

Communicating science is an art! What do artists who work in an itinerant science museum say?

ABSTRACT

The research presented in this article sought to investigate the visions and perceptions of artists involved in the context of a traveling science museum in respect to science communication, the role of artistic interventions that travel with this museum, and their participation in this dynamic. The Fiocruz Museum of Life stands out, having since its creation in 1999, conceived and offered its public educational activities that promote the dialogue between art and science. In a similar way, Mobile Science, the mobile unit of the Museum of Life, inaugurated a new season of itinerant activity in 2013 called "Art and Science on Wheels". This new configuration aimed to promote socio-artistic-cultural inclusion on its travels to cities in southeastern Brazil. Since then, there has been an expansion and diversification of the artistic interventions that travel with this mobile science museum. The research question that has been raised is: what views on science communication do these artists involved in the activities have? Furthermore, what would be the perceptions of theater, circus, and visual arts professionals about the role of arts in an itinerant context and their involvement and experiences in this process? For this, interviews were conducted with 09 (nine) artists involved in the artistic activities developed within the scope of Mobile Science, who were still actively traveling before the activities were suspended by the Covid-19 pandemic. For the analysis of the interviews, qualitative methodology was used, based on an intuitive process of immersion and crystallization (STEWART; GAPP; HARWOOD, 2017). The results considered the dimensions previously presented and raised some of the potentialities and opportunities that this type of activity offers for this interface between the fields of the arts and science communication, even though challenges are recognized. The interviewees reflected on the goals pursued by scientific communication activities, from the most concrete to the most symbolic, on how art merges with this and broadens horizons, and on how they see themselves as participants in this work. At the end of the article, it is concluded that mobile science museums' actions are presented as a fundamental social inclusion strategy for the scientific and cultural dissemination of Brazilian productions, allowing them to be accessible to populations that often do not have access to cultural facilities. By allowing broad access to culture in an interaction between art and science, itinerant projects reinforce their role in popularizing culture and knowledge. The interaction between art and science allows the planning of scientific communication activities that go beyond the deficit model, developing actions that support dialogue, criticism, and the perception of knowledge in not only cognitive, but also affective and emotive, ways.

KEYWORDS: Itinerancy. Traveling museums. Art and Science. Mobile Science.

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INTRODUCTION

In line with the proposal of this Thematic Dossier, the authors of the present article proposed to investigate which perceptions on science communication are mobilized by artists who work in different artistic languages – performing arts (theater and circus) and visual arts – and understand what, in the view of these agents, the roles played by an artistic intervention that travels together with a traveling science museum would be. It also sought to know how the artists see themselves as members of this activity. The traveling museum in question is Mobile Science: Art and Science on Wheels, from the Museum of Life at the Oswaldo Cruz Foundation (known as Fiocruz), in Rio de Janeiro.

The Museum of Life Fiocruz was founded in 1999 and is composed of various spaces for visits and different educational activities that go beyond the walls of the museum. Soares et al. (2016) define the museum in a succinct manner.

It is a space that integrates science, culture and society, situated in the North Zone of Rio de Janeiro; it aims to make information available and carry out educational actions in science, health and technology, exploring the playful and creative character present in its exhibitions, interactive spaces, theater and laboratories (SOARES *et al.*, 2016, p. 201-202).

As regards the actions that go beyond the walls of the institution, the Museum of Life has an itinerant service that administers Mobile Science and a portfolio with about 15 traveling exhibitions of different size and complexity, which are taken to various cities in Brazil (GONZALEZ *et al.*, 2019).

In 1997, even before the inauguration of the Museum of Life, the Science in Scene was created as a space in which to discuss and think about educational activities that would bring together art and science (ALMEIDA; LOPES, 2019). Promoting these activities within this perspective has always been a unique characteristic of the Museum of Life. The museum has produced theatrical pieces that promote this dialogue in an organic way, bringing together the institution's activities and, up to the moment of writing, has produced more than 18 plays, dealing with different subjects in science and health, some of which have been put on at the museum, in both social and exhibition spaces (ALMEIDA; LOPES, 2019).

This dialogue widened through activities offered to the public during events such as Fiocruz for you¹, The Museum of Life's Birthday and Children's Day, in which circus presentations and interactive workshops involving juggling, monocycling, clowns, aerial acrobatics and other activities characteristic of this artistic format have been included. Recognizing the potential of practices linked to the field of visual arts, in 2019 the museum opened a new visual arts exhibition to the public. Entitled *Rivers in Movement*, it displayed contemporary figurative paintings portraying rivers in different regions of the country, in dialogue with scientific aspects present in them.

The Museum of Life has historically taken a leading role in powerful events and studies involving the dialogue between art and science. As an example, the Science and Art Symposium of 2006 culminated in a publication bringing together recollections of the event (MASSARANI, 2007); and, more recently, a book entitled *Science on Stage: theater in the Museum of Life* [Ciência em Cena: teatro no Museu

da Vida] (ALMEIDA; LOPES, 2019) was published. For its authors, Almeida and Lopes (2019):

Uniting science and theater has become a more recurrent practice in recent decades, above all in developed countries that have a tradition in the area. Gradually, however, the phenomenon has spread to developing countries, among them Brazil (p. 22).

However, what are the perceptions of professionals in the field of performing and visual arts regarding their work presented in the itinerant context of a science museum? What views do they hold on science communication and the role of art in this field? Going beyond the work itself, how do they see themselves as part of an itinerant activity of scientific communication?

With these questions permeating our discussions on the relationship between art and science in contexts as specific as itinerancy, we proposed to carry out this research, which aimed to hold interviews with the artists who took part in actions with the itinerant museum *Mobile Science: Art and Science on wheels* in 2018 and 2019. These are the actors who put on the play **The Fiddler and Rebecca [O rapaz da rabeça e a moça Rebeca]**, the artists from the circus collective **NOPOK** and the artist who painted the canvases in the exhibition **Brazilian rivers**.

ART AND SCIENCE IN COMMUNICATING SCIENCE

Relations between art and science are as old as the two fields themselves, and they were particularly intertwined until the advent of the scientific revolution (SAWADA; ARAÚJO-JORGE; FERREIRA, 2017). Specialization and fragmentation of knowledge then became current practices in both fields, which on the one hand allowed for a rapid and broad advance in both, but on the other created limitations to the generation of new knowledge. In the manifesto **Artscience**, published by Root-Bernstein and co-workers (2011), the authors affirm that we can understand reality as much through art as through science. However, this knowledge would be incomplete. Thus, it would only be through an integrative action called **Artscience** that we would be able to understand the world more completely. The authors also defend a return to a new Renaissance, which they understand as a richer period in this relationship, considering that the great advances in modern science were only possible starting from joint action – be it voluntary or involuntary – between art and science.

Halpern and Rogers (2021) also identify this long tradition, but they point to an enormous expansion of interest in the last 20 years. By criticizing what they classify as an instrumental use of art by science, with origins that they trace to the Renaissance period, they propose new typologies by which to understand the art-science relationship in the context of communicating science. In their new proposal for typologies, works of art and science can be understood as relating to conveyance, when the work seeks to transmit a message, be it scientific information or an attitude toward science; contributive works, when it seeks to construct new knowledge by uniting areas of expertise; contextual works, when it wishes to represent the context in which science is produced, engaging the public in rethinking their individual or collective role in the big questions being asked; critical works, when the central point of it is the analysis of how science is

manufactured, either through criticism of scientific practices or uses, including ethical questions, or through problematizing the nature of science. The authors identify the first typology, of conveyance, as the one most present in science communication, but stress that these works should not be confused with the mere transmission of knowledge within a deficit model. The communication of a message offers far richer dynamics than a unidirectional transmission of information. They also alert us to the fact that the typologies should not be understood in a fixed or exclusive way, because works of art and science can be considered as belonging to more than one of these typologies.

In this study, works of art and science will be analyzed within an itinerant action of communicating science, using different languages. The works under analysis use the languages of theater, circus and the visual arts. The three languages have a long tradition of interaction with science in the context of science communication.

Circus art as a part of science communication is the least studied among these languages and probably the least present. It appears in exhibitions by science centers and museums, exploring the science behind the circus², in texts communicating science, with the same aim (BEVILAQUA; CRONEMBERGER, 2006; GIGLIOTTI, 2020), in interactive circus activities within science museums (BEVILAQUA; AVELLAR, 2011) and of spectacles of the Science Show type, carried out by jugglers and clowns³ in a practice that is apparently more common in the USA. Besides these practical examples, there are few academic reports on the subject, which is a gap still to be filled.

Visual artists have long been producing works of art that seek a dialogue with science (CURTIS; REID; BALLARD, 2012; ZHU; DAVIS; CARR, 2021). These works of art aim to translate complex and difficult-to-grasp scientific concepts to a broad public by means of images. Artists have also tried to integrate art and science using more complex arrangements, to deal with controversial subjects, to stir up emotions about science and even to foster the participation and mobilization of the public in scientific subjects (HALPERN; ROGERS, 2021; MATIAS *et al.*, 2021). In environmental topics, photography is frequently used, not only to translate scientific discourse, but especially to engage the public and awaken emotions (ZHU; DAVIS; CARR, 2021). In science centers and museums, the use of canvases and installations has a very special use, as a means of innovating in the communication with their public. The experience of the Science Gallery in Dublin (GORMAN, 2008) has started new approaches and modified the way in which the scientific field interacts with the arts.

When reporting the experience of collaboration between artists and scientists, Rödder (2015) affirms that this interaction does not produce only works of art that stay closer to scientific discourse, which would reveal collaboration that is beneficial in only one direction. According to the author, the greatest richness in this collaboration is found in the process itself, given that many learning experiences are involved on both sides. Considering the major challenge of social inclusion in science communication projects, Matias *et al.* (2021) and Curtis, Reid and Ballard (2012) defend the use of arts as a great ally in promoting and attracting a new public. Matias and co-workers (2021) argue that the arts help to knock down “invisible barriers” and the sensation that science museums and centers “were not made for me” (DAWSON, 2014).

The language of theater in communicating science is, among the different artistic languages, the one that appears to be most studied by academia (ALMEIDA; LOPES, 2019). Diverse initiatives in the production of plays in science museums have proliferated in the last 15 years. Despite having found work like that of Moreira and Marandino (2015), Oliveira (2012) and Pinto and Moreira (2019), which are characterized as academic studies that provide reflections for the field, there is still plenty of room for investigations that debate this relationship between science and art, especially if we consider the high number of field practices. Cavalcante, Barbosa and Silva (2021), in a systematic literature review on theater and teaching science, pinpoint a large number of studies in the initial stage of this field, identifying significant potential for growth in this area of investigation.

Almeida and Bevilaqua (2021) analyzed the collaboration between artists and scientists in the production of the play *Life of Galileo*, by Bertolt Brecht, which was staged in the Science Tent at the Museum of Life. In that article, the authors interviewed 13 social actors who were involved in the production and acted in the play in question. The researchers found divergences in the view of the collaboration process among the different social actors interviewed, but emphasize that these divergences did not jeopardize the production or the acting. They also identified that, in the context of science communication, the theater presents specific features, such as how the results of contemporary spectacles and science communication are defined. The article dialogues with the previous study by Dowell and Weitkamp (2011), which analyzed the collaboration between artists and scientists in the United Kingdom. In the same vein as Rödder (2015), Dowell and Weitkamp (2011) identify great potential in this collaboration, principally in the learning process that takes place among the participants, who are also transformed in terms of their beliefs and attitudes. By going beyond the simple transfer of scientific knowledge, this action surpasses the dimension of communication based on the unidirectional and vertical transmission of information, known as the deficit model (BROSSARD; LEWENSTEIN, 2010). Almeida and Bevilaqua (2021) also add that, beyond the divergences that arise from this collaboration, all the parties involved in this process set aside their different perspectives when seeking a common goal: engaging the public. The dynamics of dialogue between art and science comes close to what Hooper-Grenhill (1999) calls the cultural process of communication, in which audience and specialists dialogue and negotiate about different types of knowledge. In this specific case, this construction of new ways to communicate occurs between artists and scientists, making it possible to have a dimension of communication that is very close to what models of interaction and of public participation emphasize, where science is understood in a cultural, human and dynamic dimension (MARANDINO et al., 2008).

DESCRIPTION OF THE TRAVELING SCIENCE MUSEUM

Mobile Science: Art and Science on Wheels is a mobile unit of the Museum of Life, with objectives that are closely linked to spreading the communication and popularization of science nationwide, seeking to bring science closer to visitors' daily lives by using a series of activities including games, multimedia, videos, thematic exhibitions, an inflatable planetarium, three-dimensional models and interactive equipment. Mobile Science also aims, essentially, to help strengthen

science education and sociocultural inclusion for the populations it reaches (GONZALEZ *et al.*, 2016).

Mobile Science started life in 2006 (FERREIRA *et al.*, 2012), arising out of a government funding call published in 2004 by the then Ministry of Science and Technology (MCT), in partnership with the Brazilian Academy of Sciences (ABC), with the objective of supporting the development of mobile science units (Edital ABC/MCT nº 01/2004) in Brazil (ROCHA; MARANDINO, 2017). Initially known as *Mobile Science – Life and Health for Everyone*, its creation came from a formal partnership with the Foundation for Sciences and Higher Education at Distance in the state of Rio de Janeiro, the Fundação Cecierj.

Its central subjects are life and its diversity, the promotion of good health and the interventions made by humans in life and the environment. Currently, its actions are carried out using a truck with a trailer measuring 13.5 meters (44 feet) in length, which transports its various activities, occupying an area of about 600 m² (nearly 6500 square feet). An action in any given city lasts for four days on average, with the capacity to receive up to 350 people per hour. Most of the audiences book their visit (school groups, residents' associations, church groups, support groups for people with special needs, etc.), but there are also spontaneous visits (GONZALEZ *et al.*, 2016). Some qualitative investigations and other research into levels of satisfaction have been carried out with the public, both spontaneous and school-groups, including teachers – and the response has been predominantly positive (BEVILAQUA *et al.*, 2013, FERREIRA *et al.*, 2012, MANO; DAMICO, 2017).

In these nearly 15 years of traveling around the Southeastern region of Brazil, Mobile Science has covered over 102,441 km (about 64,000 miles) during 198 trips to 123 different counties, enabling 825,175 visitors to develop new perceptions about science and technology. There are many different dimensions and challenges to consider when preparing an itinerant activity, among which we would highlight: the suitability of the objects to be exhibited, the time needed for specific training of mediators, the constant need to maintain the materials and the vehicle, the transport for the team (about 25 people), identification of partners with the ability to take on counterpart actions (food and accommodation for the whole team, appropriate space, among other things), and our own financial sustainability in order to fulfill our responsibilities (GONZALEZ; GUIMARÃES, 2019).

In a survey carried out with data from the Brazilian Institute of Geography and Statistics (IBGE), the presence of cultural facilities in municipalities visited by Mobile Science was investigated. Only 26% of the municipalities possessed some type of science center or museum and 34% possessed some type of museum (BEVILAQUA *et al.*, 2013). When data were updated in 2016, it was seen that among the cities visited, 41% have no Cinema, 34% have no Museum, 33% have no Theater and 21% have no Cultural Center. These indicators show how important it is to bring Brazilian cultural production into provincial parts of the country and to recognize the role of this traveling science museum in confronting inequality in the distribution of cultural facilities.

During this time, the museum has sought new funding sources and widened the languages it uses and the ways in which it communicates with a diverse public. In 2013, given the need to dialogue increasingly with the artistic activities that the museum offers to visitors, this traveling museum inaugurated a new season, which

added varied artistic activities to the set of activities already offered by Mobile Science (SOARES; GONZALEZ; VIANNA, 2015), as will be explained below.

ART AND SCIENCE ON WHEELS

It is known that the challenges in developing actions by itinerant museums of the Mobile Science kind are not limited to the efforts necessary for their implementation, but rather continue during their evolution over time, especially linked to the high costs of itinerancy. On the other hand, in a country of the size and complexity of Brazil, it is easy to see that the municipalities and peripheral zones – which form the main focus of action for initiatives of this kind – are also the places that have few or no cultural facilities on offer.

In 2012, a funding project was submitted to the – now defunct – Ministry of Culture to raise money using a tax-exemption law, known as the Rouanet Law. The project presented Mobile Science’s fundamental actions and proposed to incorporate cultural activities in its program. When it was approved in 2013, fundraising started with possible sponsors, which led to the inauguration of a new season for the traveling museum, entitled “Art and Science on Wheels” (SOARES; GONZALEZ; VIANA, 2015). This new configuration, which sought socio-artistic-cultural inclusion by bringing art and science closer together, continues to the present, and it has included three different successful funding projects over this period (PRONAC 12/2459, PRONAC 16/0399 and PRONAC 18/1226). The artistic interventions that have accompanied Mobile Science over these years are in theater, circus and the visual arts, and they have undergone adaptations to a greater or lesser degree, so as to meet the specific needs of the itinerant dynamic.

Figure 1 – Records of the Ziripitó Theater Company activities with the Mobile Science unit



Source: Mobile Science Collection (2014 and 2015).

In the ambit of theater, the Ziripitó Theater Company put on a group of sketches linked together with the content proposed and the interactive apparatus of Mobile Science, which were recreated as scenic elements. In these interventions, the actors used the esthetic of the *Commedia Dell’arte* to create their well-defined characters with the masks typical of this artistic movement

(*Arlecchino, Brighella, Colombina, Dottore, Pagliaccio* and *Pantalone*). The sketches had an improvised character, without any prepared text, but following a loose script known as the *canovaccio*, in which the basic elements for a scene are laid out, and always using comedy to dialogue with the audience (SCHMITT, 2004). At various points in the exhibition, the actors would appear representing different characters, interacting with the apparatus and the public, creating amusing situations where science is the main theme, as can be seen in the photographs in Figure 1.

Figure 2 – Images from the play “The Fiddler and Rebeca [O rapaz da rabeça e a moça Rebeca]”



Source: Mobile Science Collection (2016 and 2017).

Still within theatrical arts, and thinking of the Museum of Life’s expertise in developing science communication actions using creative and innovative languages, the play “The Fiddler and Rebeca [O rapaz da rabeça e a moça Rebeca]” was adapted to enable it to accompany visits by Mobile Science to various municipalities. The play comes from a *cordel*, a traditional pamphlet containing folk tales and songs, sold mainly in northeastern Brazil, in this case a story by José Mapurunga from the state of Ceará. In the fictitious backlands of Cantiguba dos Aflitos, João and Rebeca are the star-crossed lovers, because he is very poor and she very rich. João finds a fiddle (the *rabeça* of the title) and sets off for the big city, where he becomes a famous star. When he is preparing to return in triumph to the backlands, João is infected by HIV on one of his reckless and unprotected amorous adventures. Using poetry, humor and music, the play breaks paradigms with the triumph of love between the sero-different couple João and Rebeca. The design of the play is inspired by Brazilian northeastern culture and theater from the streets, the square or the fair. A few boxes and musical instruments are the only props. The play takes place in the round, with the audience circling and participating in the presentation. No theater or stage is needed, which makes the play very accessible. In Figure 2, some of the props are shown, as well as the staging in gymnasiums during actions carried out with Mobile Science.

More than contributing to the discussion about interfaces between art and science, this production, which was entirely conceived with an itinerant format in mind, was designed to take place in town squares or in the playground of schools

(many of them in the countryside) that do not have means of transport to visit Mobile Science, which would usually hold its activities in the sports gymnasium of the municipality. It thus expanded efforts to take culture into the interior of the country and reached new audiences that are often excluded. As well as traveling with Mobile Science, the play also appeared at the Museum of Life and was put on in schools in socially vulnerable communities, in another kind of itinerancy. Almeida et al. (2021) have studied the audience's response to the questions of health and science brought up by the show.

In circus presentations, the playful and interactive art activities are organized by circus professionals who are part of the Nopok Collective, in the show "In the pocket [No Pocket]", which is suitable for public spaces and makes no big structural demands. Its objective is to make the audience aware of the magical characteristics that circus techniques, the skill and the precision of movements can offer. For many spectators, the beauty of the circus lies in surprise, where each movement is seen as a challenge to the laws of physics. This pairing – circus and physics – creates a very rich dynamic, where visitors are constantly stimulated to sharpen their wits and their senses. In Figure 3, we can observe these interventions in the exhibition space and their relationship with the public.

Figure 3 – Records of presentations of "In the pocket [No Pocket]", by the Nopok Collective



Source: Mobile Science Collection (2014 and 2017).

In relation to visual arts, the exhibition *Brazilian Rivers*, composed of ten acrylic paintings on canvas, traveled with Mobile Science. In it, as well as provoking wider thoughts on what sustainability would be and on the source of life, historical and geographical characteristics of different rivers in Brazil are examined, bringing in some curious facts. This production aims to establish a connection between the public and artistic creation, inviting visitors to reflect on the need to preserve the country's river basins, taking a critical and sensitive view of the issue (Figure 4). This was the exhibition that inspired the creation of the temporary exhibition *Rivers in Movement*, mentioned at the beginning of the present article and currently on show in the Museum of Life exhibition hall (but not receiving visitors due to the Covid-19 pandemic), with the artist's original paintings, among other productions.

Figure 4 – The art exhibition “Brazilian rivers” within the Mobile Science environment



Source: Mobile Science Collection (2018 and 2019).

More than denouncing the destructive human actions against the environment, the paintings seek to awaken the public to the need for depollution and recovery initiatives for urban rivers, fundamental to the survival of animal species, including humankind itself. The issues highlighted include recovery of river sources; recovery of gallery forest along riverbanks; planting of native and fruit trees in the area near rivers; and awareness-raising and mobilization among communities living near rivers.

This artist's contemporary figurative painting generally deals with Brazilian issues, and the environmental subject is a constant feature. From the geometric and organic lines that move across the canvas arise forms that speak to us through color, making up an open image in which the viewer participates in recognizing various elements. In order to protect the original paintings, heat-press prints were made, stretched over a wooden frame, and then fixed on easily mounted structures designed for actions within Mobile Science.

Incorporating this kind of activity in the list of actions taken by Mobile Science has allowed it to broaden access to goods that relate the universes of art and science for populations who live in municipalities that have medium, low or no supply of cultural facilities. Special attention was paid to showing national cultural products, which helped to consolidate the Museum of Life as an institution directed towards social inclusion and the promotion of cultural citizenship, by means of popularization of art, culture and science.

By focusing on tightening the ties between the arts and scientific culture, implementing these activities has allowed science communication practices to be expanded to include new languages and means of communication with audiences, encouraging movements of free imagination, emotion and creativity. Such artistic interventions seek to ensure that high-quality art reaches these populations, while at the same time amplifying the potential of science popularization activities, exactly by recognizing them as subjects worthy of artistic treatment.

METHODOLOGY

The present study aimed to understand how artists taking part in actions by a traveling science museum, in this case Mobile Science, see their involvement in this context, what the challenges are and which transformations are needed in these actions. The interviews also sought to understand the changes experienced by the artists and the importance of cooperation between multidisciplinary teams in this process. This article presents results arising from the artists' perceptions of science communication and how their work relates to it, exploring aspects linked to its integration within the dynamics of actions taken by Mobile Science. Moreover, using the experiences of the authors and documents analyzed, we aimed to systematize and record the collaborations between art and science that were experienced by Mobile Science in the last decade.

Artists were invited to take part in the interviews if they were involved in the interventions that were an active part of Mobile Science's travels before the Covid-19 pandemic suspended activities. Thus, invitation emails were sent out explaining the objectives of the research to the artist who painted the canvases in the Brazilian Rivers exhibition, to the pair of artists who make up the Nopok circus collective and to the six actors who took part in the initiative of traveling with the play "The Fiddler and Rebeca" as part of Mobile Science. After receiving the consent of all of them, the interviews were booked for times chosen by the participants; only two actors had problems and could not take part (Table 1).

Table 1 – Characterization of the subjects of the research

Profile	Identification	Sex	Age	Training/background
Theater	T1	M	63	Performing arts
	T2	F	38	Theater direction
	T3	M	33	Theater and theater direction
	T4	F	33	Teaching degree in Theater
Circus	C1	M	42	National Circus School
	C2	M	36	Dance
Visual Arts	A1	M	53	Business administration and history of art

Source: The authors (2021).

With the exception of the visual artist, the interviewees opted for collective interviews, using a dynamic similar to a round-table, in the belief that this model would help to provide better engagement, given that the experiences undergone while on the road involve an immersion in collective processes, be they within the team itself, between different teams or with different audiences. So one round-table conversation was held with the actors and another with the circus artists, who talked with at least two of the authors of the present article.

The interviews followed a semi-structured script, allowing the dynamics of each interview to develop in a flexible way. Each interview script was prepared

specially for each profile, but all of them sought to identify the memories that the subjects had of the trips they undertook with Mobile Science; how they became involved in the initiative; what their perception was of the involvement of artistic activities in communicating science and what their role was in this; how the subjects perceived their collaboration with the project's multidisciplinary team; what the interaction with the public was like; and which transformations arising out of the project could be seen in their professional and personal lives.

Due to the challenges imposed by the Covid-19 pandemic, which jeopardized social research involving fieldwork and, thus, face-to-face meetings, the interviews/roundtables were carried out in a digital environment, using the Microsoft Teams platform, and were recorded on the same platform. The recordings of the meetings took 5 hours 13 minutes and 3 seconds. The meetings had the subjects' consent for video recording, and the audios were later transcribed in their entirety.

The migration of these meetings to an online platform raised challenges that left their mark on the production process for the research data, related either to internet connection instability, which imposed a different rhythm on the interviews (such as signal loss for some participants), or to the quality of the audio recordings (either due to headphones not being used or because of background noise where the interviewee was), which has a direct impact on the transcription stage and, as a result, on the analysis of what is said. On the other hand, the use of digital platforms for social research and the birth of these social networks supported by the internet have allowed people from different cities and even different countries to come together. This was a crucial aspect in making the most of shared memories of experiences and in casting light on the power of a collective experience, which would not be feasible if the option had been a face-to-face meeting (DESLANDES; COUTINHO, 2020).

The analysis was carried out by qualitative methodology using a process of immersion and crystallization (BORKAN, 1999, MALTERUD, 2001, MILLER; CRABTREE, 1994, STEWARD; GAPP; HARWOOD, 2017). Arising from this subjective immersion in the data, the authors aimed to organize, reveal and make the necessary connections to crystallize the most relevant knowledge relating to the research objectives (BORKAN, 1999, MILLER; CRABTREE, 1994, STEWARD; GAPP; HARWOOD, 2017). In this methodology, the authors need to make use of their experience and their intuition acquired in practice, and to use them during their immersion in the data analysis. The active participation of the authors of the article in these actions is understood as being positive in this type of analysis, because it broadens the reflexivity of the researchers' vision of the material they have collected, allowing for better interpretation of and immersion in the data (MALTERUD, 2001).

RESULTS AND DISCUSSIONS

The results will be presented arising from the artists' perceptions of science communication, the relationship they and their work have with that, and the opportunities that an action of the traveling science museum kind offers to this field. In this analysis, elements emerged that are related to their views on science communication, the role of art in science communication, and the perceptions of

these subjects regarding what it means to be part of these initiatives and to interact with them and with their audiences.

The actors, the circus artists and the painter mentioned various aspects concerning the meaning of being part of an artistic intervention together with a traveling science museum. They reflected on the very objectives of the science communication activities – from the most concrete to the most symbolic – on how art is part of this and broadens horizons, and on how they see themselves as participating and involved in this work.

When thinking about the potential of joining art and science in an itinerant undertaking, the decolonization of knowledge featured strongly. Some pundits recognize that the theoretical constructions in the field of museology in recent decades are marked by paradigms that arose within the colonial power structures. Thus, experiences that cannot be translated, in terms of cultural or linguistic viewpoint, have been removed from the discourse of epistemic centers (BRULON SOARES; LESHCHENKO, 2018).

In the view of T3, it is exactly the union of these languages (art and science) that can bring about a rupture with the privileged model of relating with the world, inaugurating a new way of seeing this same world and other people:

[...] it has the feature of decolonizing [...] it's breaking with a privileged way of seeing and knowing the world, isn't it [...] colonial thought put science as the true way of knowing the world and others, and I think that having us together there, different sciences, ways of seeing the world, I think that we are already producing this type of decolonization, and when we decolonize, we open up a big field of questions [...] (T3).

This opening toward a movement of questioning oneself tends to be a constant search when one is trying to popularize science, especially in museum activities, with the varied kinds of mediation that happen with the public (whether these are human, informational or technological mediations). For this reason, the artist identifies the critical potential of the interaction between art and science, as stated by Halpern and Rogers (2021), in an action whose main goal is to strengthen a critical and non-automatic view of seeing how science is made, and its role in society.

Communicating science thus would have this intrinsic role of raising doubts rather than answering or teaching, roles that would be left more to schools, according to one of the interviewees:

[...] actually, I like it when people raise doubts because certainty is immobile, certainty is monolithic, while doubt, a question, it moves you and forces you to leave your place and makes you take some steps [...] we aren't there to teach, it's school that teaches, it's the teacher, isn't it? We're there to show another side of knowledge, another facet. So that you do what you like with it, bring up some doubts, you know, and live with your doubts, for doubt will make you move, won't it? (T1).

By looking at this junction between art and science within science communication, T2 gives the impression of something that is being completed, like the closing of a cycle that allows us to sum up and bring together the parts of a piece of knowledge. This connection between art and science, for Root-Bernstein et al. (2011), is the key to producing truly new knowledge.

[...] I really believe it's about completeness, it's completing [...] knowledge [...] completing an opportunity [...] to receive [...] this knowledge, so I believe that the play, the theater performance joined with sciences has this role of completing, of closing a cycle, handing over the parts of knowledge all added together. (T2)

By talking about the completeness of opportunities, it is also possible to think that offering opportunities promotes citizenship and democratization of the access to scientific culture, elements that have historically been fundamental for thinking about the purpose of science communication actions. When in the context of itinerancy, these aspects are even stronger, given that many of the places visited have little or no opportunity to use cultural facilities and cultural activities (FERREIRA, 2014), as portrayed in the excerpts below:

[...] I think there's another aspect, which is democracy and citizenship [...], actually practicing it, democracy, that's what the show was doing, which was an opportunity to be together in that space, in an arena, which can be a theater arena, but can be in the town square [...] sitting down to debate a topic that [...] goes beyond the question of health [...] (T3).

[...] Mobile Science, it goes to people in the interior of the country who don't have access to this kind of knowledge [...] I think that the show within Mobile Science has the function of culture and art [...] because just when you arrive in very small towns [in which a] child goes to the science fair and is astonished by this world of science, with the magic that's there all around science, and she touches something and it lights up, she pedals and it lights up, she sees how a hydroelectric power station works, you know, all those things that have goodness knows what in them, when she watches a circus show she feels the same astonishment [...] and there are towns where people have never been to the circus, you know, and you go somewhere with 10,000 inhabitants, 15,000 [and] in comes a school bus from the countryside [...] she has maybe heard of a circus there, but she has never seen a circus passing, never seen the circus tent, never seen a juggler, never seen [...] (C2).

One of the components that is most evident in science communication actions is perhaps the one relating to which subjects and concepts are being communicated and by which strategy, a concern that also appears among the interviewees. As pointed out by Halpern and Rogers (2021), the conveyance of knowledge is quite a frequent typology in this interaction between art and science, which is not limited to a mere transmission of information, but allows us to translate different types of knowledge and establish communication arrangements that are quite sophisticated and not unidirectional.

Unlike the great majority of those who communicate science, the subjects of this research have no academic background in the sciences. However, it is in the interaction with the multidisciplinary teams that this dialogue develops and produces new initiatives (ALMEIDA; BEVILAQUA, 2021; DOWELL; WEITKAMP, 2011; RÖDDER, 2015).

[...] this idea of trying to bring circus together with the concepts, and then at first we didn't really manage to do this [...] lack of knowledge, in fact, we didn't have the scientific knowledge to be able to talk about it, so we [...] managed to do this specifically with some of the things in the set, in the Mobile Science unit itself [...] and so we still have in our minds this possibility that we can build up a scene that truly talks about it. (C2)

At the same time, the interviewees raise counterpoints, when they understand that the function of a traveling science museum and its activities is not to make content into a didactic or explanatory process. Rather, everything that is done in this context can go beyond the circumscribed set of scientific content and produce other ways of engaging the audience as well as bringing aspects of social discrimination into discussion.

And so there is this thing about Mobile Science [...] it isn't there to explain a concept, but perhaps to throw it up in the air, and the person will understand it through the mediation, the equipment that is available in the fair [...]. (C2)

[...] thinking about HIV, and AIDS and STDs [sexually transmitted diseases] I think that goes well beyond the question of health, I think it goes into the layers of the imagination, of gender and sexual violence, and why shouldn't it? I think race and class too, you know? If we really get the way information is democratized, access to public goods [is democratized], then it's about debating all these aspects, I think that these were things that were all involved and weren't about the final answer, but about mediating [...]. (T3)

In fact, at the same time that we recognize the urgency of developing activities that stir up debates about such questions and reject any type of exclusion and violence, we see that the literature has increasingly stressed these aspects, showing that spaces of non-formal education, like science centers and museums, and other activities of science communication, can structurally promote social exclusion or end up reproducing chauvinistic, racist, homophobic and sexist attitudes (DAWSON, 2014; 2018; DAWSON *et al.*, 2019).

In relation to content, the interview shows A1's immersion in research that took place before his artistic production, with the intention that scientific issues can also be inferred from the works created for the exhibition, **Brazilian rivers**:

[...] I also tried to find something linked to science, for example there's the question of the painting of the River Negro and Solimões, the meeting of the River Negro and Solimões that talks about the muddy waters of the Solimões and the black waters [of the River Negro] that don't mix. And why is that? Why don't they mix? And there's the question of temperature, of the density of the water, and so we tried to have something in each painting that was related, you know, trying [...] to link art with science. (A1)

There is another element in what he says that commonly mobilizes those dedicated to science communication, which is the challenge of presenting scientific knowledge within a historical perspective. This is an approach that dialogues with what Halpern and Rogers (2021) call the perspective of contextualizing the relationship between art and science.

I generally do some historical research. I researched a lot about these rivers, I looked for rivers in various regions of Brazil, so there are some from the North, South and Southeast, and I try to put it on the canvas [...] put it in the same plane, that question of past and present, together in the same space and telling the history of these rivers. (A1)

For A1, from the point of view of an educational activity, being able to present the historical, geographical and scientific aspects using his paintings is what makes his work different from an art exhibition that only has achievement as a goal:

You see, an exhibition, above all, it should inform, shouldn't it? Especially with the objective it has with the Mobile Science project. Art itself doesn't ask for anything, it's done for you to be fulfilled, but within this project I tried as much as possible to create, to contextualize all the paintings of rivers in relation to their historicity, geography, various aspects, the question of science, so that school children could get information, as much information as possible about the question of rivers, our Brazilian rivers that are so endangered at the moment by pollution. (A1)

In terms of how they critically recognize their role in the dynamics of development and involvement in artistic activities with Mobile Science, the participants see their undertaking as going far beyond the esthetic question. As pointed out by Zhu, Davis and Carr (2021), it is exactly in the aspects of affectivity and the emotions that the visual arts and photography can awaken a critical awareness in the population with regard to science, but particularly about the dimension of environmental impacts.

[...] I think it is very important for the artist to position himself in front of the public [...] not just in relation to beauty, the image [...] creating something that awakens something in that person who is receiving you. Because art can serve various purposes, such as a form of protest [...] and I believe that painting the rivers mainly showing what they were like in the past, what is happening today, is a very valid way for me as an artist to position myself in relation to all these difficulties that we are going through today with the question of environmental accidents, of all this pollution. (A1)

These activities should not be seen as extraneous or carried out in an amateur way, but rather as an essential part of the experience of the traveling museum. They allow us to reach dimensions that would not be accessed in other ways by science communication activities, thus forming a unique product that allows us to know about, reflect on and question science, starting from cognitive, affective and emotional dimensions. In this context, the interviewees propose responsibilities and political dimensions for their work, as a possibility of generating real mobilization that, by means of pleasure and entertainment, ends up provoking a strong reaction.

It's our function in all of this, what a beautiful thing, isn't it, how beautiful it is to think, it's a huge privilege when you stop and think, because the function is to take on this responsibility [...] Taking on this seriousness, this responsibility, this sense of importance, this information, this entertainment, this pleasure and this provocation at the same time [...] (T2)

FINAL CONSIDERATIONS

This research sought to understand the transformations, potentialities and rich experiences that arise from integrating artistic activities and science communication actions, especially those produced in an itinerant context. If the literature on itinerant science communication is scarce, it is even more restricted when talking about the relationship between art and science, despite the enormous potential in this, and the different initiatives that are already underway, revealing a rich field for new studies. Although the present research analyzes a specific initiative, we understand that the challenges and reflections are relevant for other projects, as they reveal a common context. The investigation focused on

the view of professionals from the artistic field and also the understanding of the transformations in the science communication team itself, as this is another aspect that merits exploration.

Itinerant actions are presented as a strategy for social inclusion that is fundamental to science communication. They allow populations that rarely have access to the goods and facilities of science culture to encounter these. The itinerant characteristic allows us to reach this public, who are historically excluded from these resources, either by physical barriers such as distance, by the cost of an entrance ticket, by the lack of time to go to such places, or by invisible dimensions, such as cultural codes and the preconceptions of the teams who carry out such activities (DAWSON, 2014).

[...] access is denied to so many people, like there's a thing that they might go to, and they think they don't really have to right to go, you know? This is really crazy, because the person thinks that he doesn't have the right to it, it's not for him, is it? [...] This already [...] creates a kind of resistance, like it's really symbolic because in a country that is so completely excluding, the person has a thing that is actually for him, and he thinks it isn't for him, he feels he doesn't have the right to make use of it, you know? (C2)

By giving access to culture in a broader way, in an interaction between art and science, itinerant projects reinforce their role in popularizing culture and knowledge. As we have seen in the reports presented in this work, this interaction allows richer communication arrangements to be built up, ones that allow us to break down barriers to access (MATIAS *et al.*, 2021). These arrangements favor the construction of models for science communication that go beyond the unidirectional model for transmitting information, building up actions that stimulate dialogue, criticism and the perception of knowledge in a cognitive but also affective and emotive way. This is only possible due to the context of intense interaction between the different professionals who are involved, which ends up functioning as a continuous learning process within the action itself. Incorporating this in a more organic way into learning and training processes for the itinerant teams would broaden the potential for interaction between art, science and the professionals themselves.

Another aspect that deserves to be highlighted is the perception of the artists regarding their work in the itinerant context. All the interviewees spoke about reflexive and critical dimensions to the way in which the production and presentation of their work, be it in performing or visual arts, involved esthetic, social, and scientific processes, not to mention principles dear to Fiocruz itself, such as the defense of equitability and of full citizenship. Art and science actions in the realm of itinerant science communication bring a range of new meanings and significations to the artists' work to places where these actions take place, as well as to the population that gains access to the dialogue between art and science.

This movement has immense potential, but it also presents challenges, such as the experience of traveling together with people who deal differently with unpredictable events (artists, generally, find it easier to live as a community), logistical problems, unexpected reactions from the audience, and even funding issues. As seen here, these difficulties are understood as being less important than the result of the work, which not only produces an effective action, but also allows the actors involved to grow. Thus, dealing with these challenges is made easier by

the willingness of the participants, especially the artists, to collaborate and participate in itinerant actions, given that this perspective of actively seeking the public was already present in their professional actions, as we can see in several of the interviews. However, even considering this previous experience, none of the participants – artists or science communicators – is the same after this process of collaboration. In this way, we understand that this model of interaction between art and science is one that can be honed and replicated by other itinerant projects.

After all, what would be the role of art traveling with science?

I think it is to humanize science, right? (C1)

Divulgar ciência é uma arte! O que dizem os artistas que atuam em um museu de ciências itinerante?

RESUMO

O recorte de pesquisa apresentado nesse artigo buscou investigar as visões e percepções de artistas inseridos no contexto de um museu de ciências itinerante sobre a divulgação científica, o papel de intervenções artísticas que viajam junto a esse museu e suas próprias participações nessa dinâmica. O Museu da Vida Fiocruz (MV) se notabiliza por conceber e oferecer ao seu público, desde sua criação, em 1999, ações educativas que promovem o diálogo entre arte e ciência. Não diferentemente, o Ciência Móvel (CM), a unidade móvel do MV, inaugurou uma nova temporada de atuação em sua itinerância chamada de “Arte e Ciência sobre rodas” em 2013. Essa nova configuração buscou a inclusão sócio-artístico-cultural em suas viagens a cidades do sudeste brasileiro. Desde então, houve a ampliação e diversificação das intervenções artísticas que acompanham esse museu itinerante de ciências. A questão de pesquisa que se coloca é sobre quais são as visões sobre divulgação científica desses artistas envolvidos nessas atividades. E mais, quais são suas percepções, enquanto profissionais das artes cênicas (teatro e circo) e visuais, sobre o papel das artes em um contexto de itinerância e sobre suas próprias inserções e experiências nesse processo. Para isto realizou-se entrevistas com 09 (nove) artistas envolvidos nessas atividades desenvolvidas no âmbito do CM, que ainda estavam ativas na dinâmica de viagens antes da suspensão das atividades pela pandemia da Covid-19. Para a análise das entrevistas, utilizou-se metodologia qualitativa a partir de um processo intuitivo de imersão e cristalização (STEWART; GAPP; HARWOOD, 2017). Os resultados apresentados consideram as dimensões anteriormente citadas e levantam algumas das potencialidades e oportunidades que uma iniciativa do tipo museu de ciências itinerante oferece para essa interface entre os campos das artes e da divulgação da ciência, ainda que desafios sejam reconhecidos. Os entrevistados refletiram sobre os próprios objetivos das atividades de divulgação científica – dos mais concretos aos mais simbólicos -, sobre como a arte se funde a isso e amplia horizontes, e sobre como se veem partícipes e envolvidos nesse trabalho. Ao final do trabalho, conclui-se que as ações itinerantes se apresentam como uma estratégia de inclusão social fundamental para a divulgação científica e cultural de produções brasileiras, permitindo estar ao alcance de populações que frequentemente não têm acesso a bens e equipamentos de cultura. Ao permitir o acesso à cultura de forma mais ampla, em uma interação entre arte e ciência, essa atividade itinerante reforça o seu papel de popularização da cultura e do conhecimento. A interação entre arte e ciência permite a construção de arranjos comunicativos que favorecem o planejamento de atividades de divulgação científica que vão além do modelo de déficit, que favoreçam o diálogo, a crítica e a percepção do conhecimento de forma cognitiva, mas também afetiva e emotiva.

PALAVRAS-CHAVE: Itinerância. Museus itinerantes. Arte e Ciência. Ciência Móvel.

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NOTES

1. Fiocruz for you [Fiocruz pra você] is an event that is promoted by Fiocruz and that has been taking place since 1994 on its campus. The objective is to stimulate vaccination of the population, linking this to a supply of various cultural activities, science communication and health promotion.
2. See, for example, the initiative by the Ontario Science Center showing a traveling exhibition about circus at <https://www.ontariosciencecentre.ca/exhibit-sales-rentals-plus-consulting/travelling-exhibition-rentals/circus>, accessed on 20 June 2021.
3. See, for example, the work of The Circus Science Spectacular at <https://www.glberg.com/roster/The-Circus-Science-Spectacular>, accessed on 20 June 2021, and of the Science Circus at <https://www.sciencecircus.org/>, accessed on 20 June 2021.

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