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PROCESS OF INSTRUCTION OF ERGONOMIC DEMAND RELATED TO ACCESSIBILITY IN THE CONTEXT OF EMERGENCY EVACUATION IN A MUSEUM

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Abstract

This study aims, in light of the Ergonomic Work Analysis (EWA) method, to describe the process of ergonomic demand instruction underway in a museum located in the city of Natal/RN, Brazil, and to characterize its structure and overall functioning, considering the accessibility of the museum and the possible need for evacuation of occupants in an emergency situation. To this end, a bibliographical survey was initially carried out to identify problems existing in museums, related to disaster risks or disasters, accessibility, informational and physical barriers and evacuation of occupants in an emergency situation. The survey of these problems, as part of the ergonomic demand instruction process, and the study of the structure and overall functioning of the museum resulted in the formulation and presentation to the museum director of a hypothesis of ergonomic demand (provoked demand) that is being discussed and analyzed with him, in order to establish the negotiated ergonomic demand. The social construction developed proved to be an efficient EWA device in the process of instruction of the demand in the museum.

Keywords: Museum; Emergency; Ergonomics; Social Construction; Demand Instruction.

1. INTRODUCTION

Human populations, of the most diverse ages, characteristics, cultures, languages, capacities, limitations, etc., are attracted daily to visits to museums of all kinds in all parts of the world, but most of them lack systems for the prevention and mitigation of accidents or disasters and for preparing the occupying population (employees and visitors) for the safe evacuation of these facilities in emergency situations.

This article aims, in the context of the accessibility of museums for the safe evacuation of users in an emergency situation caused by an accident or disaster, to describe, in the light of the method of Ergonomic Analysis of Work-AET, the process of instruction of the ergonomic

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demand underway in a museum located in the city of Natal/RN, Brazil, and to characterize its structure and global functioning, aiming at the definition of the negotiated ergonomic demand.

Museums are "permanent, non-profit establishments at the service of society and its development, open to the public, which collects, preserves, researches, communicates, and exhibits, for study, education, and entertainment, the material evidence of man and his environment" (ICOM, 2022).

Museums are too important in the representation of a society, since they are spaces that contribute to the cultural formation of the country. Its materials are the result of the action and thought of different social groups and, thus, serve as a bridge between cultures, distinct and distant peoples (ONO; MOREIRA, 2011).

In Natal/RN, where the research that led to this article is being carried out, the Secretariat of Culture (SECULT) is responsible for planning, suggesting and implementing municipal policies to support and encourage culture (SECULT, 2023). Law No. 7,515, of May 16, 2023, provides for the Municipal Culture System of the municipality of Natal, which is integrated into the Municipal Museum System (SMM) of the city of Natal/RN.

In the state of Rio Grande do Norte (RN), Decree No. 4,793, of April 4, 1967, established the State Council of Culture – CEC/RN, linking it to the State Secretariat of Education and Culture. Among other commissions, the CEC/RN is advised by the Historical Heritage Commission. In 2022, Law No. 11,227 was created, which instituted the State Policy for Living Culture in the state of Rio Grande do Norte, with the purpose of

> "to promote the production and dissemination of culture and access to the cultural rights of different groups and collectives, constituting itself as a community-based policy, with the objective of expanding the access of the population of Rio Grande do Norte to the conditions for the exercise of cultural rights" (RIO GRANDE DO NORTE, 2022).

In Brazil, in 2003, the National Museum Policy – PNM was launched (BRASIL, 2003). Later, the Brazilian Museum System (2004), the Museum Statute (Law No. 11,904/2009) and the Brazilian Institute of Museums (IBRAM, 2009) were created.

The *International Council of Museums (ICOM*) (Portuguese) was established in 1946. It is an international, non-profit, non-governmental organization dedicated to developing international policies for museums and supporting the creation and development of museums of all types and themes around the world. ICOM maintains formal relations with UNESCO and is a member of the Economic and Social Council of the United Nations (UN) (ICOM, 2023).

According to Valente (2008, p. 32), "the museum is dynamic and permeable because it allows the inclusion of countless contents organized in different ways and the promotion of the most different integrations with knowledge, institutions and individuals".

Museums also play an important role in inclusion and accessibility. Chacon (2011) states that the museum should be open to the community, without contempt or imposition of ideas, considering social, political, psychological, anthropological and economic aspects. This means that communities must be heard, understood in their complexity and diversity, and welcomed in their differences.

An accessible museum space must extinguish barriers, whether physical, informational or other, in order to promote accessibility both in facilities and in content and service (COHEN; BRASILEIRO, 2012).

Museums are subject to various types of accidents, requiring in addition to the protection of the collection and the objects on display, attention to the protection of human life, especially in a context of rapid abandonment of the place. It is necessary to develop previously prepared and effective emergency plans (ONO; MOREIRA, 2011).

Natural disasters such as floods, storms or earthquakes, as well as human-induced events such as terrorism, vandalism or armed conflicts, lead to the loss of numerous assets and cause significant damage to many people (ROMAO; BERTOLIN, 2021).

The Sendai Framework for Disaster Risk Reduction (DRR) 2015-2030 states that "it is urgent and critical to forecast, plan for and reduce disaster risk in order to more effectively protect people, communities and countries, their livelihoods, health, cultural heritage, socio-economic heritage and ecosystems, thereby strengthening their resilience" (UNISDR, 2015, p. 4).

According to one of the guiding principles of the Sendai Framework for DRR, "disaster risk management aims to protect people and their property, health, livelihoods and production assets, as well as their cultural and environmental heritage, and to promote and protect all human rights, including the right to development" (UNISDR, 2015, p. 13).

The barriers create direct implications during the context of an emergency evacuation of the space by the population, since the place needs to meet the safety conditions for a safe evacuation of the population.

Another important factor concerns people's perception of the risks of accidents/disasters in the museum space, as well as about the emergency response systems in the museums in

which they are located. This perception can be developed or sharpened by conducting simulated evacuation exercises in museums for the occupying population, but it is noted that few Brazilian museums adopt this type of practice with any regularity.

It is expected that, at a later stage of the research to which this article is linked, one or more simulated exercises will be developed and applied for analysis in the museum in question, considering the scenario of the museum's accessibility for the emergency evacuation of occupants in a safe way.

2. DEVELOPMENT

2.1. Method

a) Instruction of the Demand

The AET process begins with the emergence of demand. According to Guérin et al. (2001), the demand may arise from different transmitters and it is necessary for the ergonomics professional to analyze and reformulate the situation in order to characterize a fundamental perspective in the conduction of the course. According to the authors, the instruction of the demand consists of defining "the problems raised in relation to the prescribed/actual distance and the modalities of its management" (GUÉRIN et al., 2001, p. 41).

For Vidal (2003, p. 87), the instruction of the demand "... consists of the passage from the managerial perception of the problem (managerial demand) to the proposal of ergonomic action (ergonomic demand), from which an ergonomic intervention contract can be entered into".

Carvalho and Saldanha (2001) state that the demand can be conceived from the company interested in solving problems, through a manager of an organization, for example, who formulates one or more demands associated with such problem(s) identified and enunciates it to consultants/researchers contacted to answer it(s), with the aim of carrying out an EWS. In this case, it is called "managerial demand". There is also the situation called provoked or induced demand (CARVALHO; SALDANHA, 2001) in which researchers interested in a certain topic of Ergonomics research in a certain field or sector of society, identify potential problem(s) existing therein, formulate hypothesis(s) of demand(s) associated with it(s) and enunciate it to some potential demander or interested party of an organization (director, for

example), in order to understand and solve possible existing problems, in the scope of Ergonomics, in an organization, following an EWS, through its stages.

To formulate the demand caused, a bibliographic survey was initially carried out on the theme in question – *physical and informational accessibility in the context of emergency and evacuation in museums*, through which problems in museums were identified, in general, associating disaster and accessibility/informational and physical barrier, disaster and evacuation of people in emergency situations and evacuation and accessibility/informational and physical barrier. Based on these problems, potential ergonomic demands (hypotheses of demands) were formulated, which have been presented and discussed with the museum manager, in order to establish the negotiated ergonomic demand(s) that will follow up on the AET in the museum.

The databases explored in this research were Scopus and Science Direct, from the CAPES Journal Portal (CAPES, 2023), following the criterion of peer-reviewed articles to ensure the quality of publications.

In the selected journals, the search was performed using Boolean operators "*or*", so that the search result contained, at least, one of the keywords related to this operator, obtaining publications with one or another related keyword, and "*and*", so that the search result contained all the groups of keywords related to this operator, obtaining publications with all the keywords related to the operator " *and*". The use of the "*all*" operator was intended to obtain all the publications of this search. Chart 1 below shows the organization of the keywords that were used.

Table 1 – Keywords used in the databases

Terms and Synonyms				
Accessibility	***Museum***	***Evacuation***	***Disaster Risk***	***Ergonomics***
Museum accessible	*Museum safety*	*Safe evacuation*	*Risk*	*Cognitive*
		Emergency evacuation	*Disaster*	
		Safe evacuation for all	*Risk perception*	
		Museum emergency evacuation		

Source: Authors (2023)

The terms *"ergonomics"* and "*cognitive" were excluded* because they did not return results. Therefore, the search was carried out as follows: *ALL (("museum" OR "museum safety") AND ("safe evacuation" OR "emergency evacuation" OR "museum evacuation" OR "safe evacuation for all" OR "museum emergency evacuation") AND ("risk perception" OR "disaster risk" OR "risk" OR "disaster"))*.

As a result of searching these terms in the databases, 108 documents, including scientific articles, theses, dissertations and books, were found in Scopus and 461 in Science Direct. Duplicate articles, documents that were not scientific articles published in journals, and articles very different from the area of study proposed here were excluded. The abstracts were read and, subsequently, the full texts of the documents found, according to the screening. The search period was not limited, obtaining a final result of 11 scientific articles between the years 2017 and 2022.

The problems listed in Chart 2 below were obtained from the literature search described, from UNDRR documents (2009, 2012, 2013, 2015, 2019, 2023) and from articles and reports in the media. From these problems, an ergonomic demand was formulated (provoked demand), in order to present to the director of the museum in question, prompting the beginning of a discussion and analysis, which has not yet been concluded, in order to negotiate an ergonomic demand, to be answered through an AET.

Chart 2 – Problems and ergonomic demand presented to the director of the museum in question

Issues related to accessibility, accident/disaster risk, and emergency evacuation in museums (Pi)		Provoked or induced ergonomic demand (demand hypothesis or potential demand)
P1	Failure in the emergency system (emergency equipment not installed, lack of training of the team for emergency situations)	Analyze the risks of accidents/disasters, the conditions of physical and informational accessibility of the Museum and the risk perception of the occupying population, in order to prepare it for
P2	Technological disasters (failure of the environmental control system, power outage, fire, chemical spill, structural collapse, collapse of waste collection)	
P3	Accidents (medical emergency in visitor or employee, physical damage to the building or collection)	
P4	Low perception of risk of accidents in the museum (by the fixed and floating user population)	

P5	Failures of the museum's teams, such as improper handling and transportation of the collection, improper operation and maintenance of air conditioning equipment, use of cleaning products in the environment with potential for aggression to the works	evacuation in a possible emergency situation.
P6	Failure in the physical and informational accessibility system (absence of assistive technologies, elevator without information in Braille, inadequate ramps, absence of defined escape route, absence of exit emergency equipment, etc.)	

Source: Authors (2023)

The interactions (conversations) carried out so far, with the direction of the museum of the case study, dealing with the potentially existing problems (because they were obtained from bibliographical, documentary and media research), and the field observation have favored the identification of real/situated problems in the museum, which are identical and distinct from those already identified. This ongoing process, which should be expanded with interactions with employees who deal directly with certain problems and with visitors, will possibly make it possible, in due course, to formulate and define the negotiated ergonomic demand(s).

b) Global Analysis

The global analysis consists of knowing the structure, the global functioning, the population and technical, economic, productive and market problems of the place/organization where the EWS will be held. Thus, the global analysis is appropriate to expand the initial objective, adjust the focuses, and improve the ergonomic demand (VIDAL, 2008).

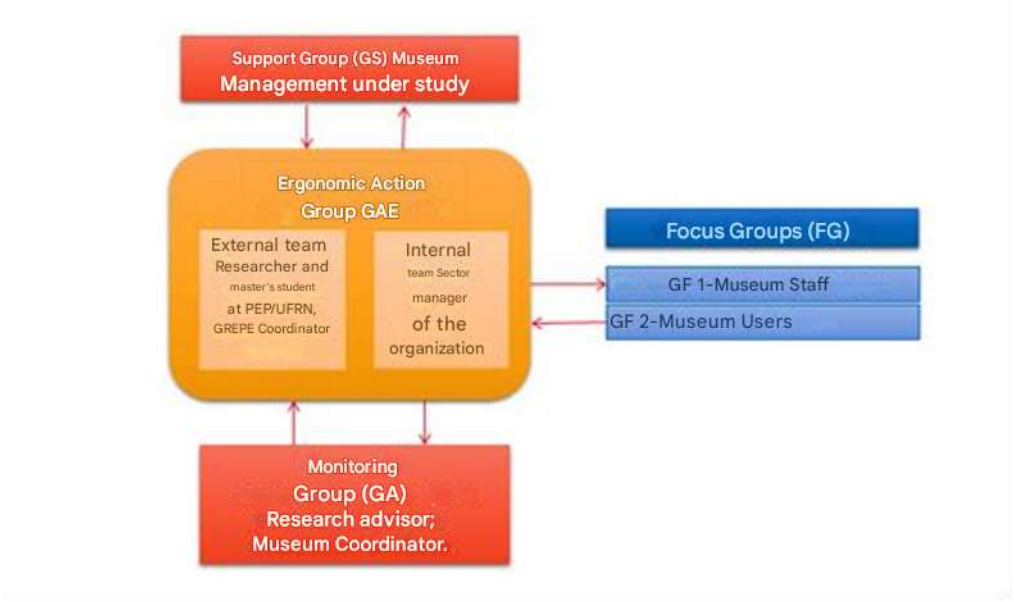
The overall analysis was developed through documentary research, on the *website* and in official documents related to the museum, and through interactions (conversations), for data collection, with the director and employees of the museum.

c) Social Construction

Social construction is a methodological device used in the ELA, which has a dynamic and participatory character, and is progressively adjusted throughout the ELA (VIDAL, 2008). The social construction developed, until the current moment of the research, took place through interactions with the director of the Museum located in the city of Natal/RN. Figure 1, below,

presents the groups planned to compose the process of social construction in all phases of the ELA, which is being carried out in the aforementioned museum.

Figure 1 – Scheme of Social Construction carried out in the museum in question



Source: Authors (2023), adapted from Vidal (2008)

3. RESULTS AND DISCUSSIONS

3.1. Characterization of Museums in Brazil, in the state of Rio Grande do Norte and in the city of Natal/RN

Currently, according to the Museus BR platform (2023), the official website for Museum registrations by the Ministry of Culture, Brazil has 3887 registered museums, 85 in Rio Grande do Norte and 30 in Natal/RN (ANALYTICAL PANEL, 2023).

The public count of the Museums, which indicates the exhibitions with the largest audience, the need to adapt the services offered, the need to expand the educational action, takes place in Brazil through the Annual Visitation Form (FVA). The last form released, in 2020, shows a total visitation of 7,010,196 people in museums in Brazil. A total of 1118 museums provided answers considered valid, with 91% of this value being museums that counted an audience and 09% did not count a visiting public (FVA, 2020).

In Rio Grande do Norte, 11 museums filled out the FVA in 2020, and it is not possible to identify whether the museums in Natal are included in this published number.

It is believed that the low participation of Rio Grande do Norte is related to the pandemic period.

It is the responsibility of the Department of Dissemination, Promotion and Economy of Museums – DDFEM to "subsidize, stimulate, support and develop lines of action and studies on the economy of museums and their interfaces with the cultural industry" in Brazil (DDFEM/IBRAM/MINISTRY OF TOURISM, 2023).

Currently, the financing of projects in the museum sector is supported by the Special Secretariat of Culture and the Brazilian Institute of Museums with resources from the General Budget of the Union (OGU). In 2020, the budget made available for Culture was R$ 1.94 billion — a decrease of 41.8% compared to 2011 (IBRAM, 2020).

The State Program for Cultural Incentive, called Câmara Cascudo Law - Law No. 7,799, was created on December 30, 1999, with the aim of encouraging cultural development in RN using the tax waiver from the Tax on Circulation of Goods and Services (ICMS) (RIO GRANDE DO NORTE, 1999).

In its time of existence, the program has already made available more than R$ 72 million in resources, and more than 444 projects have already benefited, 90% of them in the state capital (RIO GRANDE DO NORTE, 1999).

In Natal/RN, Law No. 4,838, of July 9, 1997, institutes the Djalma Maranhão Project of tax incentives for the realization of cultural projects in the municipality and among the cultural facilities covered by the law, the Collections and historical-cultural heritage and Museums, cultural centers and libraries stand out (NATAL, 1997).

Just as the State Foundation of Culture – FEC allocates resources to the state's cultural production, in Natal, the President of the Capitania das Artes Cultural Foundation – FUNCARTE, in the use of his legal attributions, made public, in 2018, the notice CULTURAL INCENTIVE FUND – FIC with the purpose of selecting and allocating resources to cultural projects (SECULT/FUNCARTE, 2023).

In 2018, the FIC, in support of tangible and intangible heritage, allocated the amount of R$ 100,000.00 (one hundred thousand reais) to the contemplated projects, in programming for museums managed by the Municipality, programming and activities in parks and places of memory (various themes and Christmas in World War II), actions for tradition groups and restorations in monuments (SECULT/FUNCARTE, 2023).

3.2. Characterization of the Museum under study

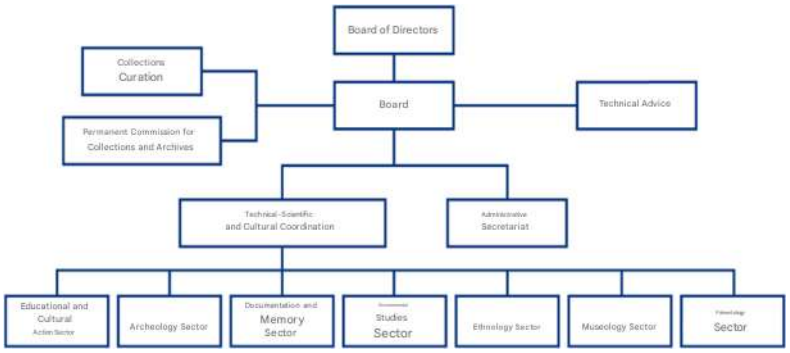
The museum object of this study began its history in Natal/RN in 1960 as a space for the production of scientific knowledge in the state and, in 1973, established its current name as a form of tribute to the first director (UFRN/MCC, 2023).

Since the museum was built in two stages, a large pavilion of 1,668 m² was inaugurated in 1969 and, in 1971, other pavilions were inaugurated behind the first one, to house technical reserves, laboratories, classrooms, administrative spaces, and accommodation for researchers (UFRN/MCC, 2023).

In early 2010, due to a major renovation in the Exhibition Pavilion, the main entrance was moved to the side of the building, completely modifying the appearance of the original façade, as well as changes were initiated in the internal spaces (UFRN/MCC, 2023).

Currently, the museum has the following organizational chart (Figure 2):

Figure 2 – Organizational chart of the museum object of the study



Source: UFRN/MCC (2023)

The museum's accessibility system for users is under development. The museum does not have assistive technologies or information in Braille or sign language interpreter, but it does have access ramps, an elevator for wheelchair users, 02 accessible bathrooms and 01 wheelchair for the respective users.

The emergency system is being improved, has an emergency and evacuation plan in preparation and safety items (such as hydrants for fire fighting) are being installed in the museum space, which has, in operation, fire extinguishers, emergency exit and some signs that can still be improved.

The Exhibition Pavilion is open every month of the year, for public visitation, from Tuesday to Saturday. The current opening hours are from 8:30 am to 12:00 pm and from 1:00 pm to 4:00 pm. Admission is free (UFRN/MCC, 2023).

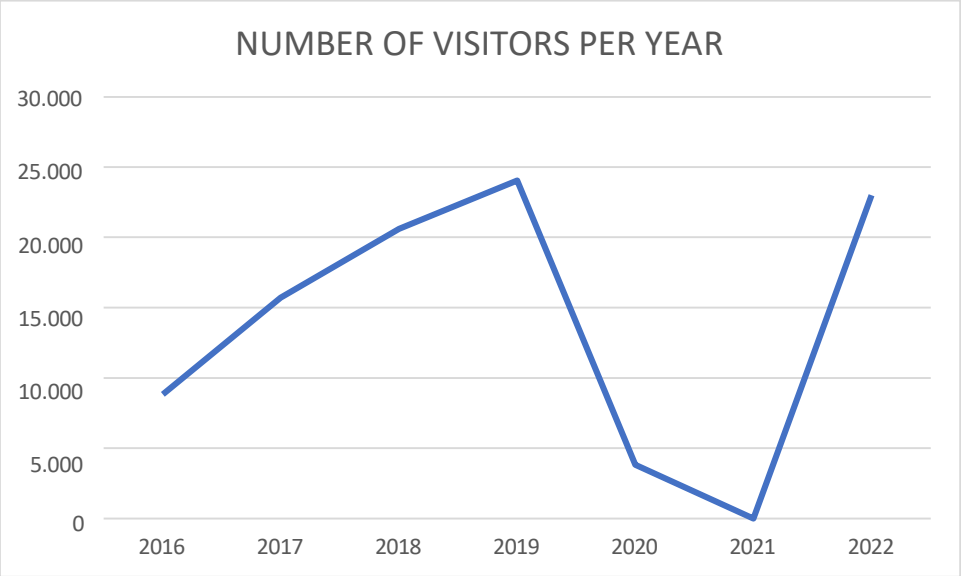
For single visitation, no appointment is required, but visits in school groups need to be scheduled with the Educational Sector. Groups must have a minimum of 10 and a maximum of 40 people per time. The mediated visits last up to 1h30min, from Tuesday to Friday, and take place at 8:30 am, 10:30 am, 1:00 pm and 3:00 pm. The museum does not have a sign language interpreter (Libras) for people with hearing impairment and does not have an audio description service for people with visual impairment (UFRN/MCC, 2023).

The last record of the number of visitors was released in 2022 on the museum's official website (UFRN/MCC, 2023) with a total of 22,989 people in the 12 months of 2022, considered a significant number since the museum remained closed throughout the pandemic period. In 2019, before the pandemic, the museum received 24,050 people in the 12 months of the year (UFRN/MCC, 2023).

In 2022, daily visitation records were broken at the two largest annual events held by the museum: Museum Week (823 visitors on May 21) and Museum Spring (1046 visitors on September 24) (UFRN/MCC, 2023).

Figure 3 below shows the number of people who visited the museum, per year, between 2016 and 2022.

Figure 3 – Number of visitors per year to the museum under study, from 2016 to 2022



Source: UFRN/MCC (2023)

It is possible to observe a significant increase in the number of annual visits from the year 2017. In 2020, in the first 03 months before the closure of activities due to the COVID-19 pandemic, 2,316 visitors were registered in January, 987 in February and 523 until mid-March,

according to the annual management report available on the museum's official website (UFRN/MCC, 2023). Generally, the months with the most visits are January and February due to school holidays and the presence of tourists in the city.

The Museum has 27 workers, 12 of whom are permanent staff members of the Museum and 15 are outsourced. Of this workforce, 03 are teachers, 05 are outsourced employees and 19 are administrative technicians, 15 are female and 12 are male. The working day is 40 hours per week for administrative technicians and teachers and 44 hours per week for outsourced workers (UFRN/MCC, 2023).

4. CONCLUSION

This article aimed to describe the process of instruction of the ergonomic demand underway in a museum located in the city of Natal/RN, Brazil, and to characterize its structure and global functioning, considering the accessibility of the museum and the possible need for evacuation of occupants in emergency situations.

The applied social construction process, which is a device used to promote the participation of stakeholders in an EWS, proved to be efficient during the current stage of the stages of global analysis of the museum and instruction of the demand carried out.

The presentation, to the museum director and staff, of the potential problems related to the triad *accessibility – emergency situation – evacuation of occupants* in museums, the demand provoked and the global analysis related to the museum of the case study – fruits of bibliographical, documentary and media research –, provided a discussion around potential demands (hypotheses of demands), which is evolving into the formulation and definition of the corresponding negotiated ergonomic demand.

It is expected that, after the negotiation of the ergonomic demand, with the museum's stakeholders, the localized analyses of the visitations will be initiated (provided by on-site observations, interactions with the user population and application of a simulated exercise for analysis). It is intended, with this, to establish an ergonomic diagnosis of the analyzed situations and the indications for improvement of the respective situations, aiming at the prevention and mitigation of accidents/disasters in museums and the preparation of the user or occupant population for possible emergency evacuations of museums in a safe way, thus minimizing the potential number of victims with or without deaths.

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