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ANALYSIS OF SELECTED ERGONOMIC PROBLEMS OF LEFT-HANDED WORKERS IN PRODUCTION ACTIVITY

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ABSTRACT: The article deals with the issue of laterality in production activity in terms of two ergonomic points of view. The first issue focuses on the analysis of reaching distances of worker – left-handed person to the control (notification) on the machine (handling and work place). The second issue is devoted to variations in lighting of the work area for right-handed or left-handed person. There are mentioned two examples of the study.

KEYWORDS: Left-handed, environment, daily lighting, workers

INTRODUCTION – LATERALITY

In the ergonomic system (Figure 1), person is the weakest component and often vulnerable element in production. A curiosity is that, if one stands out from the most of workers by his/her characteristics, whether psychological, physiological or physical. The right to work is not longer enshrined in the constitution in many countries, but people want to work even with various restrictions – handicaps. Left-handed worker is also handicapped in certain way in environment that is not adapted to him/her. From the total number of these interactions, the subject of this article will be:

- interaction: left-handed person and machine,
- interaction: left-handed person and environment (lighting) versus right-handed person.

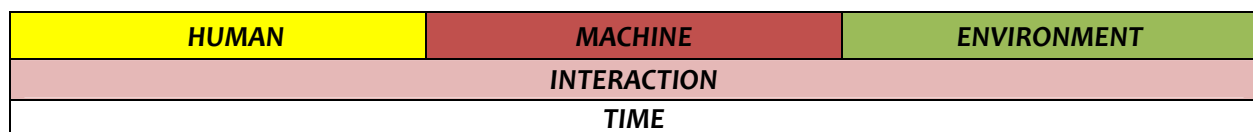


Figure 1. Five elements of ergonomic system in production

The concept of laterality comes from the Latin word *latus* – side. This is the preferred use of one of paired organs of locomotive or sensory organs of human. The possibility of expression of laterality in an individual is given by habits, building of his/her body and the outside world. Laterality, as an expression of an individual, may affect education, while the dominance is not transformed by the educational influence, poor education can distort the natural optimal ratio of dominant and subordinate hemisphere. [1]

There are two levels of laterality – lateral preference and lateral dominance. Lateral preference is characterized by persistent preference for one side of the body throughout the life. All operations made by preferred limb are performed with high confidence and precise movements. Evident differences and predomination in the performance of one of paired organs are determined by lateral dominance. [7]

Table 1. Quality statement of categories of laterality

CATEGORY	DESCRIPTION OF CATEGORY
L	Pronounced, significant left-handedness
L-	Less pronounced, mild left-handedness
A	Unpronounced laterality, ambidexterity
P-	Less pronounced, mild right-handedness
P	Pronounced, significant right-handedness

Strongly pronounced left-hander comes into various conflicts in right-handed environment, which he/she must resist. He/she resists any pressure and he/she cannot be trained. He/she will rather break his/her character or suppress the development of intellect. [13]

Index of laterality can be calculated by using the Cuffo's formula, which is described by Sallybová, Drnková [1].

It is valid: P = number of tasks performed by the right side, L = number of tasks performed by the left side. The result is in range – 100 to + 100, while positive values indicate the degree of right-handedness and negative values indicate the degree of left-handedness.

$$Li = \frac{P-L}{P+L} * 100 \quad (1)$$

The most obvious manifestation of laterality is dominance of one of the upper extremities, resulting from the implementation of daily operations with one hand. Nowadays, the most of the population belong to the group of right-handers, a minority of about 10% is created by left-handers, but we can also find such individuals, who use both hands equally, in this case we refer to ambidexterity, reciprocity [7].

CASE STUDY 1 – PRODUCTION EQUIPMENT VERSUS LEFT – HANDER PERSON

The analysis of production equipments and their controls or notifications for the possibility of taking an employee – left hander was the subject of the case study. Would operation of equipments be optimal by such worker and wouldn't make working activity difficult? Here are photos from metalworking operation.

Displayed pictures 2-5 show the need for adjustments of the control mechanisms and their relocation to the left side, which requires investment. It is therefore necessary to consider separately each solution not only with regard to access of control, but also frequency of its use.



Figure 2. Grinder

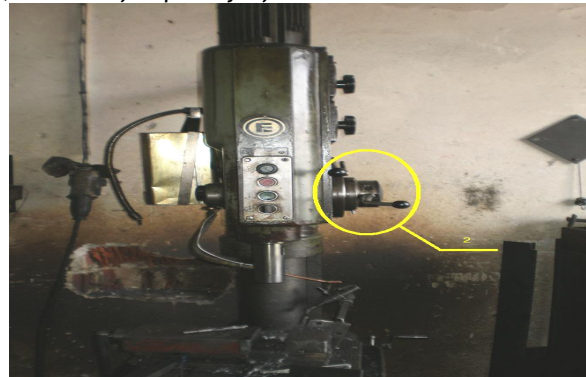


Figure 3. Table drill



Figure 4. Forklift



Figure 5. Grinder



Figure 6. Press for right-hander



Figure 7. Press for left-hander

Displayed pictures 2-5 show the need for adjustments of the control mechanisms and their relocation to the left side, which requires investment. It is therefore necessary to consider separately each solution not only with regard to access of control, but also frequency of its use. In production, there are also equipments, which can be adapted even for left-hander. An example is the press, which has a sliding runner and can allow pressing from the right side (Fig.6) as well as left side (Fig.7). Lever is on a separate base, so you can put it anywhere (on right or left side).

CASE STUDY 2 – LIGHTING IN THE WORK AREA RIGHT- HANDER VERSUS LEFT - HANDER

Measurement of daily lighting in relation to the lighting hole and shading by hand during writing is documented on the difference of left-handed and right-handed people (laterality). Statistically, the number of left-handers is about 10% of the population in a stable location of work areas, where the light shines from the right site; there occurs deterioration of light conditions for right-handed people.



Figure 8. Shading by one’s own hand while writing

Table 3. Measured values of artificial lighting [5]

E _o	Place of measurement according to the Figure 9	
	1	4
Person – right-handed E (lx)	342	165
Person – left-handed E (lx)	186	110
Reduction of value Δ E (lx)	156 45,6%	55 33,3%

Table 2. Measured values of daily lighting [5]

D _o (%)	Place of measurement according to the Figure 9			
	1	2	3	4
Person – right-handed D _o	11,9	4,58	4,28	8,62
Person – left-handed D _o	8,23	3,18	2,28	4,18
Reduction of value Δ D _o (%)	3,67 30,8%	1,4 30,56%	2,0 46,72%	4,44 51,5%

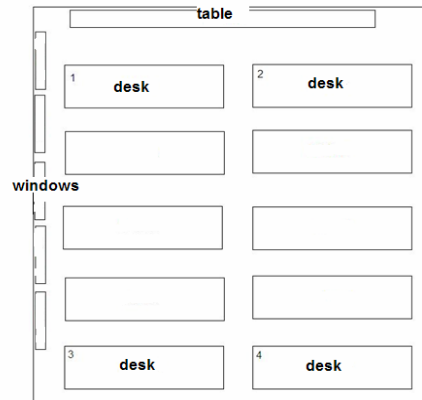


Figure 9. Scheme of the measuring points 1 – 4 in the classroom for the daily lighting



Figure 10. Measurement of lighting of work area for right-handed and left-handed people

CONCLUSIONS

Employment of left-handers in production often faces the problem that the entire workplace is designed for operation by worker – right-hander. Such a worker may experience certain psychological trauma and in terms of production conditions, there is a risk of:

- the reduction of worker performance (time loss),
- protection of health and safety (the possibility of accident, deteriorated lighting of work area at the impact of light from the left side).

Ergonomic solution in the given area can be described in the following Table 4.

Table 4. Ergonomic measures for workers at work – left-handers in the production

Measures of left-handers for the work :	
A - organizational	Optimal choice – assigning workers to machines that don’t need control from the right side.
	Check of optimal activity of the left-hander on the given equipment in relation to the performance of right-hander.
	Purchase of machines and equipments with production adjustments for left-handers.
	Inclusion of left-handers in activities doesn’t require controls on the right side.
B - Technical	Modification of the current machines and equipments for left-handers (consider frequency and reaching possibilities of controls).
	Solution of additional lighting of the workplace with the impact of light from the right side.
C - Combined	Joining of variants A,B.

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