

# The influence of visitors' specific motor actions on the perception and evaluation of museum exhibits

Tetiana Yermakova<sup>1ABCDE</sup>, Sergii Iermakov<sup>1ABCDE</sup>, Mateusz Tomanek<sup>2CDE</sup>, Wladyslaw Jagiello<sup>3CDE</sup>, Lidiya Zavatska<sup>4CDE</sup>

<sup>1</sup>*Kharkiv State Academy of Design and Arts, Ukraine*

<sup>2</sup>*Nicolaus Copernicus University in Torun, Poland*

<sup>3</sup>*Gdansk University of Physical Education and Sport, Poland*

<sup>4</sup>*Academician Stepan Demianchuk International University of Economics and Humanities, Ukraine*

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## Abstract

**Background and Study Aim** An important element in the system of museum activities are approaches to attracting visitors. Among these approaches, one can single out the dialogue of the museum with visitors through specially organized active motor actions. Such actions have certain parameters (the nature of physical activity and its age-appropriateness, intensity, duration, etc.), which can influence the perception and evaluation of exhibits and the decision of visitors to return to the museum. The purpose of the study is an attempt to explain how specially organized active motor actions of visitors affect the perception and evaluation of museum exhibits and getting satisfaction from visiting.

**Material and Methods** Publications from the Web of Science Core Collection (WoS) were selected as the source of information. The search was carried out using keywords that characterize the interaction of visitors with the subject-spatial environment of the museum. The VOSviewer program was used to analyze the relationships between documents retrieved from WoS.

**Results** It is argued that the sedentary behavior of visitors, typical for many museums, does not contribute to their involvement in the museum space and the creation of meaning in museums. It is noted that an important aspect in the organization of special motor actions of visitors is the orientation to their motivation and interpretation of movements in the museum exhibits. The optimal level of physical activity has been identified. It creates a comfortable feeling and contributes to an adequate perception of the exhibits and corresponds to the main mission of the museum.

**Conclusions** Specially organized motor actions form the maximum motivation for visitors to study the museum exhibits. Such movements carry a certain semantic character of the theme of the museum.

**Keywords:** motor actions, museum visitors, physical activity, cognitive abilities.

## Introduction

An important element in the system of museum activities are approaches to attracting visitors. The traditional interactions of the museum with visitors are undergoing significant changes in the ever-increasing competition among cultural institutions. It is becoming more difficult for potential museum visitors to be interested in certain marketing offers. Communication with visitors through mobile applications, social pages of the museum, interactive events is much inferior to direct contact with the exhibits. All these require the search for more attractive approaches to attract visitors to museums. Among these approaches, one can single out the dialogue of the museum with visitors through specially organized active motor actions. Such actions have certain parameters (the nature of physical activity and its age-appropriateness, intensity, duration, etc.), which can influence the

perception and evaluation of exhibits and the decision of visitors to return to the museum. The rationale for such approaches can be divided into several areas.

*The influence of motor actions of museum visitors on cognitive abilities, creative thinking and decision making.*

The relationship between physical activity and cognitive activity is based on the neurobiological mechanisms of human decision making. This can be clearly seen in numerous examples of physical activity of people of different ages [1, 2, 3, 4], physical education of children [5, 6, 7], athletes' activities in sports [8, 9, 10]. These studies have improved the visualization and understanding of the cognitive processes that emerge and develop in the context of physical activity and sport. The authors revealed a positive relationship between a variety of physical activities and cognitive activity. In turn, the World Health Organization claims that physical activity improves thinking, learning and judgment skills

[11]. Other studies note the following: physical activity has a positive effect on creative thinking [12]; moderate-intensity physical activity improves the cognitive abilities of both young and old people [13]; in young people there is an improvement in memory associated with exercise [14].

Other similar studies have documented the enhancing effects of exercise on cognitive function. Thus, Salehinejad et al. [15] argue that physical exercise with certain cognitive parameters has an effective influence on cognitive functions, especially executive functions. Nezhad et al. [16] note that exercise is effective in reducing mental and physical fatigue.

This interrelation of cognitive and executive functions characterizes a person's ability to perceive and evaluate material objects, which include museum exhibits. In general, all important indicators of physical activity (thinking, learning and judgment skills) differ in the intensity, duration and nature of physical activity. At the same time, the motor actions of visitors are closely related to the atmosphere of the museum space. This space provides for the presence of a certain level of mood among museum visitors, which is necessary for the perception of exhibits and their evaluation. In this, a certain role can be assigned to special motor actions.

The results of Chan et al. [17] and Campbell et al. [18] show that moderate-intensity exercise is associated with greater improvement in mood. According to Chan et al. [17] to improve mood, a regimen of 10 to 30 minutes of exercise is enough. Another study notes that aerobic exercise improves fitness and quality of life [19]. The authors state the following: continuous moderate-intensity jogging can improve cardiac function and maximal oxygen uptake; regular exercise of moderate intensity causes a positive trend in systolic and diastolic blood pressure.

At the same time, for museum visitors, it is necessary to take into account the focus and levels of physical activity that are more conducive to a better perception and appreciation of the exhibits and attract them to future visits.

*Motor actions of museum visitors with a focus on attracting them to the museum*

In studies of such field of study, through specially organized motor actions of visitors the authors recommend to create the following: an attractive and comfortable environment [20, 21]; interactive data visualization [22, 23, 24]; conditions for active participation in the experimental study of the topics of the exhibition [25]; conditions for achieving the harmony of one's body, which is inherent in works of art [21]. Such approaches lead to the interaction of staff and visitors, has a positive impact on the interaction of visitors with exhibits [26].

At the same time, specially organized motor actions of visitors in the museum space must be considered from the point of view of the interaction of human motor and cognitive functions. In this context, the museum is faced with the task of finding the optimal level of intensity and duration of special motor actions of visitors that would arouse interest in them and contribute to a positive perception and evaluation of the exhibits. In general, such motor actions should also lead visitors to the desire to return to the museum later.

Hypothesis. It was assumed that the relationship between motor and cognitive functions of a person can be used to create a more comfortable object-spatial environment and ways of interaction between museums and visitors.

Therefore, the purpose of the study is to try to explain how to encourage museum visitors to get satisfaction from the perception of exhibits through specially organized active motor actions and encourage them to return to the museum.

## Methodology

### *Sources of information*

We chose publications from the Web of Science Core Collection (WoS) as a reliable source of information. The search was carried out using keywords that characterize the interaction of visitors with the subject-spatial environment of the museum. The VOSviewer version 1.6.18 [27] program was used to analyze the relationships between documents retrieved from WoS. The websites of the world's leading museums were also used.

### *Research Design*

Documents were extracted from the WoS database using keywords – *museum/visitors* in the following sequence. The depth of the search was limited to 5 years. This is due to the assumption that technologies that are attractive to visitors are becoming more and more advanced. Therefore, it makes no sense to analyze earlier studies. First, documents were searched for the keyword *museum* (All Field)s. Then the search was carried out on the retrieved documents for the keyword *visitors*. This approach allows you to extract documents with the most characteristic features – *museum/visitors*.

The search results are saved via the menu "Export/Tab Delimited File/Full Record and Cited References" as a text file (e.g., museum.txt). It should be considered that WoS only allows you to save 500 documents. If there are more documents extracted, then it is necessary to save as several files. Then merge the files in a text or other editor (e.g., Adobe Dreamweaver, Notepad++). To do this, in the second or subsequent files, you must delete the first line. The special structure of the file allows it to be used for further analysis in the program VOSviewer [27].

As a result, we obtain a map of the relationships between the cited documents. Directly from the map it is possible to view the selected document [28]. In the context of our study, this approach is widely used in the analysis of publications on motor activity and physical activity of various categories of people [29, 30].

Next, we identified sources that present various approaches to the interaction of museums with visitors. Particular attention was paid to research on the use of active motor activity of visitors in the museum space.

#### Data for analysis

A search for the keyword *museum* showed 87927 publications, 1940 publications of which were found for the keyword *visitors*. These 1940 publications were further searched for a combination of the keywords: *physical* or *perception* or *activity* or *entertainment* or *games* or *cognitive* or *installation* or *danc\**

541 documents were found. From them, documents were extracted by keywords: *activity* - 92; *games* - 56; *entertainment* - 46; *installation* - 41; *danc\** (*dancing, dance, danceable*) - 12. These keywords characterize the motor actions of museum visitors to the greatest extent. 85 documents were selected for further analysis.

### Results

According to the documents extracted from the WoS database, a map of their relationships was compiled (Figure 1). The documents with the most links have the largest circle size. This allows you to select relevant documents for further analysis.

The largest number of retrieved documents (Table 1) is in the category “Humanities Multidisciplinary” (16.8%). The category “Art” is represented by almost three times fewer documents (5.9%). This testifies that there are a small number of publications in this category that may have potentially useful information

on the topic of our study. It can be assumed that the most useful may be documents from categories that occupy positions 3 and 4 (Table 1).

An important criterion for the quality of extracted documents is the number of citations (Figure 2). Figure 2 shows that over the past 5 years, the number of citations and the number of publications remain constant. It can be assumed that new problems are constantly being considered on the topic of our study. This is also evidence of the ongoing interest in the research problem.

The distribution of the retrieved documents by the category “Countries/Regions” (Figure 3) indicates that researchers from the leading countries of the world (USA, England, Italy) show the greatest interest in solving the problem.

### Discussion

An analysis of the extracted documents from the WoS database allows us to identify the most focused on solving the problems of our study. In general, such publications can be conditionally divided into several areas.

*Motor actions of museum visitors as a means of creating a positive mood and a sense of comfort*

Various studies have shown that specially organized motor actions improve cognitive abilities and have a positive effect on creative thinking [12, 13, 14]. In our opinion, these characteristics of visitors are an important element of their introduction into the museum space. They fully fit into the concept of the main mission of museums. In this context, it can be assumed that creating the necessary mood and feeling of comfort among visitors contributes to an adequate perception and evaluation of museum exhibits. In fact, there is a positive relationship between physical activity and cognitive activity. This is supported by other studies involving adults [3] and children [5]. We agree with other authors [15,

**Table 1.** Distribution of search results according to the category “Web of Science Categories”

Rankings	Web of Science Categories	Record Count	% of 541
1	Humanities Multidisciplinary	91	16.8
2	Computer Science Interdisciplinary Applications	52	9.6
3	Education Educational Research	52	9.6
4	Hospitality Leisure Sport Tourism	51	9.4
5	Computer Science Theory Methods	44	8.1
6	Computer Science Cybernetics	36	6.6
7	Computer Science Information Systems	32	5.9
8	Art	30	5.5
9	Computer Science Artificial Intelligence	27	5.0
10	Environmental Sciences	27	5.0

Showing 10 out of 117 entries



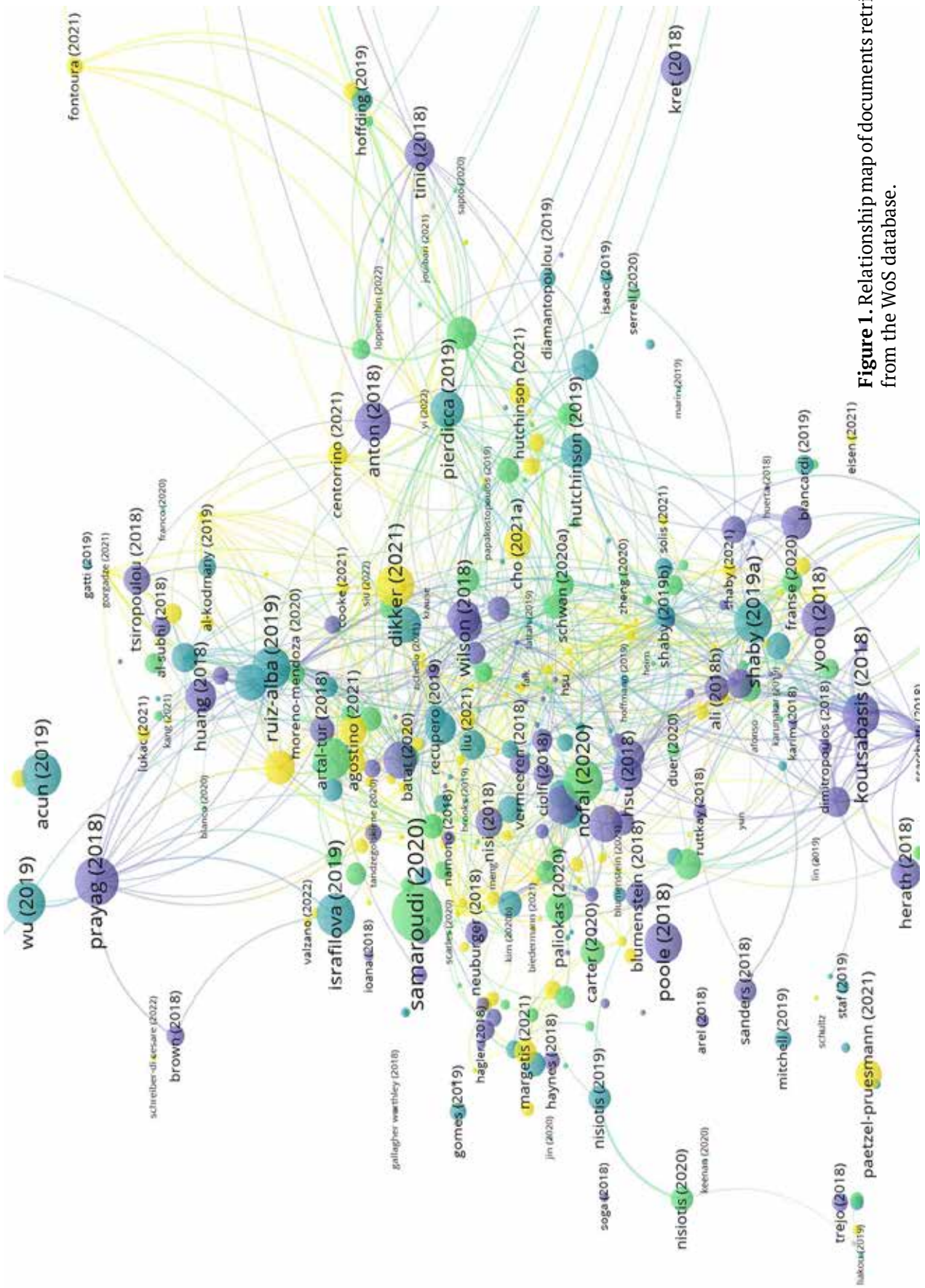
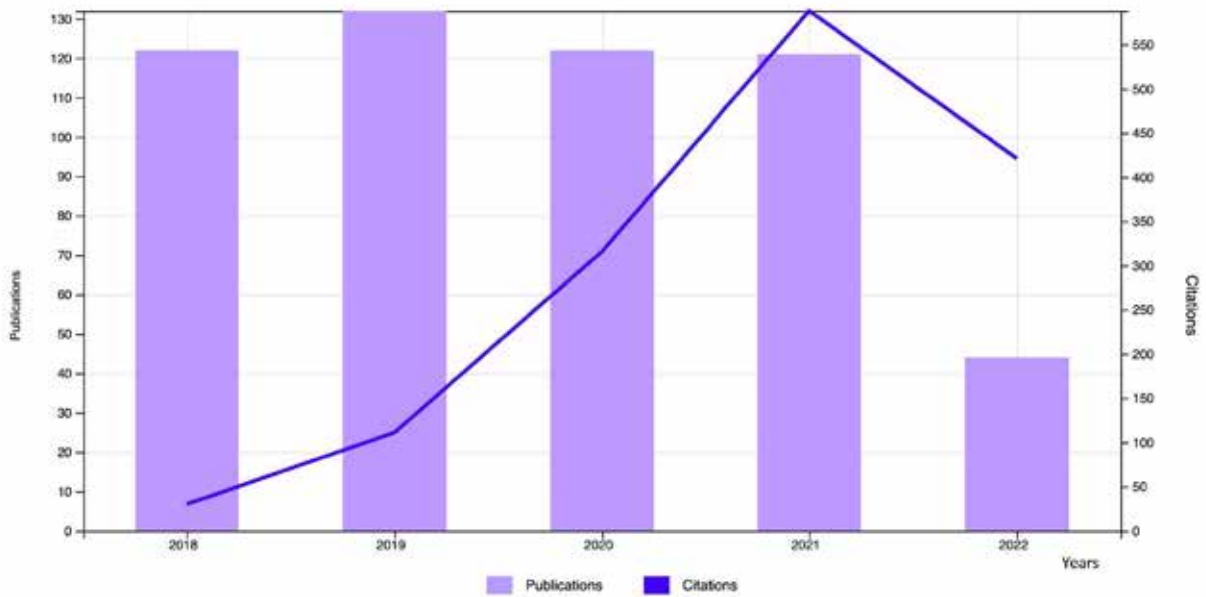
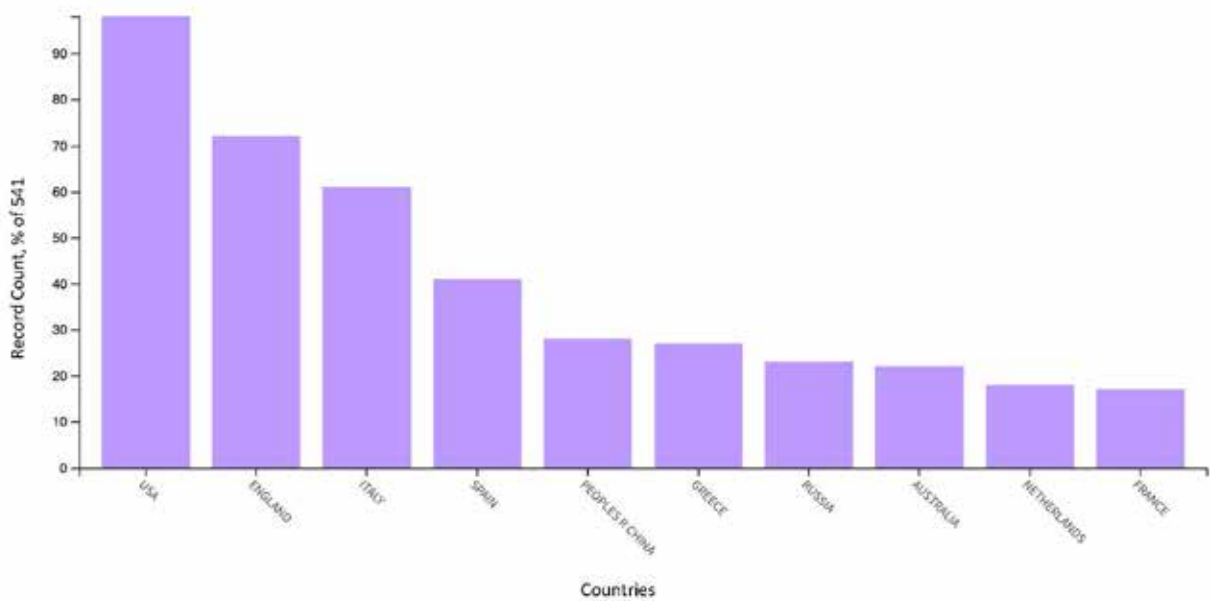


Figure 1. Relationship map of documents retrieved from the WoS database.



**Figure 2.** Distribution of search results by Times Cited and Publications Over Time



**Figure 3.** Distribution of search results according to the category “Countries/Regions”

16] that the motor actions of visitors are a means of reducing mental and physical fatigue. Obviously, with this approach, the level of physical activity (intensity, duration, focus) is important.

*Motor actions of museum visitors with a focus on attracting them to the museum*

Active movements of museum visitors of moderate intensity are supposed to be used in interactive visualizations. In this case, the visitor shows physical activity and thereby interacts with visual objects on the floor or on the screen of a large monitor. In fact, the visitor is involved in a certain game and shows activity and interest in the museum space.

It is known that interactive and immersive technologies can significantly improve the work of museums and exhibitions [24]. The study of Valverde Martinez [31] confirms this. The author believes that attempts to maintain traditional relations between visitors and museums, despite the introduction of digital devices, only increase alienation.

Many authors note the need to attract visitors through interactive data visualization. Thus, Mishra et al. [20] examined the physical movements of visitors with the installation of the exhibit on the floor. The authors believe that simulating the movement of the user’s body on the screen can be an interesting compromise. The authors provide

design guidelines for creating engaging experiences of human interaction with data through active movement. Alhakamy et al. [22] explored the design of interactive data visualizations that users control using gestures and body movements. The authors believe that such interaction is especially useful in museums for a more complete knowledge of the object. According to Trajkova et al., [23] museums are increasingly using interaction that generates excitement among visitors and has great educational potential. The authors considered interactive visualizations that users control using gestures (fine motor skills) and body movements (gross motor skills). This approach affects the number of visitors who interact with the installation.

In general, we agree with other researchers [20, 21, 25, 26] that an important element of museum activities is the creation of an attractive and comfortable environment for the active participation of visitors in the study of objects of the museum space. Such an environment is created by specially organized motor actions of visitors, which are focused on a very specific theme of a particular museum.

Thus, the introduction of digital devices and technologies to attract visitors to museums has its positive aspects. In our opinion, the active movements of visitors of moderate intensity are more focused on attracting them to the museum than on the evaluation and perception of the exhibits. In fact, the museum hopes that after participating in the installations, visitors will pay attention to the exhibits and get some satisfaction from the museum space. Of course, there is a certain sense in this approach of the museum – some of the visitors will pay attention to the exhibits and appreciate them. Obviously, it is necessary to somehow orient and prepare visitors for the further transition from participation in installations to the evaluation and perception of exhibits. Otherwise, the museum loses its main mission – getting satisfaction from visitors precisely from the perception of the exhibits. In this aspect, it makes sense to consider approaches to involve visitors in museums with active movements of a different direction.

*Special motor actions of museum visitors with an orientation towards the evaluation and perception of exhibits.*

It can be assumed that the level of intensity of active movements of visitors is closely related to the assessment and perception of the object and the museum space. Engagement in the museum provides for close interaction of visitors with the staff, structure and content of the program of stay.

In this context, Shelley Kruger Weisberg [32] considers the theory and methods of an original approach using movement to study museum objects. The author notes that kinesthetic learning

can increase the involvement of children and the creation of sense in museums. Recommendations on educational links with theories and concepts of kinesthetic learning are given. Lauren [33] notes that the relationship between mind and body allows for physical knowledge and understanding. The successful integration of physical activity into educational programs and offerings requires the full participation of staff. In this aspect, the role of museum staff is important, who can help plan exhibitions taking into account the active movements of visitors. The study of Koutsabasis [34] showed that kinesthetic applications in museums and cultural heritage institutions complement the visitor experience. Appropriate kinesthetic technology in museums depends on the visitors. The participation of visitors in purposeful body movements and hand gestures convey the significance of the museum exhibits.

Visiting museums involves the movement of visitors in the museum space. Natural walking with stops in front of the exhibits is a characteristic movement of visitors. In this context, Sayyad [35] considered the impact of natural walking in a large physical space on the user's presence and preferences. The authors focused on family entertainment and cultural centers, including museums. The data also show a trend towards higher levels of presence with natural walking. A study by Kelton et al. [36] is based on the analysis of walking and movement as forms of creating place and meaning in an exhibition space. The authors argue that walking creates place and meaning, considering routes through exhibition and sensory interactions. This approach allows you to temporarily reconfigure the relationship between walking, feeling and knowing. The authors argue that walking and other movements are components of the interpretive achievements of visitors, and not just a background for them. In a study by Lykke et al. [25] explored approaches that encourage visitors to actively participate in experiential exploration of exhibition themes. Each exhibit was built on experience through physical activity: balance, coordination and flexibility. The results showed that whole body activities generated the greatest motivation to participate in the exhibition and to explore the theme of the exhibition.

The analysis of publications indicates the general opinion of the authors that motor actions will contribute to the involvement of visitors in the museum space, obtaining satisfaction from the visit and the exhibits. In our opinion, an important aspect in the organization of special motor actions of visitors is the orientation to their motivation and interpretation of movements in the museum exhibits. We agree with the researchers that through preliminary physical activity it is possible and necessary to form the maximum motivation of visitors to participate and study the subject of the



museum. In this context, the direction of the motor actions of visitors, which is focused on a specific theme of the exhibition or museum exhibits, becomes important.

*Dance movements of visitors in the perception of the museum space.*

One of the attractive forms of museum interaction with visitors is the presentation of dance as a work of art. In this case, visitors are involved not only in the contemplation of the dance, but also become part of such an action. The greatest effect from the participation of visitors can be achieved in museums that represent the actual dance and its accompanying attributes – clothing, objects, history, etc. Museums that represent collections of works of art depicting the human body should be added to this. At the same time, visitors, through their own dance movements, try to achieve the harmony of their bodies, which is inherent in works of art. In other cases, dance performances should be attributed more to the marketing activities of museums and they are just a good addition to attracting visitors.

Among the dance performances, one can single out a project with the participation of the world's leading museums that are exploring new ways of interacting with the audience [37]. The purpose of such projects is to: improve visitor travel through museum spaces; exploring how live performance can help you understand and engage with the visual arts [37]. In this context, it is noted that the museum has the opportunity to model a new goal for museums of the 21st century, which is based on dance [38]. In the study of Franko and Lepecki [39] it is noted the ever-increasing presence of dance performances and choreographic works “exhibited” in the world's major museums. Another study [40] considers the possibility of choreographic thinking to interact with the forms of exhibition exposition. Bishop [41] presents four of the most relevant opportunities/challenges for representing dance in a museum: historical framing, audience attention, changing the meaning of the work, and financial support.

In our opinion, the organization of dance performances in the museum space is a stimulating factor for visitors to perform their own dance movements. This approach can be applied in the practice of museums, the exhibits of which are closely related to the dance or representation of the human body or its movements. In the context of the perception and evaluation of museum exhibits, the most important is the direct participation of visitors in the performance of dance movements. Our statement is based on the results of other studies. For example, in the study of Bishop [41] was raised the problem of exhibiting dance as a part of a permanent museum collection. The author argues that museums and the art world in general

cover only certain areas of dance. It is proposed to find a way to present the dance as a part of a historical dialogue with the visual arts, and not just entertainment for visitors. Another opinion is expressed by Franco [42]. The author gives his reflections on the growing presence of dance in museums at the beginning of the 21st century. The author argues that the presence of dance in a museum can foster new relationships with visitors. According to Franco and Giannachi [21], the dance movements of visitors form a state of comfort in them. The authors offer a range of practices for the body and mind. Morejon [43] considered creating a dance composition that is based on an exploration of the form, line, design and symbolism of art glass. This dance is based on creativity and improvisation of movements. Diamantopoulou and Christidou [44] analyzed the significance of the movement in shaping museum encounters. The authors consider the museum experience as inextricably linked with the interactive connection of bodies and objects located in the museum space. This approach made it possible to shift the focus from objects and collections to the inclusion of museum meetings as a bodily representation unfolding in the connection of bodies, objects, space and time.

Thus, the authors come to a common opinion about the usefulness of dance movements in the artistic perception of objects, certain compositions of the museum space. Obviously, this approach will require museums to involve dance instructors and dancers, coaches and athletes in artistic/rhythmic gymnastics. Also, the museum needs to have more free space for conducting classes of this kind. At the same time, we do not agree that dance performances, even with the participation of visitors, contribute to a better perception and appreciation of the exhibits of any museum. We attribute this fact to the marketing research of museums. In our opinion, the problem of the intensity and duration of physical activity that visitors receive through dance movements remains little studied. In this case, the control of physical activity is of great importance.

*Justification of the optimal level of physical activity of visitors for an adequate perception of the museum space.*

The optimal level of physical activity is characterized by the creation of comfortable sensations for visitors from special motor actions. At the same time, in the context of the main mission of museums, it is necessary to take into account the impact of physical exercises on the cognitive abilities of visitors. It is cognitive abilities that are one of the important elements in the perception and evaluation of museum exhibits.

The level of physical activity in the form of various movements of visitors is characterized by the aerobic nature of the exercises. The WHO guidelines

on physical activity and sedentary behavior notes that moderate-intensity physical activity causes an increase in heart rate and respiration [45]. Recommendations on physical activity with aerobic load are offered.

The most convenient form of physical activity control is various mobile devices – fitness bracelets, etc. The load level is recommended to be determined as a percentage of the maximum heart rate (HRmax). To estimate HRmax, specific population formulas should be used. The most accurate equation is:  $HR_{max} = 205.8 - 0.685(\text{age})$  [46]. For museum visitors, the most acceptable levels are low intensity (60–70% of HRmax) and very low intensity (50–60% of HRmax). A low level of intensity is characterized by comfortable sensations, a small load on the muscles and the cardiovascular system. Very low intensity is characterized by comfortable sensations and minimal effort. Higher levels cause rapid breathing and are not suitable for museum visitors [46].

The creation of a comfortable feeling for visitors in the museum space is indicated in many studies: Tarakci-Eren [47] believes that visitor satisfaction is characterized by a state of safety, comfort and convenience; Kaya and Afacan [48] found statistically significant correlations between visual comfort and visitor satisfaction; Bazan et al. [49] recommends creating lighting designs for museums that provide comfort and visual quality.

In our opinion, the specifics of the interaction of visitors with the object-spatial environment of the museum is characterized by the performance of two tasks: walking or performing active movements and evaluating exhibits. From these positions, the level of physical activity on visitors (characterized by intensity) should not interfere with comfortable feelings and adequate perception of museum exhibits. As a test to control the level of physical activity, it is recommended to use the “Conversational test”. This test is based on the ability to maintain a conversation with an interlocutor while performing physical activity without any difficulties. In fact, the test allows you to determine the intensity of physical exercise by the level of comfort. This approach to exercise control is noted in many studies [50, 51, 52, 53]. The authors note that such a test is usually used as a means of control when performing simultaneous motor and cognitive tasks or dual tasks.

Thus, we can agree with the researchers that comfortable sensations from physical activity contribute to an adequate perception of museum exhibits. It should be noted that the “speaking test” has some restrictions on its use in the museum space. Adequate perception of museum exhibits also depends on the cognitive abilities of visitors. In this aspect, the need to consider the influence of motor actions on the cognitive abilities of visitors is obvious.

### *Cognitive abilities and exercise*

Traditionally, a visit to the museum is characterized by low mobility of visitors. In fact, visitors do not perform any additional movements, except for movements in the museum space. At the same time, active movements (like physical exercises) are closely related to human cognitive abilities. This fact is an important prerequisite for an adequate understanding and perception of museum exhibits by visitors. So, in the study [54] it was proved that physical exercises have a positive effect on human cognitive abilities. Toth et al. [55] showed the potential role of physical exercise in improving the cognitive aspects of gaming activity using the example of eSports. Rego et al. [56] has found that exercise is a good way to increase cognitive abilities. The study of Tang [57] notes that fatigue affects physical and cognitive performance. In another study [58], the authors concluded that dance therapy improved gait and cognitive function. Gentile et al. [59] found that the introduction of sports program enriched with cognitive stimuli had a beneficial effect on children’s working memory and cognitive flexibility. The results of another study suggest that aerobic exercise can improve memory in older adults [60].

Thus, it can be argued that physical exercise is closely related to the cognitive abilities of visitors. It can be assumed that specially organized motor actions of visitors contribute to an adequate perception and evaluation of museum exhibits. In our opinion, the sedentary behavior of visitors, which is typical for many museums, does not contribute to their involvement in the museum space and the creation of meaning in museums.

### **Conclusions**

An analysis of publications shows that many of them do not take into account the influence of the level and nature of active movements of visitors on the perception and evaluation of museum exhibits. When organizing special movement programs by museum staff, an important element is the operational control of the level of physical activity of visitors, which is optimal for the perception and evaluation of exhibits. In this aspect, the recommendations of researchers who deal with the problems of the influence of physical activity on the perception and assessment of the external objective environment can be useful.

### **Recommendations**

Interaction with the museum space with the help of special (specific) motor activity of visitors can be considered in the following areas:

Walking of visitors in the traditional interaction with the museum object space. This type of movement is characterized by slow walking with



frequent stops and rest in front of the exhibits.

- Motor activity of visitors, which requires the movement of various parts of the body with movement in space. This type of movement is typical when the museum uses interactive technologies for visualizing the object environment, which requires visitors to perform movements of low intensity. Often such movements are of a playful nature and are more focused on school-age children.

- Motor activity of visitors, which is characterized by the maximum allowable level of intensity. Such movements carry a certain semantic character of the theme of the museum. These include dance moves, brisk walking through corridors or tunnels/mazes, physical relaxation exercises while visitors are relaxing.

It is proposed to use fitness bracelets and other similar devices to control the motor activity

of museum visitors. It is also proposed to use the “Conversational Test” as a means of monitoring the level of traffic intensity of visitors.

### Author disclosure statement

Authors declare that they have no conflict of interest with the existing project, financial, social or otherwise.

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**Information about the authors:**

**Tetiana Yermakova;** (Corresponding Author); <https://orcid.org/0000-0002-3081-0229>; yermakova2015@gmail.com; Department of Pedagogy, Ukrainian and Foreign Philology, Kharkiv State Academy of Design and Arts; Kharkiv, Ukraine.

**Sergii Iermakov;** <https://orcid.org/0000-0002-5039-4517>; sportart@gmail.com; Department of Methodologies of Cross-Cultural Practices, Kharkiv State Academy of Design and Arts; Kharkiv, Ukraine.

**Mateusz Tomanek;** <https://orcid.org/0000-0002-9527-2513>; mtomanek@umk.pl; Department of Business Excellence, Nicolaus Copernicus University in Torun; Torun, Poland.

**Wladyslaw Jagiello;** <https://orcid.org/0000-0001-7417-4749>; wjagiello1@wp.pl; Department of Sport, Gdansk University of Physical Education and Sport; Gdansk, Poland.

**Lidiya Zavatska;** <https://orcid.org/0000-0001-5550-8248>; liz6050@ukr.net; Department of Theory and Methods of Physical Education and Adaptive Physical Education, Faculty of Health, Physical Education and Sports, Academician Stepan Demianchuk International University of Economics and Humanities; Rivne, Ukraine.

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