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Science Museums and the Popularization of Science in Brazil

Les musées des sciences et la popularisation de la science au Brésil

Museos de ciencias y la popularización de la ciencia en Brasil

Museus de Ciência e a popularização do conhecimento no Brasil

Cecilia C.B. Cavalcanti and Pedro Muanis Persechini

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Science Museums and the Popularization of Science in Brazil

Cecilia C. B. Cavalcanti[1], and Pedro Muanis Persechini[2]

[1] Doctor in Communication and Culture from the School of Communication Studies–Federal University of Rio de Janeiro (UFRJ) and contributor to the Espaço Ciência Vida.
[2] Professor of Biophysics and Physiology, Carlos Chagas Filho Institute of Biophysics–Federal University of Rio de Janeiro (UFRJ), Instituto Nacional para Pesquisa Translacional em Saúde e Ambiente na Região Amazônica, Conselho Nacional de Desenvolvimento Científico e Tecnológico/ MCT (INPeTAm/CNPq/ MCT), member and co-founder of Espaço Ciência Vida.

Abstract. We analyzed the role and importance of the popularization of science in science museums, and its perspectives in Brazil, from the experience we have developed over the years in the *Espaço Ciência Viva*[1]; and our participation, observations and studies related to the popularization of science in other science museums and science centers in Brazil and abroad. From an analysis of the historical environment that started in the early 1980's, to a new era of popularization of science in Brazil and abroad, we briefly evaluate its current state in Brazil and make some considerations on popularization of science, which we need to support for the future economic and social development of our country.

Keywords. Education, Museums, Science, Brazil, Policy, Economic Development, Cultural history.

1 Introduction

"Every artist must go where the people are…"
(*Nos Bailes da Vida*,
from Milton Nascimento and Fernando Brant).

What is there in common between the two children in the photos presented in Figure 1? They are the most convincing representation of what psychology teaches us and that is usually propelled as one of the main motivations for the initiatives of popularization of science: the innate curiosity of human beings, which is the main power behind science. Being a common trait of every human being, but pushed away from the common citizen, science must now be demystified; it is not something that can only be understood by a few enlightened, but something that can be accessed by everyone. To be understood would be enough to associate it with our daily lives.

We do not say this possessed by a romantic vision, preaching that everyone can know everything and that science must be everyone's activity. First of all, if the volume of knowledge accumulated in every field of human knowledge is dominated by the cleverest specialists, and there are many fields to be understood, what can the common citizen, especially those outside the fields of scientific research and education, understand? Nevertheless, in the information society, everyone can understand how the scientific method functions and see science as a human activity, and as such, tangible.

Everyone can rediscover and let natural curiosity unveil, dare to ask questions, dare to look for answers, dare to answer and analyze the answers; feel the pleasure of discovery and thereby, find out how things are discovered, and being a little bit more scientific, have a better understanding of the scientific process. It is from this understanding that everyone can take possession of scientific knowledge as a cultural good–have a better understanding of the relationship between science and society, and know how a new finding will be able to influence his life, environment, planet and then participate in the scientific development process as leading actors of this process and no longer in a supporting role or as passive subjects of scientific development.

Curiosity persists in various conditions and here it is noticeable both in a middle class child that visits the science museum *Espaço Ciência Viva* in Rio de Janeiro with her school, or the child who lives on the street and who, hopeless, finds some consolation in moments of introspection where time stops and the uncertain future seems not to matter.

[1] "Espaco Ciência Vida" or "Life Science Space" is the hands-on Science Museum located in Rio de Janeiro, RJ, Brazil (www.cienciaviva.org.br) which pioneered the new era of Popularization of Science in Brazil during the early 1980´s.

Correspondence to: Cecilia C. B. Cavalcanti
ceciliacbc@gmail.com

Figure 1. Curiosity is innate of human beings.
(A) Child from the street of Rio light up a match using old glasses. Neighborhood of Gloria, Rio de Janeiro, alien to the events of the 4th "*Semana Nacional de Ciência e Tecnologia*[2]" (October 2007).
(B) Child finds microscopic life in the event "*Meio ambiente com saúde*"[3] (may/2010). This event is part of the series "*Sábados da Ciência*[4]" which takes place on the last Saturday of every month in the *Espaço Ciência Viva*.

This is the experience that we, who act in the dissemination of science, live on a daily basis, through the science museums and on the streets, and which is often abolished by the schools and extinguished in adults.

The first photo was taken during a walk by one of the authors through the streets of Rio, towards one of the most crowded squares of the city, during the activities of the *4ª Semana Nacional de Ciência e Tecnologia*,[5] an event created in 2004, similar to what has been done in various countries, which is one of the most recent of a series of initiatives that in the last 200 years and, particularly in the last 40 years, have been increasing the popularization of science in Brazil.

Today, popularization of science appears on the agenda of some of the main official financial institutions, in the progress reports of the scientific activities and in the agendas of different media organizations. Science museums are growing in number and diversity. Scientists, educators, curators, journalists and other professionals have become increasingly dedicated to popularization of science.

Here, we want to consider the meaning of actions for popularization of science in science museums, particularly those developing in Brazil in the last few decades.

2 Motivations for the actions aimed for the popularization of science

Why? For whom? How? Where does popularization of science take place? These questions have been answered in various ways, but we can separate the answers in two groups: Those that have a similar answer anywhere in the world, and those that would be added to developed or developing countries. Some examples are summarized in **Table I**.

Most frequently, these motivations include the need to improve the educational system or public health, and generate initiatives that belong to the broader field of science education. It is also common that initiatives in science popularization are motivated by a more pragmatic view, as the need for obtaining from the public, opinion leaders, and legislators, the support for obtaining financial aid and the approval of important laws required for continued scientific development. However, contrary to these positions, the main motivation for most of the initiatives that led to the creation of many science museums around the world during the last few decades, can be placed in a more romantic and amateurish field, would be "making science closer to the common citizen, demystifying science," enabling the "intellectual orgasm" of discovery (Wagensberg, 2007), pure celebration of one of the most sophisticated human work: scientific culture and the technological achievements.

Just like air, water and food, to ask questions is an inherent need of human beings. To encounter nature, explore it and ask yourself questions has always been a recurring activity of humans and, believing that the exercise that the human spirit may aspire in saying its last truth, *"the Sciences can only learn to formulate transitory and unfinished truths"* (Oliveira, 2003).

Actions of popularization of science are also needed to allow people to follow the scientific processes and make their own decisions in relation to various current themes. In other words, the time has come to change into the goal of popularization not only the scientific theories, but its relationship

[2] National Science and Technology Week
[3] Health and Environment
[4] Saturdays of Science
[5] Fourth National Week of Science and Technology

Table 1. Motivations for promoting popularization of science

All countries	**Underdeveloped or Developing Countries**
Disseminate new advances in science.	Disseminate the scientific culture and the importance of science. The so-called "scientific literacy".
Wake new talents to tecno-scientific professions.	Improvement in health care.
Increase public understanding of science.	Support public health campaigns.
Options of leisure and culture.	Teacher training.
Lobbying in favor of science, in general aiming a conviction to increase finance or approval of laws.	Citizenship formation.
Debate or questioning of matters of impact such as nuclear energy, genetically modified organisms, stem cells and the environment.	Fight mysticisms and superstitions.
Fulfill curiosity.	Supplementation of the deficient formal education system.
Social responsibility: pay satisfaction to the public about public expenditure in scientific research.	Social responsibility: Give back to the public the knowledge and other benefits reached through public funding.
Enable the dialogue science ⇔ society	Approach the scientist to the reality of the population.

with a broader social context that favors its development and affects its consequences (Navarro, 1992).

3 The time through time in the science museums

Just like the arts, science and scientists have much to benefit from interactions with the people, which can only take place far from an environment that is often aseptic, isolated and distant, as are most research laboratories, libraries or offices. In this sense, science museums can be considered as privileged mediators between science and the public. It does not matter whether being represented in isolated initiatives in small rooms, or in large buildings, real modern "cathedrals"; the Science museums have today a definite presence in Brazil and around the world.

We understand museums as those institutions that are central to culture, as sources of excellence, where connections take place between knowledge and society and, as depository spaces of cultural values, ideas and models of representation. Science museums, as a narrative of scientific culture, make copies and reproductions of experiments or experiences that have changed the perception of nature and our understanding of the world.

Historically, we can verify that the changes in the exhibits of exotic species of nature, just like the chemo-physical effects, derive in the face of curiosity and the need to exchange information between the philosophers of science or naturalists, and the desire to learn of a common individual. The historical narrative, as a representational means, organizes the human perception and the way in which it perceives reality, inter connecting experiments from different times, transmitting cultural tradition. Benjamin (1994), citing Proust, tells us that "*the presence of the past in the present and the present that is already there, pre-stated in the past, in other words, a deep similarity, stronger than the time that passes and goes without us being able to hold it.*"

Crang (1994) views museums as "*machines that inscribe time on space*", that encapsulate time, using its analytical categories to segment and represent it in displays or galleries. Moreover, the idea of accumulating, creating general archives, disclose in one place, all times, all eras–a place of all times, timeless–infinite accumulation of time in a place where nothing would change–belongs to our modern time. Or, still, as in Foucault, the museum and the library are heterotopias, related to the accumulation of time (Foucault, 2006).

In this direction, the inaugurations of memorials or monuments that appeal to the memory of historical characters and achievements that reflect the supremacy of knowledge have been getting to know a "triumphal return" (Huyssen, 2000). According to some authors (Canclini, 1992, 2005; Castells, 2003), the return to local references could be viewed as a process of globalization, in the midst of popular resistance in face of the diffusion of external codes (Primo, 2006). However, while in the 19th century the museums prioritized the research and protection of their archives, in the second half of the 20th century, museums face the challenge of making their collections more accessible, be it through their exhibitions or through educational work.

Thus, during the centuries, museums as spaces of power, started to integrate several nets or technical and rhetorical devices that made the mediation, translation and association of scientific research, its processes and challenges. In a first instance, integrated with aristocracy and church, they were part of a discursive ensemble, in which the presence of the divine and power were represented in the collections.

Included in this level is the representation of power of special conquests of other worlds, and knowledge, writing the history of geographical "adjustments" which the globalized world begins to draw. The knowledge, in this phase, will also be concentrated in the elites and the crowns.

The second instance can be found in the 17th century when these institutions, now public, exalt the discoveries and discoverers. Science is power in of itself and knowledge is restricted to the intellectuals. The scientists as producers of knowledge are considered to be the ones who *"burst in the midst of all the words been used, bringing to them his genius or disorder"* (Foucault, 1979).

In the 18th century, the industrial revolution and the *"invention of a democratic culture"* transformed the museums into the spaces we know today, in other words, as one of the *"instruments that exposed at the same time, the decadence and the tyranny of the old forms of control, the old regime and the public and democratic utility of the new, the republic*" (Hooper 1995, apud: Kiefer, 2002). Also, it highlighted the urgency for the museums to integrate themselves into an educational network, turned directly to the mechanical industry. During this period, the experience of temporality itself, history donating sense and order, the museum begins to represent the accumulation of experience and realization.

In this context, the museum will be a way in which the modern world expressed the conscience of its own modernity, understood as been inserted into history and directed to a future. Its function will be to select the memory in one way and, in the same movement, give thickness to time.

The social changes allied with the advances of scientific discoveries, particularly in the area of mechanical physics, that took place in the 18th and 19th centuries, altered the games of power, transforming itself into what Foucault denominated disciplinary societies by defining a discipline as

> (…) a domain of objects, a set of methods, a body of prepositions considered to be true, a game of rules and definitions, of techniques and instruments (…) a kind of autonomous system available to whomever wants or can make use of it (…) (Foucault, 2003).

In the science museums, the objects and phenomena represented in the exhibitions are classified according to their respective disciplines, subdivided into physics, chemistry, natural history, and so forth. With this format of presentation, science museums can be considered as spaces of representations, in other words, turned to the presentation of final science products, without the presentation of a methodological process. In any way, all models of scientific experiences *"would remain the expository representation of capitalist science, the character of persuasion and the cultural and ideological directions"* (Loureiro, 2003). Furthermore, an inversion of values can be found in the established relationship of science and the public museums where *"what could be called the value in the use and reception of cultural goods is substituted by the value in the exchange; instead of pleasure, the aim is to watch and be informed"* (Adorno and Horkheimer, 1986).

To a large extent and primarily in Latin American countries, the science museums keep as their goal (similar to those presented since the 17th century), science education as a function of the *"contemporary requirements referred over all to the scientific literacy in raising the need for citizens to relate to themes of scientific knowledge"* (Valente, Cazelli, and Alves 2005). The lack of infrastructure for the practical lessons and experiments and the inadequate preparation of middle school teachers help to explain this result.

On the other hand, it can be observed that beginning in the second half of the 20th century, the Centers and Museums of Science go on to establish more creativity and dynamism to their activities, integrating science, art and culture in *"a playful and attractive manner, what in general contrast with the less stimulating way in which Science is usually presented in schools"* (Persechini and Cavalcanti, 2004).

At the end of the first decade of the 21st century, with the consolidation and reception of information through communication technologies, the appearance of big and spectacular live museums and with the advance of research in bio-technology, what becomes noticeable is the need for change in the educational system as the means to consolidate the school as a learning places, and the museum spaces as producers and privileged disseminators of information and culture.

4 Popularization of science: challenges

"Scientific communication" refers to the entire process used for scientific and technological information both between specialists and with the general public, while "popularization of science" can be defined as the multiplicity of languages and representations of scientific knowledge aimed to the general public and encountered in the spaces of communication, as in the classical media, specialized magazines, literature, art, national and local events or in the science museums.

If in a first instance, the socialization process of scientific knowledge through initiatives of popularization of science served as translator of the hermetic science language, today it has been turned into clarifying the social impact of its results. The world is now translated by the language of science, presented in images, graphs, and metaphors.

In the last 40 years, manifestations of the popularization of science have intensified throughout the world, with a vast publication catalog, courses and public conferences, the creation of many scientific magazines, an increasing number of scientific reports in daily newspapers, the creation of blogs, internet sites, tourism, national events and fairs, in addition to the restructuring or creation of new science and technology museums. This shows that there is a growing market for scientific knowledge, creating a state of mind more receptive to the sharing of information and solutions.

From now on, science museums will emphasize communication as their objective. In other words, from simple deposits of rare objects or belongings of the national heritage–which the State considers to be deserving of protection–, from simple conservation to registry, inventory, archival, classification, *"a museum sleeping in its own inertia and immersed effectively in a routine discourse and even more obsolete"* (Bolaños, 1997), we go through a new conceptualization of the expository discourses.

In other words, if before, museums were focused on physics or operated as a simple depository of collections of natural species, the increase of research in the natural sciences and consequently, the appearance of new problems–weather changes, stem or artificial cells, sustainability, DNA–create the need for museums to restructure their expository language in addition to other activities in the field of popularization of science like the national weeks, theatre, movies and an improvement of news in the media. Hobsbawn (1995) points out that *"no other period in history was more penetrated by the natural sciences or more dependent of them than the 20th century."*

Furthermore, it can be observed that human nature becomes the object of research, with an increase in value for the natural sciences. Particularly, by the end of the 1960's, a time of immense increase of scientific discourse, in a set of political-academic effervescence, the *Science Centers* arise, most with no collections and, because of that, without the concern to maintain a linear or historical language and with the objective to democratize knowledge. This new philosophy in the dissemination of knowledge will develop in Latin America in the 1980's, in a process of political opening, transforming these spaces into important channels to disseminate science amongst the popular layers of society, and increasing the number of people engaged in the political debate of applying research in our daily lives.

> The number of conversational topics increase when science moves forward and disseminates, when all kinds of information multiply and accelerate. In summary, for the change in customs, in a democratic way, it is not only the number of speakers that increase, but its quality that varies (Tarde, 2005).

In fact, many educators understand that schools and universities are not the only places where people can learn scientific concepts, especially in a country where a big part of the population is not going or has never gone to schools (Lucas, 1991; Ucko, 1985: Larrosa, 2003). Because of that, today there seems to exist a consensus between those involved in the popularization of science and its importance not as an object of consumption (Cavalcanti, 2011; Bueno, 2002; Adeodato, 2002), or miraculous solutions, envisioning, overall, a greater democratization of knowledge. In other words, unlike what happens in the scientific laboratories and their results published in specialized magazines, *"It was often observed that the diffusion of scientific communication follows preferably through informal channels"* (Latour and Woolgar, 1997).

In a UNESCO report (UNESCO, 2003), it is highlighted that with the exponential increase of the production and diffusion of information in the last decades, schools are no longer centers of exploration and generation of knowledge; other institutions and cultural activities that are either public or private have replaced them. *This way, the influence of the informal is overcoming the formal.*

It can be pre-supposed that the constant scientific advances allow us to recognize ourselves through time, making it emerge new ways of living, beyond the emergence of new values and new social models, being *"an essential and indivisible part of culture, and as such, power of new knowledge and social development."* (Marti, 2007). In this sense, the diffusion of scientific culture has reached the status of an integral part of society as an opinion maker. The circulation of information and the constant changes in science and technology make it be, relative to time and space, the construction place for new bases of knowledge, whilst having in the spaces for communication, museums included, a place of its representation.

5 A new era in the popularization of science in Brazil

In Brazil, the inauguration of a new era in the popularization of science emerges from the political and cultural revival that took place after the military government, during a time when, coincidentally, it emerged in the world new reflections and attitudes in relation to science and society. It was the beginning of the 1980´s and part of the scenery had been prepared by the creation of the *Palais de la Decouverte de Paris* (1937) and the *Exploratorium*, in San Francisco (1969).

Initially considered as a parallel activity to scientific activities, the popularization of science today is integrated to it, and is included in official programs of the universities and financed by organizations that promote education and Science (like CNPq, FAPERJ and CAPES[6]). Even some calls for grant applications, like "Cientistas do Nosso Estado" from FAPERJ and the INCTs[7] from CNPq, today incorporate items of communication with society as specific requirements, in addition to the usual reports containing thesis and publications in specialized magazines.

But, going back in time, it is possible to affirm that popularization of science established its roots in the Brazilian Society for Progress in Science–SBPC, an important forum of debate and resistance to the authoritarian regime and that, in its annual meetings, allowed for the rich encounter of the various branches of science. It was also an important forum for discussions about the Brazilian nuclear program and about many other aspects of scientific policy in the country.

During the same period and throughout the world, the relationship between society and science was also changing: now, in addition to the worries about the directions of nuclear energy that placed in the agenda this relationship in the post-war, represented in Brazil by the scientific and political debate around the new nuclear program, the environment and the biomedical sciences became the main concern. The environmental movement was growing in Brazil aided by the former political exiles that returned from Europe and by the evident deterioration of various ecosystems caused by the deregulated industrialization and the implementation of new agricultural frontiers, both acting in the name of development and not worried by the long-term environmental consequences.

[6] CNPq–National Council for Scientific and Technological Development. FAPERJ–Foundation to Assist Research in the State of Rio de Janeiro. CAPES–Coordination to Improve Human Resource at Post-graduate Level.

[7] INCT–National Institute of Science and Technology

Figure 2. Origin of Espaço Ciência Viva: Popularization of science in the streets of Rio de Janeiro
(A) Repercussion in the media of one of the first activities of the group in a public space: "Science Live: The secrets of live and the Universe go to the square," says the headline on O Globo newspaper from June 12, 1983. The photo was taken on Urca's wall, by the shore of the Guanabara Bay, in Rio de Janeiro. The water, life and environmental pollution are themes present since then.
(B) Galileo Galilei in person (Amir Haddad from the theatre group "*Tá na rua*"[8] in a play by Bertold Brecht) excite the audience and invite them to discover with their own eyes, through telescopes, the satellites of Jupiter (A square in Rio de Janeiro, in the middle of the 1980's).

At the same time, the emergence of the AIDS epidemic, also in the beginning of the 1980's, created a new wave of demands by the citizen for a bigger role in decisions about the directions of biomedical sciences. More than a better understanding of the biological processes involving cells, molecules and organisms, it was also necessary to understand how choices were made, how medications were tested, who and how were established the financial priorities. The new citizen from the 1980's, after having experienced everything in the previous decades, now wanted to understand everything and in everything he needed to participate. Without noticing it, he exposed himself to being analyzed. From the most subtle detail of his molecules to the most complex forms of social organization, his affective relationships, his body and the most intimate details of his behavior, everything becomes part of scientific research to an extent never known before.

The human being notices himself as a scientist and an object of study, observer and observed, main actor and subject of the scientific development. Physics, biology, biochemistry, history, anthropology, sociology, mathematics, carefully separated throughout the centuries in the name of progress and the needs of science, had now to be reunited and there was no tool in the academic world, separated by departments and specialties with similar names, to allow for that. In retrospect, it is noticeable that these new necessities of society had found in the initiatives of popularization of science, like magazines and science museums.

Thus, it is understood as one of the first initiatives of this new phase of popularization of science in Brazil, the initiatives of the regional section of SBPC in Rio de Janeiro, that, starting from a series of meetings that took place in the beginning of the 1980's, was able to bring together scientists, educators, students and a diversity of professionals interested in the theme. The idea spread, the discussion groups grew[9] and several initiatives became managed. One of the first was a series of events called "*Ciência às 6 e meia*"[10] with a series of conferences in theatres and other places with free access and a variety of themes, always looking for a language that could reach the general public.

Two more elaborated initiatives followed: "*Ciência Hoje"* (1984),[11] a magazine with the aim of national reach edited by SBPC, actually in its 179th edition, and the *Espaço Ciência Viva* (ECV), which later, independently from SBPC, came to be the first interactive, hands on, Science

[8] At the street

[9] From the 40 thousand members of the organization, about 30 thousand joined during the military regime only to have a space in which they could criticize the government.
[10] Science at six thirty.
[11] Science today.

Figure 3. The current *Espaço Ciência Viva*: "Please touch everything with care!"
(A) In the warehouse where the headquarter for *Espaço Ciência Viva* is located since 1986, children play with things that rotate. At the back, musical instruments made with PVC pipes. Physics and music are recurring themes in interactive science museums (Photo taken in 2006).
(B) Panoramic view of the science museum *Espaço Ciência Viva* today. The banner on the entrance reads "Please touch everything with care", a sentence that represents well the spirit of science museums that emerged from the 1980's and have become the slogan for the institution.

museum of Brazil. Different from other initiatives, the ECV conceived itself as an independent non-governmental organization, and congregated under the leadership of Maurice Bazin (1934-2009), a French physicist, former Professor of the University of California, Berkeley, and recently established in Brazil, those who opted for a more active process, towards experimentation (Costantin 2001; Kurtenbach, Persechini e Coutinho-Silva 2004).

This group initiated their activities from 1981 onwards, developing interactive events in public spaces like on the squares and streets. They counted on a large number of volunteer collaborators that mobilized their personal resources and shared equipment like microscopes and telescopes to promote the "*Dia da Célula, Dia da Água*, *Dia do Céu.*"[12] The news attracted a public that sometimes reached over a thousand people per event and that ended up calling the media's attention, which sometimes highlighted some of the activities been developed (Figure 2).

In this pioneering period, what was noticeable was the concern with the environment, with the quality of water and the unveiling of the microscopic world of cells and microorganisms, without forgetting the fascinating and beautiful, represented through the direct observation of the moon and planets. To attract the public and start reflecting on the scientific method and the relationship between science and society, there is nothing better than a theatre play[13] that reminds us of the early conflicts of modern Science: Galileo Galilei in person invites the public to observe the planets Jupiter and Saturn with their own eyes.

After some years performing on the streets of the city, this group established itself in an old, abandoned warehouse and, in 1986, they inaugurated the new space of popularization of Science in the neighborhood of Tijuca, where they remain to this day (Figure 3).

Their objectives were defined in a simple and direct way:

> "The main goal of this institution is the dissemination and demystification of science, making it accessible to the common sense, likewise, the improvement in the teaching of science and mathematics. Through simple participatory and playful experiments, this space rescues the liking for experiments and findings. It starts from the premise that the understanding of nature is a desire of the human being such as the arts and games; and that Science is a creative activity accessible to all". (Kurtenbach, Persechini e Coutinho-Silva 2004).

During the same time, new initiatives emerged in Brazil, like the *Estação Ciência*[14] in São Paulo, *Museu de Ciência e Tecnologia*[15] in Porto Alegre, RS, and the *Museu de Astronomia e Ciências Afins*[16] in Rio de Janeiro, RJ, among others.

To this day the *Espaço Ciência Viva* remains loyal to its initial objectives and continues to operate in the same place. During all these years it has influenced several generations of disseminators and professors of science, likewise, students from all levels and the general public. In addition to a collection of about 60 interactive experimental modules, its activities can also be characterized by thematic events that always take place on the last Saturday of every month, covering a

[12] Day of the Cell, Day of the Water, Day of the Sky.
[13] The theatre play Galileo Galilei from Berthold Brecht was staged by the theatre group *Tá na Rua* and directed by Amir Haddad.
[14] Science Station.
[15] Museum of Science and Technology.
[16] Museum of Astronomy and Related Sciences.

variety of themes like Dengue Fever, microscopes, and nutrition. These activities are built basically by the members, especially by scientist volunteers working together with young university students, scholarship recipients and volunteers who are, at the same time, teaching and learning. In 2010 there was a 10% increase in the number of visitors (6.957) and schools (104), in relation to the previous year. The museum also sponsors once a month a "*Sábado da Ciência*,"[17] with specific themes and gathering an estimate public of 100 to 200 per Saturday.

Its success is measured more by the influence it exerts and for its capacity of personal development, motivating youngsters, future professors, to develop themselves as science teachers and for the freedom and creativity of their initiatives.

Today, within the scenario of scientific museums in Brazil, the *Espaço CIência Viva* is inserted amongst the 190 spaces of popularizing science spread throughout the country like: museums, zoos, aquariums, planetariums, observatories and botanical gardens that sponsor a variety of events for different age groups. According to data from 2009 and raised by the *Cadastro Nacional de Museus*,[18] Brazil entered the 20th century with 12 museums and today it has 3,025 institutions, with most of them located in the south and south eastern parts of the country. São Paulo (132), Rio de Janeiro (124), and Salvador (71) are the Brazilian cities with the most museums. The three most crowded capitals of Brazil also contain the biggest collections. The biggest collection of preserved cultural goods are in the *Museu Nacional*–located in Quinta da Boa Vista, Rio de Janeiro (15 million); in the *Memorial de Medicina Brasileira* of the Universidade Federal da Bahia,[19] which houses more than eight million in goods; and the *Museu de Zoologia da Universidade de São Paulo,*[20] which preserves a similar amount of objects. The research from the *Registro Nacional de Museus* does not show visitor numbers.

It is highlighted that out of the three thousand museums, the data that follows corresponds to 1.500 that responded to the inquiry from the *Registro Nacional de Museus*.

In regards to the typology of the collection of Brazilian museums, the science and technology museums are inserted in seventh place with 23.1% (Table II).

In addition, these science museums were taken to perform an important counter point to the formal teaching of science, catalyzing the vocational sense of those unsatisfied with the teaching of science in the schools. Motivated by the methodological limitations, not enough emphasis on laboratory activities, poor quality of teacher training, and precarious condition of the public education system, went on to function also as laboratories of new procedures, a complement for school activities and a training center for teachers. For this, and in a general way, it is possible to observe that in Brazil, most of the science and technology museums have interactive proposals managed from the 1980's. Some others, still with an outdated vision, only show their collections in a passive way while aiming to "teach" or "transmit" information to the visitor, without been able to attract the public in its search for experimentation, entertaining and beauty.

In Europe and in the United States, the 21st century begins with the investment in large museums, true centers of spectacles, and a greater visibility of the themes related to the concepts of biotechnology and sustainability; a process that, as we can tell, Brazil is beginning to adopt, as it is the case with the *Museu do Amanhã* with inauguration scheduled for 2012 and the *Museu da Amazônia*[21]*–MUSA*, open to the public in 2010 (www.museudaamazonia.org.br). The *Museu do Amanhã*[22] is part of a revitalization process of the downtown area of Rio de Janeiro and will have its architecture based on the elements of nature, occupying an area of 12.5 thousand square meters. The proposal is to unite science, technology and knowledge inside a concept of sustainability. The MUSA is a living museum, where one can experience the complexity and the social and biological diversity of the Amazon. Occupying an area of 100 acres of the Adolfo Ducke reserve in Manaus, the museum invites its visitors to enter the forest and, through their senses, allied to a variety of instruments–magnifying glasses, microscopes and cameras, observe nature as well as get to know the scientific research projects developed there.

Anyway, it is possible to say that in the last 40 years it was established in Brazil a network of science museums that have contributed in sparking a lively interest for things related to science and playing an important role in the communication between science and society; as well as on the wakening of new talents and in the formation of new science teachers.

However, a more critical reflection should be made about the popularization of science in Brazil today, how we relate ourselves to the tendencies in other parts of the world, what resources we have used and how they are inserted in the set of developmental initiatives that are so much needed. Are we being effective? Is there a coherent public policy? Or are we only implementing a set of actions with the noblest principles linked to education and popularization of science, but structured in a way that it is not integrated with the needs of scientific and cultural development?

There is no doubt that knowledge, the acquisition of competencies to acquire it and the development of capacity to make decisions based on this knowledge is a fundamental tool for freedom and the development of a human being. They are therefore important pieces of the so often proclaimed "citizen's right," "social inclusion," "sustainable development" and "economical and social development." Further to the conquest of universal literacy will be the scientific "literacy", also universal and one of the main tools to enable us to reach these objectives.

[17] Saturday of Science.

[18] National Registry of Museums. Available at: http://www.museus.gov.br/sbm/cnm_estatistica.htm

[19] Memorial of Brazilian Medicine located at the Federal University of Bahia–It is important to point out that the School of Medicine from the Federal University of Bahia is the oldest medicine school in Brazil, founded in 1808 right after the arrival of the Portuguese King Dom João Vito Brazil, and first named as the Surgery School of Bahia.

[20] Zoological Museum of the University of São Paulo.

[21] Amazon Museum.

[22] Museum of Future.

Table 2. Percentage of museums in Brazil according to typology of collection–2010

Typology	%
History	67.5
Visual arts	53.4
Image and sound	48.2
Anthropology and Ethnography	29.5
Archeology	26.9
Sciences and Natural History	23.5
Science and Technology	23.1
Librarian	14.8
Virtual	3.9
Documentary	2.6
Archival	0.9
Others	7.4

The data in this table do not add to 100%, because every museum may present more than one type of typology of collection. For a complete list of Science museums in Brazil please refer to the catalog made available by the *Associação Brasileira de Centros e Museus de Ciência*[23] (ABCMC) at: www.abcmc.org.br.
Source: *Cadastro Nacional de Museus* - Ibram / MinC, 2010

It seems that everyone recognizes the enormous distance that separates us from the developed countries, that everyone knows that education and science are essential for overcoming our sad reality and realizes that much of the work must be concentrated in schools. The so called "academic community" needs to respond to this demand through innumerous initiatives. The popularization of science in centers and science museums is one of them.

It is considered that Brazil is currently in a unique moment of its history where the dreamed development and social justice have finally come true. If this will happen, we still do not know, but we are sure that this will not take place without a big qualitative and quantitative change in the field of education, at all levels, especially in the field of science. If this comes to take place, we believe that the science museums will be able to have an increasing role in it.

6 Conclusions

There is in Brazil today a great abyss between our economic, social and cultural situation, and the full development which we all dream of. There is also an abyss between science and society.

The current science museums and science centers divide their activities between educational proposals in science, the training of teachers and popularization of science in a broader sense. Although they do not completely fulfill the need for dialogue between science and society, or fill up the emptiness left due to the lack of quality schools, they have increasingly, and together with other Mediums, fulfilled an important role in disseminating the scientific culture in Brazil. However, after the creative and innovative period of the 1980's, they have grown in number but stagnated in terms of proposals for actions. They became important for the image of institutions and cities, sprouted in grand projects and proliferated in small science centers, but lost the audacity and the creative impetus. New ideas are rarely presented in popularization of sciences or to increase and make more effective the communication between science and society. Depending on the leading institutions and/or government funding, they remain in a continuous financial crisis, avoiding running the risk to upset those who keep them.

There are many possibilities for the development of science centers and science museums: from the classic museums, anchored in the big archival collections accumulated throughout the centuries, to the interactive museum that prepares living exhibitions of ephemeral existences, from the modern and sumptuous cathedrals of science that proposes to present to the inhabitants of the big urban centers with a bit of the future, to the small science center in a small rural town that helps to satisfy the need of every human being to get to know himself and the nature around.

There is a place for everyone and there are no formulas or pre-set rules. It is possible to disseminate science by looking to the planets or through microscopes, listening to the sound of migrant birds flying, lighting a match or, simply admiring a rainbow during sunset.

What we cannot have are empty museums that exist only to justify their own existence, built many times to satisfy egos, institutions or governments, repeating with no enthusiasm or vibration ready-made or pre-determined formulas. The danger is forgetting the own subject of its existence, science itself.

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[23] Brazilian Society of Science Centers and Science Museums.

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