

## The psychological influence of open and enclosed spaces on the regulation of motor activity

OLENA POLIANYCHKO<sup>1</sup>, GEORGII LOPATENKO<sup>2</sup>, VIKTORIA BILETSKA<sup>3</sup>, LILIA YASKO<sup>4</sup>, OLENA SPESYVYKH<sup>5</sup>, ANATOLY YERETYK<sup>6</sup>, BORYS GRINCHENKO<sup>7</sup>  
<sup>1,2,3,4,5,6,7</sup>Kyiv University, Kyiv, UKRAINE

Published online: June 30, 2018

(Accepted for publication May 08, 2018)

DOI:10.7752/jpes.2018.02102

### Abstract:

A study of the psychological influence of open and enclosed spaces on the regulation of motor activity was conducted. During the process, some exhibited primary adaptation to the space, and others exhibited mental disadaptation under extreme conditions. In total, 350 students from Kyiv higher educational institutions who were from 17 to 23 years old participated in the study. The study revealed the influence of the perception of open and enclosed spaces on the regulation of movements in extreme conditions when in the mountains at altitudes from 2000 m to 5000 m above sea level and in caves (horizontal: from 40 km to 200 km, vertical: from 60 m to 150 m). The group stayed inside the caves for 3, 6, and 12 hours. All the subjects exhibited an increase in tonic activity in their angular and temporal dimensions during the stay in the caves. When defining the distances (spatial extension), there were errors in the direction of reducing the actual length of the path while staying in an open vs. an enclosed space. During the stay in the enclosed space, 71% of the subjects underwent a sharp shift in the balance of their autonomic nervous systems in favour of the sympathetic region. In total, the subjects exhibited a 14% higher superiority of the sympathetic region of the autonomic nervous system in the enclosed space than when exposed to open space. The enclosed space causes more stress to the mental state, requires more effort to adapt and overcome the stressful situation, mobilizes the forces of the organism under extreme situations, and increases the consumption of energy resources. The time microintervals (perception of the subjective one-minute time interval) and the tonic activity were studied at different heights (2500 m, 3000 m, 3500 m, 4000 m) and are subject to certain patterns and show a positive correlation ( $p < 0.05$ ).

**Key words:** perception, open and enclosed spaces, regulation, motor activity.

### Introduction

Development of motor activity regulation is a part of general physical education, which provides efficiency of motor skills, refining the body organs, stimulating the intellectual activity etc. (Visan P., Visan V., 2017). This kind of regulation plays a significant role in the development of personality since the early age (Marouli A., Papavasileiou Glykeria-Erato, D. Aspasa, Venetsanou F., 2016) and requires an integral approach in development and scrutiny of itself (O. Lahno, O. Hanjukova, O. Cherniavska, 2015). All human movements are carried out in space and time. A person's perception of open and enclosed space in the course of motor activity significantly influences the quality of various activities. Each action or movement of a person is regulated by certain areas of a complex functional motor system. Specific psychomotor qualities (V.V. Klymenko, 2007) are of great importance for the adequate perception of space during motor actions. Scientists have emphasized the peculiarity and exclusiveness of motor activity, which is considered to be a bundle of activities of the psyche and human consciousness (M.O. Bernstein, 2012). The perception of spatial and temporal indices during motor activity is complicated by the need for constant fine-tuning of movements, making necessary corrections for the preservation of spatial-temporal orientation, accuracy and coordination in solving various motor tasks. One effective guarantee to prevent traumatic situations and to maintain adequate psychomotor activity may be information about the peculiarities of perception of open and enclosed spaces during the regulation of motor activities, taking into account the individual profile of functional asymmetry. A new view on this problem was presented in a recent paper (Polianychko, Yeretyk, 2017) in which the peculiarities of the objective mental reality were presented in detail.

### Materials and Methods

In total, 350 students from Kyiv higher educational institutions who were from 17 to 23 years old participated in this study. The study revealed the influence of the perception of open and enclosed spaces on the regulation of movements in extreme conditions when in the mountains at altitudes from 2000 m to 5000 m above

sea level and in caves (horizontal: from 40 km to 200 km, vertical: from 60 m to 150 m). The group stayed inside the caves for 3, 6, and 12 hours.

In an open space at different altitudes, the subjective assessment of the perceived space was complicated by the lack of clearly defined landmarks (shrubs, trees, stones, rocks, etc.) on which the adequacy of visual perception was based. The distortion of the perception of open space also contributed to the presence of snow cover, which covered almost all of the field of view of the subjects

During this study, we used the Lüscher colour test, the "time perception", "seven-meter measuring standard", and the "measuring energy potential" (Klimenko, 2007).

## Results

The time microintervals and the tonic activity were studied at different heights (2500 m, 3000 m, 3500 m, 4000 m) and are subject to certain patterns and show a positive correlation ( $p < 0.05$ ). When the subjects were at altitudes of 2000 to 2300 m, an "accelerated" subjective perception of the elapsed time was recorded. At an altitude of 3000 m, a "slow" subjective perception of the microintervals of time was recorded. In the enclosed caves, the perception varied depending on the depth, the forced restriction of movement, the uncertainty of landmarks, the change of posture during the movement, and the presence of illusions and phobias. In the enclosed space, the following areas were mainly affected in the subjects: their processes of perception (underestimation of spatial signs of depth and distance to objects and their sizes), their psychomotor coordination, and their temporal relations. Due to their lack of experience staying in caves, illusions and mental tensions were recorded. The estimation of time microintervals before entering the cave was "accelerated" in 86% of the group, indicating a stressful mental state. After adaptation to the unusual conditions of the enclosed space inside the cave, the indices of the perception of the subjective one-minute time interval decreased in 67% of the subjects. The sense of fear and phobias also accelerated the subjective perception of the flow of time. After leaving the cave, the time perception in 63% of the subjects accelerated; however, it was closer to normal. When inside the cave, 95% of the subjects perceived an exaggerated elapsed time period. Illusions and phobias prevented the subjects from responding adequately to all possible situations that arose during the passage through difficult areas in the cave.

During the study, we found that the students underestimated the distance to objects while staying in an open and vs. an enclosed space. This was determined by the subjective perception of the distance from the starting point to a certain object and the time it took to approach it. When estimating the distance to the point by eye, the assessment of the students was very subjective. At a distance of 0.5 km, students were mistaken for by 10%, from 2 to 4 km, they were mistaken by – up to 20%, and at above more than 4 km, – the error reached was 50% or more. Defining the interval of time needed to pass a certain path, the students again underestimated the elapsed time. Using the Lüscher test for various spatial conditions, we studied the range of different mental states as a function of the external circumstances. Analysis of the data confirmed that the enclosed space caused the subjects more mental stress than when in an open space.

During the tests ("seven-meter measuring standard"), a correlation was found between the search for the shortest path to the aiming point and functional motor and sensory asymmetry. In total, 60% of the subjects with right-side (motor and sensory) asymmetry were deviated to the right during the first attempt, and 87% showed injuries on the right side of the body. Additionally, 70% of the subjects with left-hand (motor and touch) asymmetry deviated to the left, and 80% showed injuries on the left side of the body. Correlation analysis of the data showed statistically significant relationships between injuries ( $p < 0.01$ ) and functional sensory-motor asymmetry in the subjects.

## Discussion

Our study showed that the perception of open and enclosed spaces directly and indirectly influences the regulation of motor activity. Similarities in the perception of open and enclosed spaces were as follows: mandatory presence of landmarks (visual information), absence of phobias of open space, enclosed space, fear of height, darkness, phobias of traumas, depth, etc., the ability to make corrections in perception in the presence of illusions (visual, auditory, sensory-motor). Differences in the perception of open and enclosed space included the following: the perception of the open space worsens with an increase in atmospheric pressure, depends on the illumination (day-night), the variability of the weather (sun, rain, snow, and fog) and changes in the month of the year. When the visual orientations were limited, the perception of space worsened, and sometimes it became impossible. The perception of the enclosed space varied depending on the depth and volume, the need to restrict movements, the change in posture of the body when moving, and the differentiation of landmarks in an unusual colour scheme. In the enclosed space, there was an underestimation of spatial signs of depth and distance to objects and their sizes. When moving in caves, during a short time, a person does significant work, spends much more energy and makes non-standard decision. An enclosed space of narrow passages gives a sense of a fast flow of time. After reaching the surface, the perception of the time spent inside the cave decreased. This is explained by the interesting route, receipt of new information, and positive emotions. Before going into the caves, when inside the caves, and after leaving the caves, the measured energy potential indicators showed that

all of the subjects exhibited an increase in tonic activity in their angular and temporal dimensions. This was explained by the mobilization of the entire organism under the specific conditions of the caves. During the adaptation period to the enclosed space, there were illusions of different types (visual, auditory, sensory-motor). The enclosed space of caves requires more adaptation. It requires overcoming a stressful situation and mobilizes the forces of the body for an emergency. During a stay in an enclosed space, under conditions of danger, stress and activity, the sympathetic nervous system dominates. In an enclosed space, the perception of distances, depths, altitudes was inadequate and depended on the illumination and the experience of being in the caves.

### Conclusions

This study of the perception of open and enclosed spaces during the regulation of motor activity showed that the perceptions of different types of spaces are different and influence the regulation of movements.

Specifically, we found that:

- the perception of an open space varies depending on the atmospheric pressure, limitation of landmarks, phobias in the open space and of heights;
- the perception of an enclosed space varies depending on the depth, the forced restriction of movements, changes in the posture of the body when moving, the presence of phobias of injuries and the enclosed space itself. In an enclosed space, the accuracy of perceived distances, depths, and heights depend on the illumination and the experience of being in such conditions.

It is necessary to have special training and experience to determine the interval of time needed for passing a distance. During the experiments in both the open and enclosed spaces, all subjects miscalculated and underestimated the elapsed time. Specifically, all surveyed subjects were going to spend significantly less time overcoming their segments of the path, than the segments required indeed.

During the adaptation period to the open and enclosed spaces, illusions of different types (visual, auditory, sensory-motor) were recorded. Illusions and phobias interfere with adequate responses to most situations that arise when perceptions of open and enclosed spaces occur during the regulation of motor activity.

The results of the study show that motor skills and abilities acquired and mastered while in one type of space will not be transferred to other types of space.

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