

Exhibitions about Human Communication in interactive science museums

Exposições sobre Comunicação Humana em museus interativos de ciências

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ABSTRACT

Purpose: To investigate the existence of exhibitions and displays on topics related to Human Communication in national and international interactive science museums, and analyze the content to determine what are the issues related to Speech-Language Pathology and Audiology discussed in the museums. **Methods:** Website analysis of 40 international science and/or technology museums and 20 national museums to identify exhibitions or displays related to the theme “Human Communication”. **Results:** Most of the researched museums have exhibitions or displays related to Human Communication. Among the national museums only four have an entire exhibition related to the topic, and among the international museums, thirteen exhibitions were found. The number of international exhibitions is greater than the number identified in national museums, and the quality of the material also varies. The primarily discussed topic in museums is acoustics, followed by message reception by hearing sense. Most museums do not approach the topics of message production, language, and voice anatomy and physiology. **Conclusion:** Science museums address basic sciences and, for this reason, acoustics is much explored. Many exhibits were found on topics related to Human Communication that allow individuals to learn about how the human body works, arousing curiosity about the subject. Because museums are institutions of science communication and informal education that contribute to the population’s scientific literacy, Speech-Language Pathology and Audiology can take advantage of these spaces to disseminate research and knowledge about Human Communication.

Keywords: Scientific exhibitions; Museums; Health education; Health promotion; Communication; Hearing; Voice; Speech; Language

INTRODUCTION

Although science museums have existed for over 300 years, those that embody the concepts of dynamism and interactivity arose only around the 1960s, mainly in the United States. Inaugurated in 1969, San Francisco’s Exploratorium Museum soon proved to have more educational value and social impact than expected⁽¹⁾. Since then, a new generation of science and technology museums have emerged. These are known as “science centres”. Presently, these centres are recognized as crucial support to the formal system of education offered by

schools⁽²⁾. In Brazil, the first interactive science and technology museums appeared during the 1980s⁽³⁾.

Science and technology museums are considered by several authors⁽²⁻⁸⁾ to be non-formal educational environments that complement the formal scholastic learning of children and the general public, and they aim to encourage the public to seek scientific knowledge. In regard to the educational role of museums, it is important to emphasize that education is understood as “a continuous and uninterrupted process that builds the individual for its role in society and also constitutes a socialization process”⁽⁴⁾.

The museum environment enables people to learn using several mediums and can provide means for visitors to interact with the object of study. This way, in an interactive museum environment, the individual is no longer a passive spectator and takes on an active role, being able to manipulate the different installations, interact with the available material and take charge in actions and discoveries^(8,9). In interactive museums “the public experiments science in a direct, lively and playful manner”⁽³⁾.

Interactivity is understood as a process that enables and encourages phenomena experimentation and participation in the obtainment of information, with the goal of expanding

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personal knowledge. In this sense, experimentation justifies the existence of interactive museums⁽³⁾. The museum must permit, for this reason, the visitors' interaction with objects, phenomenon and equipment to motivate them to learn, stimulate curiosity on a particular topic, and therefore, enable new information and contribute to their scientific culture⁽⁵⁾.

Museums aspire to create or change understandings about science^(8,10-12) and the exhibitions are cultural products with a rich educational potential. In these environments, there are some approaches to health education^(9,10,13). A research⁽¹⁰⁾ conducted at Rio de Janeiro's *Museu da Vida* (Museum of Life) has indicated that visits have contributed to "establish relations among the main topics discussed at the Museum (history, science, technology, environment and health), extending young people's comprehension of health".

Some interactive museums around the world contemplate a subject that is a part of Speech, Language and Hearing Science: Human Communication^(14,15). The *Cité des Sciences et de l'industrie – La Villette* in Paris, for example, has a large permanent exhibition called "Communication – Sounds". It comprehends sound production and reception, synthesized speech, animal communication mechanisms, linguistic similarities between adult speech and the babbling of a child exposed to the same language, phonemic sound production in human speech, among other related topics.

Considering that museums cover subjects that are of knowledge to the speech therapist, this professional is able to collaborate in developing interactive exhibits, making greater understanding of human communication more available to the public^(14,15). In addition, the speech therapist can also make use of museums to contribute to the cultural and scientific literacy process of their patients suggesting that they visit the city's museums and participate in cultural activities.

Preventive care and health promotion are both part of speech therapy work. The Code of Professional Ethics determines that the Speech-Language Pathology and Audiology professional must participate in prevention care or health promotion campaigns whenever possible⁽¹⁶⁾. In this manner, actions related to "Human Communication" are extremely important seeing that communication allows individuals to become agents for transforming society and their own reality⁽¹⁷⁾.

With primary care and speech rehabilitation, professionals should be aware of not only the pathology being treated, but also of meta-personal factors (such as cultural and social conditions and access to health and leisure services) and personal factors (including linguistic and social characteristics and also lifestyle and health habits) that determine quality of life⁽¹⁸⁾. In this context, the speech therapist can advise and encourage their patients to participate in cultural and educational activities.

The goals of this research were to investigate the existence of exhibitions or displays on topics related to Human Communication in national and international museums and analyze this information with the purpose of identifying the subjects related to Speech-Language Pathology and Audiology that are discussed in museums.

METHODS

The methodology of this research involved website analysis of 40 international museums and 20 national museums, all of science and/or technology and all of which were mentioned in the 25 museology scientific articles that this research's proposal was based on.

These scientific articles were compiled from databases (SciELO Brazil, Springer Link, Interscience Wiley and ScienceDirect) crossing the following keywords: museum(s) AND science, exhibitions AND interactive, "interactive science museum", and "interactive science center". The search resulted in 104 articles, being that 46 of them were not related to museums, 12 were duplicates, and three were in other languages. The 43 remaining articles were in relation to museums. However, 18 texts were excluded considering they were regarding art or natural history museums or the full texts were not accessible. Of the 25 articles analyzed for the theoretical basis of this research, 14 were theoretical dissertations, eight were user-centered field surveys and three were museum experience reports.

In each of these articles, museums and/or science centers that were mentioned or indicated as research venues were selected.

This survey detected a small amount of national museums. Therefore, a few selected museums were added to this group: those of which the representatives presented projects or lectures in two events that occurred in Brazil during the year 2008 – the South American Museum and Science Center Mediation Workshop held in Rio de Janeiro and the 5th International Conference Hands-On Science that took place in Recife.

After selecting the museums, the respective websites were analyzed via Internet during the year of 2009. For each institution a table was created with the following data: name, location, URL, title of identified exhibition, title of related displays, description of the material encountered and the primarily discussed topic.

For this research project, "exhibition" was considered as the area of the museum containing educational objects of the same subject and "display" was considered as an individual museum object. In this sense, an exhibition is composed by more than one display and a display is an object created to provide information or experiments with which the visitor interacts.

In regard to the displays related to Human Communication, the following was found: objects built with anatomical models, static or interactive posters, computer software, equipment with informative films, musical instruments, installations, among others. The material used in each display can vary greatly, for example: a display of the Listen exhibition at the Exploratorium Museum consists of a passageway with stones on the ground and very sensitive microphones which capture the intensity of the sound produced when the visitor walks over the stones.

In this manner, exhibitions on Human Communication and displays arranged in different areas of the museums were analyzed. The aspects considered for this assessment were anatomical, physiological and physical features of hearing

and phonation as well as broader aspects of natural languages, media, and communicative ability.

The denomination “Human Communication” is understood as the broad process that involves the following elements: message sender or decoder, the message, the receiver that interprets the message, the medium or channel or chain of channels that induce the message transmission, feedback – the element that ensures the monitoring of the message and noise (error, interference or obstruction of the process). Communication through language stimulates the interaction between individuals and is associated with hearing, body expression and oral expressiveness which includes speech, voice, diction, respiration, and the linguistic-discursive elements⁽¹⁹⁻²¹⁾.

Taking all this under consideration, the selected exhibitions and displays were classified and divided into four main categories: acoustics, auditory system, Human Communication in general and/or language and voice and/or speech. Some were added to more than one category, seeing that many exhibitions and displays address more than one subject, for example acoustics and auditory system.

In view of the tables created for each institution, the data was quantitatively and qualitatively analyzed resulting in a description of the exhibitions and displays regarding Human Communication that currently exist in the investigated science museums.

Finally, a table was created with the “Key Information about the researched National Science Museums” using the data collected on the 20 Brazilian museums that were analyzed.

Nine national museums had websites that were either outdated or showed very little information on their exhibitions. In these cases, an e-mail was sent inquiring if the Museum had an exhibition or display in relation to Human Communication and requesting further information about the matter. Only three museums failed to return the message.

RESULTS

In relation to the 20 national museums, seven (35%) are located in the state of Rio de Janeiro, six (30%) in the state of São Paulo, two (10%) in Minas Gerais, one in Ceará, one in Alagoas, one in Pernambuco, one in Bahia and one in Rio Grande do Sul. Among the 40 international museums, 14 (35%) are in the United States, four (10%) in the United Kingdom, four in Australia, four in Canada, three (7.5%) in France, and one (2.5%) in each of the following countries: Germany, Chile, Colombia, Spain, Holland, Israel, Italy, Malaysia, Mexico, New Zealand, and Uruguay.

Amid the 20 researched national museums, 16 (80%) have exhibitions or displays regarding the topic Human Communication, and among the 40 international museums, 26 (65%) explore this topic as well. Out of the 16 national museums, merely four have an entire exhibition concerning Human Communication. The other Brazilian museums have one or more displays on this subject. In regard to the international institutions, six museums have related exhibitions and 13 hold only a few related displays. The remaining seven international museums contain relevant displays in different exhibitions, in addition to a specific Human Communication related exhibition.

The analysis of all these museums demonstrates that the top reoccurring subject in the displays is “acoustics” and secondly “auditory system”. Most displays are related to sound physics and/or to hearing anatomy and physiology. The museums contemplate the physics involved in communication or the message reception through hearing, but do not cover, for example, message production, language, and voice anatomy and physiology (Chart 1).

Chart 1. Frequency of topic approach

Main topics:	National museums	International museums
Acoustics	9	20
Hearing	6	12
Human communication in general and/or language	2	4
Voice and/or speech	4	2

Note: Some exhibitions presented more than two topics.

The main information on the researched National Science Museums are provided in Appendix 1.

DISCUSSION

In general, the amount of displays found in international museums was greater than the number found in national ones, and the quality of the displayed material also diverged. Some Brazilian museums (four among those that were studied) showed only one display related to acoustics - the sound mirrors (or dishes) - into which one visitor speaks at the center of a dish structure and another individual located meters away can hear the announcer. Other museums offer printed explanatory posters or anatomical models that are to be read and viewed, but do not provide interactivity. To the contrary, in foreign museums there were large exhibitions with over 25 displays, advanced technological resources and manipulable objects that enable interactivity.

Different authors⁽²²⁾ have analyzed the main topics presented in the *Palais de la Découverte* (Paris) and in the Exploratorium. Their conclusion was that Physics was the most discussed subject and, more than any other, has great potential in interactive museums since it enables elaboration of demonstrations and displays with which the visitor can handle experiments.

An exhibition worthy of special mention is Listen at the Exploratorium, composed of 48 displays. It’s creation was based on stories told by four people who are “experienced listeners” and consider the sense of hearing very important: a cochlear implant user, a mechanic who identifies problems according to the car’s noise, a person who monitors wildlife and a blind man who interprets the sounds around him to locate himself and get around his city. It’s displays consider hearing anatomy and physiology, auditory skills, sound transmission and music and they provide different sound sources for the visitor to create new sounds and recognize, in different ways, the existing ones in the museum.

Another outstanding exhibit is “Communication – Sounds”

at the *Cité des Sciences et de l'Industrie – La Villette* in Paris (France). It's 33 displays were based on current research involving different Human Communication related professionals, including speech therapists. One of the displays compares the babbling of babies of different nationalities with the linguistic traits of the language spoken by their mothers. Another display shows a graphic representation of the tongue's position during the articulation of vowels and allows the visitor to modify the tongue's articulatory position in relation to the oral cavity and listen to the sound that would be produced.

Other relevant displays that were found addressed subjects such as: hearing aids, cochlear implants, noise level capable of causing damage to the ciliated cells, vocal production (with the use of laryngoscopy videos), synthesized speech, soundproofing (with which the visitor can test what material is best for soundproofing), among others.

Some peculiarities were brought to attention while comparing Brazilian and foreign museums. In regard to the researched Brazilian museums, it was found that many (45%) do not have online information on their displays and, in some cases, it was necessary to contact the museums via email to obtain further information. Contrarily, the information encountered on the international museums' websites was more complete and detailed. The amount of described exhibitions and displays was abundant and these institutions usually detail their exhibitions and even make online material available for visitors to access from home. However, the visit in person to some of the selected international museums indicated that not all displays are referred to on their websites⁽¹⁵⁾.

CONCLUSION

Essentially, interactive science museums cover the basic sciences and, for this reason, acoustics and physics involved in hearing are well discussed. Nonetheless, several interesting displays were found that discuss relevant Human Communication topics and allow visitors to interact with objects in order to engage them in the learning process and make them protagonists of their discoveries. The displays enable individuals to understand the workings of the human body and stimulate curiosity towards hearing sense, sound transmission and communication.

Museums are institutions of scientific divulgation and non-formal education, and also collaborate to introduce the population to science. For this reason, these environments can be employed by Speech-Language Pathology and Audiology to impart its research and knowledge of Human Communication. Furthermore, it is well known that museums can contribute to health education because they provide a favorable environment for sharing information that can help understand science and health matters. This facilitates learning and, therefore, science museums can be of good use to health promotion actions.

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RESUMO

Objetivos: Investigar a existência de exposições ou exibições sobre temas relacionados à Comunicação Humana em museus interativos de ciências nacionais e internacionais e analisar o conteúdo para verificar quais são os assuntos, relacionados à área de Fonoaudiologia, abordados nos museus. **Métodos:** Análise dos sites de 40 museus de ciência e/ou tecnologia internacionais e 20 nacionais para identificação de exposições ou exibições relacionadas ao tema “Comunicação Humana”. **Resultados:** A maioria dos museus pesquisados possui exposições ou exibições relacionadas ao tema Comunicação Humana. Dentre os nacionais apenas quatro possuem uma exposição inteira relacionada ao tema e dentre os internacionais treze possuem exposições inteiras. A quantidade de exibições internacionais é maior que a encontrada nos nacionais, e a qualidade do material também diverge. A maioria dos museus trata da acústica e em segundo lugar da recepção da mensagem pela audição e fala menos sobre produção da mensagem, linguagem, e anatomia e fisiologia da voz. **Conclusão:** Os museus de ciência abordam as ciências básicas e por esse motivo a acústica é muito explorada. Foram encontradas muitas exibições sobre temas relacionadas à Comunicação Humana que possibilitam aos indivíduos conhecer o funcionamento do corpo humano, despertando a curiosidade em relação ao tema abordado. Como os museus são instituições de divulgação científica e educação informal que colaboram para a alfabetização científica da população a Fonoaudiologia pode aproveitar seus espaços para divulgação de suas pesquisas e de seu conhecimento sobre a Comunicação Humana.

Descritores: Exposições científicas; Museus; Educação em saúde; Promoção da saúde; Comunicação; Audição; Voz; Fala; Linguagem

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Appendix 1. Main information on the researched national science museums

Name of museum/ City (State)	Webpage	Is there a related exhibition? If not, is there a display?	If there is an exhibition or display, what is the main subject?	Further information
<i>Casa da Ciência da UFRJ</i> Rio de Janeiro (RJ)	http://www.casadaciencia.ufrj.br/	Exhibition: "Anatomy of Passions: the creation of sound"	Auditory system	It's a staged area that creates the atmosphere of a concert and features the band "The Temporals" (<i>Os Temporais</i>). The musicians are human figures made from wire, in real size, connected to anatomical structures, that "play" different instruments. The figures and anatomical parts that constitute the auditory system were developed by artists and anatomists.
<i>Casa da Descoberta da UFF</i> Niterói (RJ)	http://www.uff.br/casadadescoberta/	Display with sound mirrors	Acoustics	Sound mirrors or sound dishes*
<i>Catavento</i> São Paulo (SP)	http://www.cataventocultural.org.br/	Displays: (no name)	Voice and/or speech, Auditory system and Acoustics	Inside "Virtual Man" (<i>Homem Virtual</i>) there's a poster on voice and another on hearing, both next to a model of ear structures. In "Machine" (<i>Engenho</i>), there are displays on sound and propagation of sound waves (including sound dishes*).
<i>Centro Cultural da Saúde</i> Rio de Janeiro (RJ)	http://www.ccs.saude.gov.br/	None	~~	~~
<i>Centro de Divulgação Científica e Cultural/ USP</i> São Carlos (SP)	http://www.cdcc.usp.br/	Exhibition: "Perception of Sound"	Acoustics	The exhibition is in the "Garden of Perceptions" and it's about sound waves. There are pipes that make sounds, an echo tube and sound mirrors*.

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<i>Espaço Ciência</i> Recife (PE)	http://www.espacociencia.pe.gov.br/	Displays: (no name)	Acoustics and Human Communication in general and/or language	Displays that discuss wave propagation (including a cordless phone and sound dishes*). There was a wall painted with the digital alphabet and another with a text written in scrambled letters to show that, despite the letters not being in the right order, it's possible to read the text and understand the message.
<i>Espaço Ciência Viva da UFRJ</i> Rio de Janeiro (RJ)	http://www.cienciaviva.org.br/	Displays: (no name)	Acoustics and Auditory System	It has musical instruments made from PVC (pipes that make sound), a wired telephone (transmission of sound waves within closed tubes) and a wireless phone (sound dishes*). The museum also conducts activities for preschoolers about animals sounds: children receive a certain material and learn how to sound like a chicken or a cricket, for example. In addition to this activity, there's a simple electrical circuit game for the visitor to associate the picture of an animal with the sound that it makes; with a correct association, an indicating light turns on.
<i>Espaço UFF de Ciência</i> Rio de Janeiro (RJ)	http://www.uff.br/espacouffciencias/	None	~~	~~
<i>Estação Ciência da USP</i> São Paulo (SP)	http://www.esciencia.usp.br/	Displays: Audio-kinetic sculpture and Sound Pipes.	Acoustics	Audio-kinetic sculpture: like a roller coaster, the balls are lifted and dropped at a certain height. The kinetic energy, due to the speed the ball reaches, discharges sounds and interesting visual effects. The sculpture is unique in Brazil in its size and variety of effects, this installation mesmerizes people at the entrance of the <i>Estação Ciência</i> museum. Over two meters high and three meters wide, this sculpture contains several elements (bells, cymbals, pipes, seesaws, springs, pendulums and balls, among others), and uses the generation of electrical energy to move the balls of the sculpture, consequently producing various sounds. Like on a roller coaster, this single source of energy is used to elevate the balls, from which point everything else moves due to gravity. Sound Pipes: 11 PVC tubes alongside each other in order of length, like strings of a harp. When the bottom opening of the tube is beat with a rubber plate, it delivers its distinctive sound.
<i>Museu da Vida/ Fiocruz</i> Rio de Janeiro (RJ)	http://www.museudavida.fiocruz.br/	Displays: (no name)	Acoustics, Auditory system, Human Communication in general and/or language, and Voice and/or speech	There are posters on hearing and vestibular system in the exhibition "Senses of Life". Inside the "Science Park" there are giant anatomical models (anatomy and physiology of hearing and phonation), a display on sound waves (with sound dishes* and musical pipes) and a section called "Garden of Codes" that approaches number and writing systems from different civilizations and also addresses Brazilian Sign Language (<i>LIBRAS</i>).
<i>Museu de Astronomia e Ciências Afins</i> Rio de Janeiro (RJ)	http://www.mast.br/	Displays: (no name - they're communication instruments)	Acoustics	It's a collection of 25 objects, including telephones and telegraphs, used in the rooms of the main building, in the Time room and for the Observatory's Telegraphy Service.

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<i>Museu de Ciência e Tecnologia/PUC-RS</i> Porto Alegre (RS)	http://www.pucrs.br/mct/	Exhibition: (no name) Display: (no name)	Acoustics and Voice and/or speech	The acoustics exhibition is composed by 35 interactive equipments that fill the area of the museum that shows patterns and laws of sound propagation. The display on articulatory production of vowels has a set of “five heads”, each with their own trachea. A bellows, when compressed, forces the air through the acrylic “mouths” (each head has a mouth with a different shape), to produce sounds practically identical to those made by a human being saying the vowels A-E-I-O-U.
<i>Museu de Ciência e Tecnologia da UNEB</i> Salvador (BA)	http://www.museu.uneb.br/	Display: (no name)	Auditory system	Anatomical model of the ear.
<i>Museu de Ciências Morfológicas da UFMG</i> Belo Horizonte (MG)	Não tem site oficial. O com todos os museus da UFMG é: http://www.observatorio.ufmg.br/redemuseus.htm	Displays: (no name)	Auditory system and Voice and/or speech	Anatomical structures of the ear and larynx.
<i>Museu Dinâmico de Ciências de Campinas/Unicamp</i> Campinas (SP)	http://www.abcmc.org.br/mdcc/	None	~~	~~
<i>Parque da Ciência de Viçosa</i> Viçosa (MG)	http://www.parquedaciencia.com.br/index.htm	Display: “cochichódromo”	Acoustics	Sound mirrors or sound dishes*.
<i>Parque Cientec - USP</i> São Paulo (SP)	http://www.parquecientec.usp.br/	None	~~	~~
<i>Sabina Escola Parque do Conhecimento</i> Santo André (SP)	http://www.santoandre.sp.gov.br/bn_conteudo.asp?cod=6974	Exhibitions: Communication Laboratory and Musical Installations. Displays: (no name)	Acoustics, Auditory system and Voice and/or speech	In the Art and Communication area, is the “Communication Laboratory” and the “Musical Installations” exhibition. In the Physical and Technological Sciences area, there are acoustics experiments. In the Life Sciences area, there’s a space called Virtual Human Being with displays on voice and hearing, using images from the “Virtual Man” (<i>Homem Virtual</i>).
<i>Seara da Ciência</i> Fortaleza (CE)	http://www.seara.ufc.br/	Display: Sound Mirrors	Acoustics	Sound mirrors or sound dishes*
<i>Usina Ciência</i> Macéio (AL)	http://www.usinaciencia.ufal.br/	Display: Acoustic Shells	Acoustics	Sound mirrors or sound dishes*

*Sound mirrors or sound dishes: two satellite dishes in front of each other at a distance of about 25 meters that allow two people to talk at a distance. When speaking into the center of the dish, the visitor’s voice is reflected by it and directed to the other dish, where the other visitor is placing his ear to the center.

Note: the information contained in the table was obtained on official websites of museums and enriched with information received via e-mail.