initial position has been more frequently preferred and higher actuality of the right subjective visual space part has been found. Our results in RH-RESs completely correspond to the operative pattern demonstrated in undeprived state and functioning of the right hemisphere on the background of depressed left one. On the contrary, the results of LH-LESs match the operative pattern of functioning left hemisphere on the background of suppressed right one. That is why we presume that LH-LESs normally express if not controversial, at least untypical contribution of hemispheres in the spatial distribution of the attention (probably including perception of spatial relations).

A possibility of objective eccentricity of "the point of view" of the dominant eye (positioned approximately 6 cm from the other eye) to form a different lateralized subjective position when scanning the extrapersonal space, may not be excluded. We are, however, interpreting this speculation in the context of neurophysiological mechanisms of attention and the significance of sensory afferentation for local activation of certain regions of brain cortex (6,7,13). Based on other works (1,9) we suppose that possible different figures' and background placement on central and peripheral (nasal or temporal) regions of both retinae by dominant

right or dominant left eye, may provoke different afferent stimulation and activation of both hemispheres.

It could be concluded that the individual type of lateral preferences, in particular the combination handedness-eyedness, is significantly reflected in the bilateral structure of the subjective visual space, possibly in connec-

tion with the distribution of the spatial visual attention. Based on the differences of cerebrolateral organization with LH-LESs and RH-RESs, very possibly, different type of egocentric co-ordinate system is built-up. Furthermore, different strategy of extrapersonal space scanning characterized by higher actuality of its right or left part is applied.

Table 1. Preferred initial starting position (ISP), directional exactness and number of left deviations, correct performances and right deviations

Preferred initial starting position (number of cases)				
ISP / Group	RH-RESs		LH-LESs	
Left	19		5**	
Right	5		19**	
Directional exactness				
Group	RH-RESs		LH-LESs	
Deviation (mm)	-4,5		-2,3*	
Number of left deviations, correct performances and right deviations				
Group	Left deviations	Correct performances	Right deviations	Total
RH-RESs	222	4	14	240
LH-LESs	167**	21**	52**	240

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