УДК 811.111
DOI: https://doi.org/10.17721/2520-6397.2025.2.08

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MULTISENSORY EXHIBITING IN MODERN MUSEUM DISCOURSE (BASED ON NATURAL HISTORY MUSEUMS' EXHIBITIONS IN LONDON, OXFORD, CAMBRIDGE)

The article highlights multimodal exhibiting at Natural History Museums in London, Oxford and Cambridge that position themselves as important platforms for public education and scholarly dialogue on critical environmental issues. These multisensory exhibition strategies and discourse align with contemporary educational theories, emphasise experiential learning, critical thinking, visitors' engagement and their personalised experience. By immersing visitors in sensory-rich environments that replicate real-world phenomena, museums facilitate meaningful connections between visitors and the natural world developing the concept of a participatory museum. By integrating visual art, visual aids, informative texts, soundscapes, high-fidelity audio, tactile experiences, interactive displays, panels, models, immersive exhibits, interactive technology, interactive touch-screen installations, interactive puzzle games, permanent and temporary exhibitions create a more inclusive and dynamic learning environment that accommodates different learning preferences. Tactile modality is effectively incorporated into a range of interactive experiences within Natural History museums exhibitions offering visitors a more informative, immersive and interactive way to connect with exhibits. The blend of physical interaction and descriptive content allows for a more immersive understanding of nature, fauna and flora, transforming a static display into a more dynamic, interactive learning experience. Sensory invitations, linguistic directives, textual instructions assist visitors in both visually and cognitively interpreting the intended action, enhance physical interaction with the displays. When further interaction with the exhibit is required, action verbs are accompanied by symbolic imagery to reinforce meaning. This integration of language and imagery creates a layered, multimodal communication system that engages visitors not only cognitively but also sensorily. By combining textual instructions with visual

representation, via text-image relationship, the exhibits offer an interactive learning experience that appeals to various sensory modalities and learning preferences, making complex information more accessible and memorable.

Keywords: *discourse, multimodal, multisensory, museum, participatory museum, tactile, text-image relationship.*

Background

Many natural history museums emerged in the 19th century. Traditionally, they encapsulated and memorialised nature and environmental memory in their displays and focused on visual perception of their exhibits. Faced with the environmental crisis, these museums have started to redefine their roles and look for new ways to represent natural changes (Decroupet, 2024), linking past, present and future as environmental management of the planet. Highlighting vital issues of climate change, biodiversity conservation, ecosystem disruption, ecology and sustainability, modern natural history museums are developing and implementing diverse strategies in order to transform these institutions into key sites of accelerating education, science, research, action, and partnerships. Modern natural history museums offer their visitors design-oriented, visitor-centered, self-directed experiences, immersive and enriching explorations implementing multimodal settings, multimedia technologies, digital technologies, artificial intelligence, interactivity, gamification, science media, experiments, developing Web-based learning experiences, entertainment, thus providing an engaging educational experience both for kids and adults.

The object of the research is the interaction of visual, tactile and textual modalities in modern museums exhibitions, interactive experiences of visitors.

The shift to multimodal and multisensory exhibitions in Natural History Museums discourse makes the ***subject*** of the research.

The goal of the research is to explore how multisensory and multimodal exhibition strategies employed in Natural History Museums in London, Oxford, and Cambridge enhance visitor engagement, support experiential learning, and improve knowledge retention. The study examines the incorporation of tactile, auditory, visual, and interactive elements, the role of linguistic and symbolic directives in shaping visitor interactions, and the influence of

technological innovations, such as VR, digital interactivity, and gamification, in reshaping traditional museum installations into interactive, participatory educational experiences.

The empirical data was collected during personal visits to Natural History Museums in London, Oxford, and Cambridge (2022–2024), focusing on multisensory exhibitions.

Methodology. New strategies and experience of natural history museums, their multimodal approaches have become an object of research for multiple studies within multimodality domain and New museology (Pierroux, 2024; Steiner, & Crowley, 2013; Wang, & Chen, 2023; Yan, 2024). Multimodal analysis of exhibiting at natural history museums is based on seminal works of Gunther Kress and Theo van Leeuwen (Kress, 2009; van Leeuwen, 2022). Multimodal settings offer visitors new experience of interplay of diverse modes and media, of inter-semiotic relationships and re-semiotisation (Insulander, & Selander, 2009; Qing-Mei, 2020).

Virtual reality technology and interactive display devices, multimodal and multisensory experience when visitors can engage with virtual exhibits via gestures, sound, and touch, provide new options for a deeper comprehension and experience of cultural heritage (Wen, & Ma, 2024). New technologies have become the tools of meaning-making in exhibitions. Meaning-making in a new arena for learning and communication in the specific settings (Insulander, & Selander, 2009). Due to the increasingly rich material means involved in social activities, the traditional method of meaning-making through language has been gradually replaced by the complex in which multiple media coexisted, and multimodality are the compound discourse with sound, images, charts, apart from text (Qing-Mei, 2020). Sustaining public interest in science becomes more challenging year after year. To address this, museums enrich the visitor experience, enhance the attractiveness of exhibitions, and implement immersive and interactive Virtual Reality (VR) experiences. For example, a few studies have explored the application of VR in the context of dinosaurs in museums, highlighting its potential to create compelling and informative experiences (de Carvalho Souza et al., 2023). Another key point is the studies of interactivity – a broad trend nowadays. Social

interaction, interaction between visitors, interactivity at the exhibitions have become of crucial importance for our experience and perception of museums and galleries, an important resource in enhancing interpretation and creating new forms of engagement with museum collections (Heath, & Vom Lehn, 2010). Recent strides in the field, particularly in the realm of Quality of Experience (QoE)-based museum touring, have exerted a profound influence on the dynamics of museum interactions. We explore applications of deep learning and multimedia technologies related to museum visitor experiences. This exploration is chosen because it represents a quintessential facet of contemporary technology pivotal in augmenting the museum visitor experience (Wen, & Ma, 2024). The development of visitor studies, visitors' behaviours has become a new area of research in museology. What visitors do when they stop in an exhibition–their interactions with authentic artefacts and artworks, companions, and interpretive materials–is not trivial to their meaning making process. Interactions, dwell time, movement routes etc. span behaviourist and multimodal perspectives (Pierroux, 2024). Natural history museums have played a vital historical role in science and science education (Steiner, & Crowley, 2013, p. 267) and can play an important role in the 21st century learning due to powerful educational and academic environments they have created. NHM are becoming pedagogical mediators. The most progressive of them are trying to put multimodal learning at the centre of the museum's daily life. Incorporation of entertainment facilities, entertainment options for younger generations into museums exhibitions helps to spread joy, introduce inspiring offerings, promote education, foster innovation (Barber, & QudeebAl-Ban, 2023).

Research. Natural History Museums consistently adapt to remain engaging and relevant by curating temporary exhibitions that work alongside their permanent collections. These exhibitions address a variety of global scientific and cultural issues, spanning topics like palaeontology, biodiversity, ecosystems, human evolution, and geology. Moreover, they delve into contemporary global challenges such as climate change, environmental degradation, and natural disasters. By examining these areas, the museums offer both educational and exploratory experiences that often integrate

specialised topics within biology and the intersection of culture and nature. In doing so, they position themselves as important platforms for both public education and scholarly dialogue on critical environmental issues.

In recent years, there has been a shift towards the adoption of multisensory exhibition strategies, aimed at enhancing visitor engagement. This multimodal approach, which integrates auditory, visual, tactile, and sometimes even olfactory elements, serves to create a more immersive educational experience. A clear representation of this appears in exhibitions like **The River** at the London Natural History Museum, where visitors are submerged in the underwater soundscape of the River Thames. Through the use of high-fidelity audio, the exhibit contrasts natural aquatic sounds with human-generated noises, drawing attention to the impact of noise pollution on underwater ecosystems. Similarly, the **Fair Water?** exhibition at the Oxford Natural History Museum demonstrates the effective use of multisensory techniques to address the global issue of water scarcity. Visitors engage with the complexities of water security through digital interactivity, tactile engagement, and evocative visual art, making the challenges surrounding clean water access more relatable and engaging. Interactive touch-screen installations allow visitors to engage with real-world scenarios, such as managing water resources in various regions around the world. In addition to digital elements, **Fair Water?** incorporates tactile experiences, where visitors can physically engage with geological samples relevant to water filtration and storage, such as limestone, flowstone, granite, granodiorite, and Triassic sandstone aquifers.

Tactile experiences play a significant role in enhancing sensory engagement at museum exhibitions, offering visitors a more immersive and interactive way to connect with exhibits. At the Natural History Museum in London, the exhibition **Birds: Brilliant and Bizarre** allows visitors to feel the changes in an Anna's hummingbird's heartbeat, which can drop from 1,260 to just 50 beats per minute during a state of torpor. By placing their finger on a sensor, visitors experience the bird's survival mechanism, where it enters a state of mini-hibernation to conserve energy during cold periods or food shortages. Similarly, at the **Dippy Returns:**

The Nation's Favourite Dinosaur exhibition, visitors had the chance to physically interact with a life-sized replica of Dippy's skull, allowing them to explore its structure and shape through touch, while also accessing detailed textual information. This blend of physical interaction and descriptive content allowed for a more immersive understanding of Dippy's anatomy, from its teeth to its nostrils, transforming a static display into a more dynamic, interactive learning experience. The use of replicas and tactile objects provided visitors with a tangible connection to paleontological studies. Beyond specific exhibitions, tactile experiences are embedded throughout museum collections. Visitors can engage with a variety of fossils, such as dinosaur skeletons and human skulls at various stages of evolution (Fig. 1).

At the Oxford Natural History Museum, visitors are invited to touch geological specimens, including fossilised tree trunks, minerals like quartz and pyrite, and ammonites from the Jurassic period (Fig. 2). Rare and unusual rocks such as orbicular granite and Lewisian gneiss, one of Britain's oldest rock formations, are also on display, allowing visitors to physically interact with the materials that shape our understanding of Earth's history.

Fig. 1. Barbary lion skull, Natural History Museum, London

Fig. 2. Ammonite, Natural History Museum, Oxford

Young visitors are especially drawn to these tactile experiences. At the Oxford University Museum of Natural History, children can touch taxidermied animals, such as an American black bear or a red fox, fostering a connection between textual information and physical

interaction (Figs. 3–4). Supported by visual aids and informative texts, these tactile experiences offer a personal connection to the animals. For example, an exhibit featuring the red fox includes a photo of a child stroking the fox's fur, along with an engaging fact about foxes using 28 distinct vocal calls to communicate. Sensory invitations, like "*Please Touch*" encourage participation and create a multisensory learning environment that is both informative and engaging.

Figs. 3–4. Red fox & American black bear,
Natural History Museum, Oxford

In each instance, visitors are actively encouraged to engage with exhibits through the careful use of sensory verbs, forming an integral part of the museum's multimodal communication strategy. Phrases like "*Please touch*", "*Touch*" and "*Please touch carefully*" are not only linguistic directives but are also part of a broader multisensory approach that enhances physical interaction with the displays. These textual instructions are complemented by visual cues, such as images of hands, fingers, or icons, which assist visitors in both visually and cognitively interpreting the intended action. Additionally, in certain cases, Braille script is incorporated to accommodate visitors with visual impairments, ensuring that tactile engagement remains accessible to a diverse audience.

When further interaction with the exhibit is required, action verbs like "*Press*", "*Hold*" and "*Lift*" are used, often accompanied by

symbolic imagery to reinforce meaning. For instance, an eye symbol may convey "*Watch*" as seen in phrases like "*Watch how the rocks fall*" while a hand symbol prompts actions like "*Turn*" or "*Touch*". This multimodal approach extends beyond text and imagery to include tactile experiences, such as in an exhibit exploring natural forces like gravity, ice, water, and wind (Fig. 5). Here, visitors engage through multiple senses–touching a surface marked by a hand icon to feel the coldness of ice, listening to the sound of flowing water, or sensing the breeze against their hand. Conversely, at the Polar Museum in Cambridge visitors can turn a wheel to explore how Arctic Sea ice has changed from 1870 to 2020, observing the transformation on a screen.

This integration of language and imagery creates a layered, multimodal communication system that engages visitors not only cognitively but also sensorily. By combining textual instructions with visual representation, the exhibits offer an interactive learning experience that appeals to various sensory modalities and learning preferences, making complex information more accessible and memorable.

Tactile modality is effectively incorporated into a range of interactive experiences within museum exhibits, starting with simple touch-screen games and extending to more complex activities requiring physical interaction, such as pressing buttons and moving objects. The **Red Zone Galleries** at the Natural History Museum in London offer a wealth of such interactive experiences, focusing on the dynamic forces that shape the Earth. The galleries explore geological phenomena like volcanoes, earthquakes, and plate tectonics, providing visitors with a deeper understanding of the Earth's structure and the processes that influence its landscapes. Additionally, the Red Zone delves into the formation of rocks, minerals, and the ongoing subterranean changes beneath the Earth's surface. Through interactive displays, models, and immersive exhibits, visitors are invited to engage with the dramatic forces of nature. For instance, the QuakeQuiz allows participants to test their knowledge of how to respond during an earthquake by prompting them to select appropriate actions for various scenarios, such as at home, at work, while driving, at the beach and more. Questions challenge participants to choose the correct action, such as whether

to "*Stay in your bed, protecting your head with a pillow*" or "*Roll onto the floor next to your bed*" in the event of an earthquake while sleeping. Another question might ask, "*In the event of an earthquake while at the beach, should you: 'Run into the water', 'Drop, cover, and hold on until the shaking stops', or 'Apply more sunscreen'?"* Participants receive immediate feedback on their choices, along with practical tips on how to stay safe during an earthquake. Following this approach, in another interactive game, visitors can simulate volcanic eruptions by adjusting parameters such as the amount of gas and the thickness of magma (Fig. 6). These selections lead to different types of eruptions, allowing visitors to learn about volcanoes such as stratovolcanoes, shield volcanoes and other types, depending on the choices they make. Moreover, through the use of a touch screen, visitors can delve into the world of minerals, exploring their structures and properties.

Fig. 5. Tactile experience featuring natural forces, Natural History Museum, London

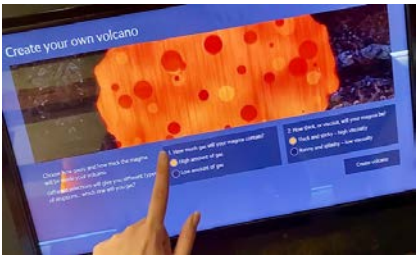


Fig. 6. Engaging touchscreen game "Create your own volcano", Natural History Museum, London

The **Green Zone Gallery** at the Natural History Museum in London offers a wide array of tactile and interactive exhibits that invite visitors to explore the intricate world of invertebrates, particularly insects, arachnids, and other small creatures. These exhibits are designed not only to educate but also to engage visitors through hands-on activities that foster a deeper understanding of the

biology, behaviour, and diversity of these often-overlooked species, which play critical roles in ecosystems. One of the interactive puzzle games within the gallery allows visitors to engage in a geometric exercise where they drag various shapes to assemble the body of a beetle (Fig. 7). This game highlights how natural science and geometric principles intersect, as participants learn the specific shapes that make up different parts of the beetle's anatomy.

Another exhibit showcases the ways insects use their bodies to detect sound (Fig. 8). Visitors can touch different parts of a mosquito's body on a touchscreen to find out where insects hear from, as different species have evolved unique mechanisms for detecting sound. For instance, some insects may "hear" vibrations through their legs or antennae, a fascinating adaptation for detecting predators or finding mates.

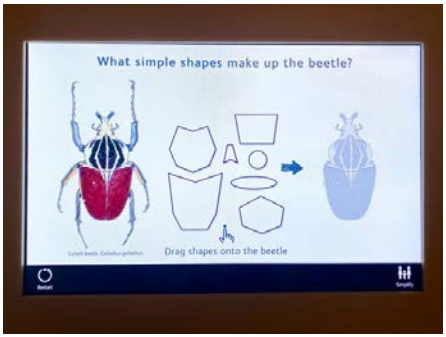


Fig. 7. Touchscreen puzzle game "Make up the beetle", Natural History Museum, London

Fig. 8. Multisensory exhibit "Sound", Natural History Museum, London

The tactile description on the exhibit "*Touch the picture where you think an insect's ears would be*" encourages active participation and engagement, enhancing the learning experience by connecting theory with physical interaction. Further enriching the gallery experience, visitors can participate in an interactive game where they build their own arachnid by answering a series of multiple-choice questions about its anatomy (Fig. 9). For instance, questions like "*How many wings,*

antennae, or pairs of legs do arachnids have?" guide visitors through the construction of an arachnid. If an incorrect answer is chosen, an insect with the selected anatomy is shown on the display, along with an educational explanation. Upon answering all the questions correctly, a large model of the arachnid appears in front of the visitor, offering a satisfying conclusion to the learning process and reinforcing the knowledge gained. In addition to these interactive games, visitors can explore a number of tactile panels and displays related to arachnid behaviour. One exhibit features videos of arachnids trapping and killing their prey, which are activated by pressing different buttons, allowing visitors to observe firsthand the diverse and often surprising methods arachnids use to capture their victims, from spinning webs to ambush tactics. Another interactive element encourages visitors to touch a sensor in the centre of a spider web image, which vibrates when touched (Fig. 10). Visitors must guess whether the vibration is caused by a potential mate or a fly caught in the web, pressing a button to make their selection. This activity replicates the sensory experience of a real spider, providing insight into the intricate communication and survival tactics these creatures use.

Fig. 9. Immersive touchscreen game "Build your own arachnid", Natural History Museum, London

Fig. 10. Sensory game "Touch vibrations", Natural History Museum, London

The interactive panels extend beyond biology, touching upon geological phenomena as well. Visitors can press buttons to explore tectonic plates contact lines or locate active volcanoes around the world. Another immersive exhibit invites visitors to shake model structures to simulate an earthquake and observe which ones withstand the shaking, teaching the principles of earthquake-resistant construction.

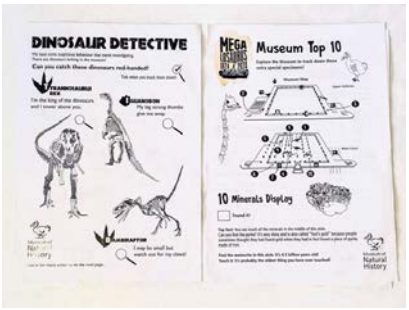
For younger visitors, the gallery features a multiplayer quiz game where participants guess whether different animals are dinosaurs (Fig. 11). Images of various creatures appear on the screen, and visitors must press buttons labelled "*Yes*", "*No*", or "*Pass*" to indicate whether they think the animal is a dinosaur. Points are accumulated with each correct answer, and the first participant to achieve a full score wins the game. Among the attractions, another engaging exhibit encourages visitors to step onto giant scales to compare their weight with that of different animals (Fig. 12). By pressing buttons, visitors can see how their weight stacks up against animals ranging from a rhinoceros and camel to a giraffe, elephant, or even a blue whale.

Fig. 11. Multiplayer quiz game "Is it a dinosaur?", Natural History Museum, London

Fig. 12. Interactive scales "Massive mammals", Natural History Museum, London

In Natural History Museums, traditional hands-on games and interactive activities remain a popular feature as well. At the Oxford Natural History Museum, younger visitors are provided with paper leaflets containing a range of interactive trails designed to guide

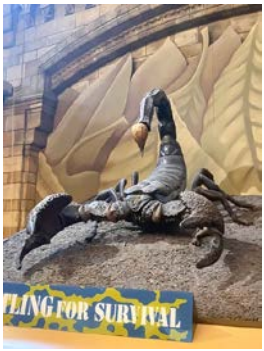
them through the museum's exhibits (Fig. 13). These trails, such as *Dinosaur Detective, Breathtaking Birds, Fantastic Fossils, Museum Top 10,* and *Small but Mighty Insects Family Trail*, accommodate various age groups and are marked with different difficulty levels (Fig. 14). Each trail also has a suggested completion time and covers different floors and galleries of the museum, ensuring that participants can tailor their experience based on their interests and abilities. The paper leaflets are filled with a mix of textual and visual information, helping children navigate the museum while learning key facts about the exhibits they are assigned to locate. The *Dinosaur Detective* trail, for instance, presents visual cues such as images of dinosaurs accompanied by magnifying glass icons, indicating that children must search for the specified dinosaur exhibit and tick it off once found. Other features, such as different dinosaur footprints representing carnivores and herbivores, further enhance the learning experience by engaging children in the task of categorising different species.



Figs. 13–14. Educational trails for children, Natural History Museum, Oxford

The tactile component is further emphasised in activities where children are invited to physically touch exhibits, such as a meteorite or a taxidermied fox, with the accompanying textual prompt "*It's 4.5 billion years old. Touch it: it's probably the oldest thing you have ever touched*", encouraging hands-on exploration. The interaction of a sensory verb "*touch*" and visual images strengthens the connection between language and physical experience, making learning both an immersive and multisensory process. Linguistic framework of these

trails is designed to guide and engage, with instructions like "*Feel the fox's fur. What do you think is the softest part?*", "*Look at the giraffe's tail. Can you see it's a different colour?*" or "*How do you think the Dodo walked? Try it out*", highlighting the connection between tactile interaction, actions and language processing. This combination of textual prompts, symbols, and active physical engagement demonstrates how museums effectively employ multimodal strategies to facilitate learning. The inclusion of reflective tasks such as "*Draw your favourite touchable specimen*" adds a personal and creative dimension, further engaging children in a multimodal experience.



Figs. 15–16. Robotic models of a T-rex and a Scorpion, Natural History Museum, London

Figs. 17–18. Green screen photo zones, Natural History Museum, London

To elevate the immersive experience and strengthen realism, Natural History Museums employ an integrated use of visual, tactile, and auditory elements throughout their exhibits. A prime example is the earthquake simulation at the London Natural History Museum, where visitors can step into a recreation of a supermarket in Kobe, Japan, during the 1996 earthquake. This exhibit combines visual stimuli, such as the realistic supermarket setting, with the tactile experience of feeling the tremors and the auditory experience of hearing the sounds associated with a natural disaster. This multisensory approach provides visitors with a comprehensive and engaging understanding of the event.

Discussion and conclusions. The move towards multisensory exhibitions aligns with contemporary educational theories that emphasise experiential learning and sensory engagement as crucial for knowledge acquisition and retention. By immersing visitors in sensory-rich environments that replicate real-world phenomena, museums facilitate meaningful connections between visitors and the natural world. This approach promotes active participation, critical thinking, and personal reflection essential for cultivating a more informed and responsible public.

The perspectives of this research are linked to studies on the engagement of children and adults in interactive, personalised experiences, the expansion of new cognitive approaches, and the further development of the participatory museum concept through new multimodal and multisensory exhibitions.

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Отримано редакцією журналу / Received: 07.02.25
Прорецензовано / Revised: 20.02.25
Схвалено до друку / Accepted: 21.02.25

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МУЛЬТИСЕНСОРНІ ЕКСПОЗИЦІЇ В СУЧАСНОМУ МУЗЕЙНОМУ ДИСКУРСІ (НА ПРИКЛАДІ ВИСТАВОК ПРИРОДОЗНАВЧИХ МУЗЕЇВ ЛОНДОНА, ОКСФОРДА, КЕМБРИДЖА)

Стаття висвітлює мультимодальні експозиції у музеях природознавства у Лондоні, Оксфорді та Кембриджі, які позиціонують себе як ефективні платформи для освітніх проектів та наукового діалогу з важливих екологічних питань. Мультисенсорні стратегії узгоджуються з сучасними освітніми теоріями, підкреслюють роль емпіричного навчання, критичного мислення, залучення відвідувачів до інтерактивності з метою набуття персоналізованого когнітивного досвіду. Занурюючи відвідувачів у сенсорно багате середовище, яке відтворює явища реального світу, музеї сприяють утворенню значущих зв'язків з природою, одночасно залучаючи їх до участі у виставковому процесі. Шляхом інтеграції візуальних засобів, інформативних текстів, високоякісних аудіоматеріалів, тактильної модальності, інтерактивних дисплеїв, моделей, інтерактивних технологій, сенсорних інсталяцій, постійні та тимчасові виставки створюють інклюзивне та динамічне навчальне середовище. Тактильна модальність є важливою складовою багатьох інтерактивних виставкових експонатів, пропонуючи відвідувачам більш інформативний, захоплюючий та інтерактивний спосіб пізнання. Поєднання тактильної взаємодії та описових текстів дозволяє глибше зрозуміти природу, фауну та флору, перетворюючи огляд статичних експонатів на динамічний інтерактивний досвід. Сенсорні та мовні директиви, текстові інструкції допомагають відвідувачам у візуальній когнітивній інтерпретації інформації та нового мультисенсорного досвіду. Подальшу взаємодію з експонатами забезпечує багатошарова мультимодальна система дієслів дії з символічними образами. Поєднуючи текстові інструкцій та візуальні образи, виставки пропонують інтерактивний мультисенсорний та мультимодальний досвід, що спрощує когніцію та забезпечує запам'ятовування нової інформації.

Ключові слова: *дискурс, мультимодальний, мультисенсорний, музей, партисипативний музей, тактильний, текстово-зображувальне співвідношення.*

Автор заявляє про ненаявність конфлікту інтересів. Спонсори не брали участі в розробленні дослідження; у зборі, аналізі чи інтерпретації даних; у написанні рукопису; в рішенні про публікацію результатів.

The author declares no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.