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The collaboration in the production of *Life of Galileo* in a science museum in Rio de Janeiro

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Abstract

Science and theatre have a long history of interactions, which usually promote collaborations between artists and scientists. Focussing on the theatre performed in the context of science communication, this article aims to analyse the collaboration between artists and scientists in the production of the play *Life of Galileo*, by Bertolt Brecht, at the Museu da Vida. Based on the interviews with 12 people involved in the production, we identified a strong involvement in the project, which provided a rich exchange and knowledge acquisition, in addition to raising relevant questions about the theatre performed in the specific context of science communication.

Keywords

Science and technology, art and literature; Science centres and museums; Science communication in the developing world

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Introduction

Science and theatre have a long history of interactions, whose origins date back to the emergence of theatre in Ancient Greece, particularly tragedy and its questions about knowledge and power [Almeida and Lopes, 2019]. Since then, science, scientists, their lives, and achievements have inspired playwrights. Based on the work of researchers who committed themselves to mapping theatre work inspired by science, today we can identify more than a hundred plays with a scientific theme, produced and staged in different countries, at different times. In her book *Science on Stage*, Shepherd-Barr [2006] lists 121 science plays produced since Christopher Marlowe's *Doctor Faustus*, in 1604. The collection by Marvin Carlson and Brain Schwartz[1] — with 145 entries, many also present in Shepherd-Barr's list — includes plays from before the Christian Era, such as *The Clouds*, a comedy by Aristophanes staged in 423 BC, in Greece.

Despite the lists covering a broad time range, they both stand out for including a large number of plays produced from the 1990s onwards, when, according to

[1] http://scienceplays.org/.

Shepherd-Barr [2006], a particularly fertile production of plays with scientific themes began. When analysing this phenomenon, Shepherd-Barr [2006] suggests a categorisation of the plays that emerge in this context. An expressive group of them would result from the interest of playwrights in exploring science in their work. Others would fit into the set of plays written by scientists fascinated by the potential of stage to transpose scientific ideas. A third type of science plays would be used in the documentary theatre format. Finally, the researcher includes in this most recent phenomenon the plays produced through collaborations between playwrights and scientists, in which she identifies a stronger integration of real science into the theatrical texture.

Barbacci [2004] separates the productions between those in which theatre is used as a means to convey scientific ideas and concepts and those that borrow elements from the scientific universe, while maintaining their aesthetic and artistic essence. The first group would include the productions for didactic purposes and those derived from the tradition of scientific conferences. The second group would include the performances that raise ethical questions related to science, point to an existential reflection, stage biographies of scientists or episodes of the history of science and that use certain fields of science to support the artistic creation.

Considering the key role that science and technology play in today's society and their increasingly visible and tangible impacts, it is not surprising that there is an ever increasing interest in the artistic environment to portray science and, from it, discuss and reflect on the human condition. However, an important part of the current growth in science plays stems from an increasing interest of the academy in the use of art as a strategy to bring science and society together. For professionals in the field of science communication, approaching art is seen as an opportunity to reach new audiences and engage them in science in a more significant way [Lesen, Rogan and Blum, 2016]. In this scenario, scientific institutions and research funding bodies play a central role in investing in projects and spaces for the integration of science and technology with different forms of art, promoting the creative collaboration among them [da Silveira, 2018].

Although it is not yet possible to accurately characterise the set of science theatre initiatives developed in the field of science communication, we can state that it is marked by a great diversity regarding themes, genres, formats, objectives, venues, involved professionals and playwriting [Almeida and Lopes, 2019]. It can also be said that, often, such initiatives are less concerned with the quality of the artistic product resulting from the interactions between science and theatre, and more interested in the opportunities they create for the collaboration between the artistic environment and the scientific environment [Dowell and Weitkamp, 2011], even though a balance between these elements is often sought.

When artists and scientists collaborate

Playwright Bertolt Brecht maintained a strong relationship with science and scientists. Known for supporting a more politically engaged theatre, Brecht was also an advocate of the need for science communication and reflected on the relations between social inequalities and the fact that working classes had poor access to science. He was an intellectual who interacted with thinkers from various fields of knowledge, particularly in the process of creating the play *Life of Galileo* (German: *Leben das Galilei*). Written over the course of 19 years, in three different

versions [Turner, 2006], the play drew on the contribution of different scientists [Schroeer, 1980].

In addition to being considered one of the most emblematic cases of science portrayed on stage — and a classic in the field of science theatre — *Life of Galileo* has been also, since its creation, an example of intense collaboration between artists and scientists. This type of collaboration is one of the aspects of theatre in the context of science communication that has been analysed in the relevant literature.

Dowell and Weitkamp [2011] studied the process of collaboration between scientists and theatre professionals in the U.K. The authors point to these interactions as a process with high collaborative potential, but also with some degree of difficulty, because of the differences between communication styles, work processes, temperaments, among others, leading to a constant negotiation between the parties involved. In their research, they point to the need for a consultancy to ensure the accuracy of science and scientific processes represented as one of the most important motivations for the collaboration. In addition, they highlight that, superficially, this process of collaboration seems to be aligned with a deficit model in the field of science communication, but there are nuances in the interaction that lead to far more interesting arrangements.

Within this direction, Pinto, Marçal and Vaz [2015] report an experience in which young scientists participated in a project of stand-up comic performances on scientific themes. In this case, the scientists played a key role in the collaboration, because, in addition to writing the script of the performance together with a professional actor, they acted throughout the entire project. The authors point out the importance of collaboration for the success of the activity, which required a large investment of time by researchers due to the highly interactive process among the professionals involved. As a result, they notice professional development in many areas beyond the one specifically considered in the project.

Ball [2002] points out other potential resulting from the participation of scientists in theatre performances. The author analyses productions in which scientists collaborated on visual and aesthetic aspects, in some cases on the border between theatre and artistic installations. The author aims to show ways in which science and theatre can collaborate and go beyond the mere insertion of scientific topics into the script of the plays. This type of production requires a more organic collaboration with scientists because it is not limited to the preparation of the script, but it involves all aspects of the staging.

In Brazil, various science museums use theatre as a strategy for science communication. Moreira and Marandino [2015] identified in the country at least 14 institutions of this type that carried out theatre activities. The authors observed that most of them were performed by people without previous training in performing arts and were carried on temporary basis. These initiatives would have emerged in these spaces as a response to the need to diversify their strategies of science communication, the desire for varied activities, and the availability of professional theatre groups or individuals willing to use this language. Based on Barbacci's categorisation [2004], Moreira and Marandino [2015] classified the theatrical activities offered by Brazilian science museums as didactic support. Despite recent attempts to map theatre in the context of science communication in

Brazil, the literature on this subject is still limited and little attention has been given to the collaborative processes it triggers.

Methodology

The purpose of this article is to analyse the collaboration between artists and scientists in the production of the play *Life of Galileo*, by Bertolt Brecht, at the Museu da Vida, in order to contribute to the discussion about theatre in the context of science communication. The show premiered in September 2016 and was part of the museum's programme until July 2018, having been seen by 7,077 visitors. We are particularly interested in understanding how the subjects involved see and evaluate their participation in the project and what their thoughts are about the final outcome of this partnership.

For this, semi-structured interviews were conducted with 13 people involved in the production of the play: five were members of the in-house team of the Museu da Vida — two physicists, a social scientist with a background in theatre, and two performing arts professionals — and eight had been hired specifically for the show in question — a theatre director and seven actors. Those linked to the Museu da Vida held different positions in the institution and played different roles in the theatre production. All interviewees were chosen due to their (high) level of involvement in the production of the show. As one of them is the second author of this article, his interview was excluded from the final corpus of the study, consisting of a total of five interviews and 12 people (Table 1).

Table 1. List of interviewees and their relationship with the project.

Identification	*Gender*	*Training field*	*Role in the production of the show (according to technical data sheet)*	*Type of interview*	*Link with the institution*
S1	F	Social sciences and Theatre	Idealization, text adaptation and scientific consultant	Individual	Permanent
S2	M	Physics	Scientific consultant	Individual	Permanent
A1	M	Theatre	General direction, adaptation of the text	Individual	Temporary
A2	F	Theatre	Idealization, adaptation of text and performance	Group	Permanent
A3	M	Theatre	Idealization and performance	Group	Permanent
A4	F	Theatre	Acting	Group	Temporary
A5	F	Theatre	Acting	Group	Temporary
A6	F	Theatre	Acting	Group	Temporary
A7	M	Theatre	Acting	Group	Temporary
A8	M	Theatre	Acting	Group	Temporary
A9	M	Theatre	Acting	Group	Temporary
A10	M	Theatre	Acting	Group	Temporary

The five interviews were conducted in person, in Portuguese, by the first author of this article — without being involved in the production — after the premiere of the show. Three were individual interviews — one with the director, and one with each scientific consultant separately — and two were group interviews — one with two members of the in-house team at Museu da Vida who performed in the play and the other with the seven actors hired for the show. Different scripts were prepared for each of the interviews. However, all of them addressed the central issues of this study: why/how they became involved in the project; what relationship they had with the institution and the play; what role they played in designing the show; how they saw their participation in the production of the show; what their highs and lows, losses and gains, main difficulties and challenges were; and how they evaluate the final result of the work. For those who were linked to the Museu da Vida, the script also included questions about the original project regarding the production of the play. The interviews lasted an average of 1 h 09 min each, for a total of 5 h 46 min of audio material. All material was transcribed in Portuguese for analysis purposes.

The choice of the semi-structured interview method, which presupposes the use of a flexible script of questions, provided privileged access to the unique experiences the research participants lived. Based on the precepts of constructivist social research, this study recognizes the social, relative and constructed nature of these experiences [Wertsch, 1985], and the influence that the choices of researchers and the contexts in which the interviews are conducted have on the results of the research [Fontana and Frey, 1994].

The transcribed material was analysed qualitatively according to immersion/crystallisation techniques, an interpretation style in which the researchers examine the data thoroughly and then extract from it the aspects considered most relevant to their study [Borkan, 1999]. This method of analysis was chosen because it allows the collected data to be combined with the researchers' experience. The fact that one of the authors of this article was directly involved in the production of the show was considered valuable for the best interpretation of the data and results that will be presented — as reported in Pinto, Marçal and Vaz [2015].

The project and its historical and political context

Life of Galileo was produced at the Museu da Vida, a science museum of the Oswaldo Cruz Foundation (Fiocruz), a scientific institution in the field of public health. As a space for science communication, its mission is to promote public dialogue in science, technology and health and its historical processes, aiming at promoting citizenship and improving the quality of life. It is located in the North Zone of Rio de Janeiro, in a region of predominantly low-class population, which is home to some of the largest slums and the neighbourhoods with the worst quality of life indexes in the city.

One of the museum's spaces is the Virginia Schall Science Tent, where science theatre plays regularly take place. To plan and perform these shows, the Museu da Vida has a permanent team of professionals trained in the artistic and scientific area who work in the different productions.

In 1970, ten of Fiocruz's most notable researchers had their civil and political rights deprived by the military dictatorship, and were forced to abandon their laboratories, projects, and students overnight. In 1986, the ceremony of reintegration of these researchers to the institution was marked by the staging of an excerpt from the play *Life of Galileo*, by Bertolt Brecht, a fact highlighted by one of the members of the museum team who had participated in the project:

> S1 — (...) in 1986, (...) a passage of the play was staged, which is the excerpt of the little monk. A very important passage in the play, which discusses science and ideology. As the production of this play today, in 2016, also has to do with the reintegration of the persecuted scientists.

The project was a way for the institution to commemorate 30 years of this reintegration, pay tribute to its researchers and highlight that the German playwright's text was still ever so current, emphasising the danger that authoritarian regimes pose to the development of society. In this production of the play, first-person fiction statements based on the Fiocruz's oral collection were introduced about the life and work of the persecuted scientists. In addition to telling a little bit of the history of the institution and science in Brazil, the statements contributed to a closer relationship between the German play and the Brazilian public.

To stage the show at the Museu da Vida, different adaptations were made, starting with its extension. The original play is about three hours long, but the proposal was that the museum's visitors could watch the show during their visit. Thus, the duration of the show was reduced to 1 h 15 min and the debate with the public, which would normally take place after the performances, was removed. Considering that most of the audience tends to be of young age, attempts were made to form a young cast with whom visitors could identify themselves.

Another peculiarity of the production under analysis is the troubled political context in which it was carried out. During the period when the project took place, the Brazilian political situation changed radically. During the interviews, the political events of the country, in close dialogue with Brecht's work, were brought up at various moments by different interviewees. The excerpt below, taken from the interview with the director of the play, describes one of these moments:

> A1 — Because it's a fragile moment for the Brazilian democracy now, I think. What will be left of all this, right now that we're putting everyone on the fire? In a way, there are things that are really horrible. But it's a very scary moment, which could come. I'm really scared. I think we can get into something really bad. Like a fascist regime. Like a radical right-wing thing. I'm really scared about that. And scientists and artists lose a lot in those moments.

The transformations in the Brazilian political scene were not on the horizon when the project of the play was first conceived. However, they were constantly reframing the show throughout the process of creating and making the production, giving it new meanings, and reinforcing others that characterise Brecht's original play.

The subjects and their participation in the production

The design process of the show began in 2014 and involved several subjects and stages until the closing of the project in 2018. Between 2014 and 2015, the project was conceived, and the funds were raised. In 2016, between March and May, there were meetings with the aim of planning the stages. In May, the director was invited to join the group. Between April and June, the text was adapted, first only within the institution's team and then with the participation of the director. The cast of the play was defined in June by means of a test with guest actors. The show rehearsals took place over a period of two months, between July and September 2016.

During the first two weeks of rehearsals, there were a series of discussion meetings — involving scientific consultants, artists and the design team of the project — to discuss Fiocruz, the Museu da Vida, science communication, Brecht, Galileo and his science, including sessions at the museum's inflatable planetarium. In addition, educational materials were developed to help artists understand the play and its context. These meetings, led by the scientific consultants of the show, were held sporadically throughout the following period of daily rehearsals, which lasted until its premiere on 21st of September. After the premiere, the actors continued to get together and discuss the play, and some rehearsals took place. Although the adaptation of the original text was finalised before the rehearsals, it continued to be modified, including the insertion of the testimonies of the persecuted researchers of Fiocruz — which involved the direction, the entire team of actors and one of the scientific consultants — and even during the season.

The relationships between the subjects

Throughout the project, there were several moments of interaction between the members of its teams. Among them, the rehearsals, and particularly the discussion meetings, had great prominence in the interviewees' statements. As this was a very diversified group in terms of its background and relation with Fiocruz, these meetings, besides being key to understanding Brecht's work, Galileo's life and physics, and the history of Fiocruz, would also be fundamental for the bonding of the teams and to generate productive collaboration among their members. For the director, the discussion meetings were central to his better understanding of the play:

> A1 — He [the scientific consultant] is great. This guy's an angel. I used to study at home, too. But there is one thing: if you're going to talk about Galileo, about Brecht, you're never prepared for [...]. So, I got closer to this universe. But I don't think I've got there prepared. Because there is a lot to study.

The actors emphasised the importance of the knowledge they acquired:

> A2 — He made maps and maps of who the real characters were, who the merged characters were [...] and why. [He addressed] the [different] versions [of the play]. An amazing thing.
>
> A3 — We had the opportunity here to study a bit of physics and astronomy effectively and, damn it, we're talking about something that we observe every day. And when you are at school the thing gets so limited. It looks like a complex calculation. The thing is explained in a language different to mine.

For the scientific consultant, the meetings were very great, especially for the engagement they were able to generate in the artists involved:

> S2 — For me it was magical, it was very magical, they were very involved, very curious, and the group was so diversified, so there were several levels, and I think that somehow my attempt to link Galileo's text with Brecht's text, with some lines, motivated them even more to understand what I was saying, that they would need to build the scene, with voice, and play.

For him too it was an opportunity to closely get to know the theatre mechanisms and the artistic processes involved in a theatre production, which led him to understand and respect the choices of the direction more:

> S2 — I followed some moments, for example, rehearsals, music production, also understanding a little bit the work behind the scenes. That's why I said, when I started seeing all these things, I saw that you couldn't introduce Galileo's projection in the middle, no, because there's no space or time for it.

The rehearsals were also pointed out as important moments of communication, especially among the actors. According to them, on these occasions they discussed the content of the play a lot, the staging itself and the political context in which it was staged, so that they were increasingly grasping the text and the show. These interactions have intensified throughout the performance season, with the stage experience and the exchange with the audience, which led to certain text adaptations:

> A7 — I think there is a validity part that, in this cast here, at least it was my perception, is that we listen to each other a lot. At least I listen a lot. If they come to tell me a criticism and I agreed with it, and normally I, before even disagreeing, I'd try it out to see if it rolls, I experiment.
>
> A10 — There is no such thing as debuting the show and it's ready, and we will not change anything. I think the rehearsal process is such an intense process that has so many issues involved, so many things need to be ready, even if the ready is never ready, that I think that sometimes when the play premieres, we start to take care of these smaller things, you know? [...] And then it starts changing and adapting.

When taking stock of the collaborative process, the interviewees tended to evaluate it positively, highlighting exactly the productive interactions between the teams, the friendship built throughout the project and the feeling of having participated in its development. The following two excerpts — one from the museum's scientific team and the other from the "guest" artistic team — illustrate the harmony of the process well:

> S2 — At first, I was a little afraid because of this, because it's a lot of content, they're actors, I don't know to what extent they are super involved, [...] but they were very engaged, the discussions were high level all the time, and at the same time pleasant, we had a lot of fun. [...] I think that everyone was so passionate about the thing, that the meeting was wonderful, and those three

> days were more than enough for everyone to feel like they're really part of the process.
>
> A1 — Dude, you know what's amazing? Because I just don't know what happened. I got along very well with everybody. I really did. [...] I don't know, maybe because I'm an outsider [...]. The loving encounter could take place without a break. Because it's a date thing. It's a date [...]. And it was cool because everybody became friends. Everybody close. A super professional environment. Super ethical.

Despite the harmonious atmosphere that surrounded the project, in some statements it was possible to identify limitations and difficulties encountered throughout the process, as well as implicitly present tensions related to the roles played by the team members and the results of the work.

From the director's point of view, considering that he was working for the Museu da Vida, in its theatre space, he had to deal with certain demands and limitations in his creative process, which, however, he regarded as positive. Because the museum has its own artistic team, he also seems to have been afraid to be seen internally as a threat:

> A1 — I'm not threatening anyone. I'm not taking anyone's place. I'm a theatre director who works out here. I have been asked to get there and do a job, and then I'm going back to my life, you know?

Regarding the in-house artistic team, it was possible to notice a quarrel over the high resources involved in the production of the show — considerably higher than previous budgets — and about the team members not being more directly involved in the process of artistic creation:

> A2 — We would participate, always with this need for us to be around, because we know the work here and it is also not the work that is done in the market. It's not the same audience, it's not the same goals, it has other characteristics. Our line is always the popularisation of science [...]. So, we stay here in this team, from the beginning, offering support, you see, but not as artistic creators.

According to one of the interviewees, this would have resulted in a high-quality aesthetic product, but with shortcomings with regards to the Museu da Vida's mission of science communication.

The relationships of the subjects with the play

Given the already discussed relevance of *Life of Galileo*, it was to be expected that the interviewees would know the play, although they revealed different previous experiences with it. Although the perceptions and interpretations about it also varied among them, an almost unanimous piece of feedback was that it is a difficult text, with many layers and, in a way, also confused by the excess of characters. This last point was highlighted by the director of the play, who said he had to read the text a few times to understand who each of the names mentioned in the play was. For the actors, the difficulty is more to be attributed to the content of the text, to its density, to the fact that it deals with several complex and profound subjects, as shown in the following excerpt:

> A7 — It is a text that has lots of layers, full of ramifications, that deals with several different topics. And if you look at it, you're going to find a lot of complex things yourself, intrinsic, social, and political problems, issues that belong to the human condition itself.

One of the actors mentions that he had to read the text several times to understand it but found this difficulty to be a positive challenge.

> A10 — [. . .] I imagine that for a person who looks at it for the first time, these questions and difficulties suddenly appear. And I think it's a very big challenge for you to put together this, such a difficult text, for an audience that maybe never went to the theatre in their life, you know? There are many people who have never had experience with theatre. So, I guess, that's the best.

According to one of the actresses, the inclusion of the statements of Fiocruz' researchers, who had been persecuted during the military dictatorship, added another layer to the show, which may have made the show even more difficult to understand.

In addition to this shared perception among the interviewees about the difficulty of the text and the complexity of the show, we found that there were different interpretations about their central messages. For some, the work is about the role of science and the scientist in society. For others, because of the dialogue with the political context in which it was staged, the play is an ode to democracy, against authoritarian governments. Within this view, some believe that the play is a warning that democracy is not guaranteed, that it needs to be reaffirmed by society. For one of the actresses interviewed, the message is "be wary of the obvious". Finally, for the director of the show, the message that remains of the play is more subjective and is related to its form:

> A1 — [. . .] how fear prevents such incredible things from happening [. . .] I think that's the message of the play. Look at what people, when they're afraid of something different, new, they're capable of, out of paranoia, going crazy and doing horrible things. I think that's the most interesting thing for me.

According to the director, the fact that the show offered multiple interpretations seems not to have been a problem, however, for one of the artists in the team of the Museu da Vida the option to keep the work so open was criticised, especially for not suggesting a preferential reading the public could make. For her, the production should have chosen one of the interpretative layers of the play:

> A2 — Because you can speak Galileo, and you can talk about a lot of things, right? You can make a Galileo to talk only about Nazism. You can make a Galileo to do only a "Wikipedia Galileo", a kind of biography. You can only focus on the issue of the Catholic Church. You can [. . .] make a construction that will reinforce the things you want to draw attention to, and the way you want. So, this is all very generic here.

The relationships of the subjects with the public

As it can be noticed from the excerpts reproduced in the previous section, the complexity of the work and the multiple interpretative layers of the show generated concern in the interviewees in relation to the public. There was a recurring question as to whether visitors to the Museu da Vida, especially young students — most of them were resident in poor neighbourhoods of the city, having little familiarity with the theatre and probably also with the play, and having not necessarily chosen to attend the show — would be able to understand it, absorb its various layers and have a culturally and scientifically enriching experience. Considering this shared concern, various strategies were aimed to overcome the difficulties the play presented and to facilitate its comprehension by the public.

During the adaptation of the text, in accordance with one of the creators, it was sought to shorten long and dense monologues and choose the humorous scenes of the play as much as possible, keeping in mind today's young audience, hyperconnected and accustomed to quick messages and short texts. From the point of view of the artistic team, humour played an important role in trying to make the play more palatable to the audience. Regarding the direction, the strategy was to exaggerate some traces of the characters, creating a dramatic tension that flows into the comedy. For the director, this humour is important, as it takes a little weight off the play. Regarding the acting, there was a particular effort dedicated to the scenes of physical humour, to make the work lighter and capture the attention and empathy of the spectators.

In his interview, one of the scientific consultants said that he would have liked to have offered complementary activities to the play aimed at the public and teachers, to explore some of its contents and layers more in depth. The other members of the in-house team of the Museu da Vida also expressed the need they felt to offer something complementary to the show, to have a more direct contact with the public, which, in general, happens through a debate at the end of the show. This caused discontent among these interviewees, because they regarded the meeting with the public as fundamental, particularly for this show.

> A2 — Because if you put on a show in other venues, you have a synopsis [. . .]. You read it, and you'll see if you like it. So, it already is part of what you are interested in. If it interests you, if you're curious to go, you'll watch. Nobody forced you to go and watch the show. So, here, we have this peculiarity. The spectator doesn't know, they don't have to know, that the show is about. . . , that it took place during the Inquisition. They don't know what the Inquisition is. They just don't. You must tell them something.

Given the impossibility of the debate, one made the most of the moments in which this more direct contact with the public occurred, particularly during the few minutes between the entrance of visitors in the theatre and the start of the show. The lack of the debate with the public would also have deprived the team of a more immediate return of the spectators, which had made it difficult to know if the objectives of the project had been met.

Despite concern about how the play would be received by the public, some interviewees — especially artists not linked to the Museu da Vida — argued that

this is a complex issue and that a significant experience in the theatre does not necessarily imply an immediate understanding of the content of the show. For example, one of the actresses interviewed draws the attention to the fact that the audience adheres to the proposed theatrical game, accepting the codes and conventions of the play, and recalls that some spectators are particularly open to the theatre experience.

Another actor interviewed argues that the understanding of the show by the audience is not necessarily instantaneous, that it can take time for it to happen, in addition to it happening in a different way for each person. For him, more important than understanding the whole content of the play is to engage with it; its understanding can come later. In general, these artists tend to see the theatre more as a means and less as an end, as shown in the following excerpt:

> A3 — [. . .] So, more than worrying about being understood, we need to understand that we need to be a tool for this aim. That's part of the construction. We must understand this as a means, not an end. If not, it's too risky, you know? If I think it needs to get a result and so on, then I give up completely.

Discussion

Based on the literature reviewed in this article, we can state that the theatre of the Museu da Vida does not fit easily into the categories used to classify the interactions between science and theatre, since it is neither purely an aesthetically and sophisticated theatre inspired by science, nor a theatre focused on content used to convey scientific concepts and arouse interest in science. Nor is it considered in the overview outlined by Moreira and Marandino [2015], to the extent that it is a permanent activity of the museum, developed by an in-house team made of theatre professionals, not necessarily tied to the themes of its exhibitions. Perhaps *Life of Galileo*, in particular, can be among the work produced through collaborations between playwrights and scientists, which, according to Shepherd-Barr [2006], have a strong integration between real science and theatrical texture.

However, more important than categorising it, it is necessary to appreciate the peculiarity of theatre activities that take place in the field of science communication. This article aims to contribute to the discussion in this sense, by addressing some of these particularities, but also by showing how singular contexts — institutional, sociocultural, geographic, etc. — influence how these collaborative practices occur in each space. Although it is based on a specific and situated case, we believe it raises important issues for those involved in similar initiatives.

When analysing the collaboration between artists and scientists, we identified a strong engagement of the subjects with the project, considered relevant and timely by the interviewees, particularly in the political context in which it was carried out, giving the work new meanings and interpretations. The reports collected and presented in this article show a multidisciplinary, dynamic and symbiotic process of cooperation, in which professionals from different areas and specialities used their specific functions and participated in several stages of the project, benefiting each other from this collaboration. This data corroborates the work of Dowell and Weitkamp [2011], as it reveals a rich and complex exchange, involving knowledge and learning that go beyond the individual role of each one in the project. As

highlighted by Pinto, Marçal and Vaz [2015], this collaboration required an intense involvement on the part of the team members, also demanding a considerable time commitment. In this case, it was only possible because the project was carried out by an institution that had professionals and financial resources to ensure its implementation.

In the case analysed, we observed that this exchange of knowledge and learning led professionals in the artistic field to a better understanding of the scientific field throughout the project. The hired artists, in particular, also experienced an immersion in the field of science communication, which made them face challenges different from those they usually face in their daily work in the theatre industry, enriching their experience as an artist, as they themselves reported.

The science professionals involved in the project — all of them already involved in the field of science communication — expanded their knowledge about the entire complex dynamics of theatrical production, which not only fascinated them, but also, and more importantly, led them to better understand the choices made throughout the project, even though they left out some aspects and content that they thought were important. In general, the subjects involved felt active participants in the process and saw their work in the final product, that is, in the staging of the show.

Despite a general positive perception of this collaboration, frictions and divergences were not completely absent from the process — which is not uncommon in collaborations of this nature, as Dowell and Weitkamp [2011] report. In our study, the main disagreements identified are more associated with the different ties of the subjects with the institution promoting the project than with the different disciplines and competencies involved, and mostly relate to the concern of the artists linked to the Museu da Vida with how the show would be received by its visitors. The impossibility of interacting with the spectators would have deprived them not only of a way to contextualise the play and have a discussion about its messages, but also of an immediate response of the public about their theatrical experience and appreciation of the play.

The artists without any ties to the Museu da Vida also expressed some concern about the complexity of the play and its understanding by the public. However, they tended to see the issue as an interesting challenge and sought solutions for it in their artwork. According to these artists, more important than the immediate reception by the spectators — that is, their understanding of the text of the play — is their aesthetic experience in the theatre. More than control over the messages of the show, they value the interpretative freedom of the play. More than objective and short-term results of the play on the public, they believe in long-term subjective effects and are satisfied with that. This perception — that aesthetic experience is more important than the text itself and its understanding by the public — is described by Ball [2002].

It is worth mentioning that the presence of theatre in a museum also offers specific aspects in relation to its reception by the public. In general, visitors do not exclusively watch the play, but have a more complex experience within its cultural space. Even if they come exclusively to watch the show, the atmosphere is necessarily different from that found in a theatre. The experience that the viewer

has is not indifferent to this environment. On the contrary, it defines how the play is received and it deserves to be investigated further, because it may provide answers to many of the concerns raised by the theatre professionals who work in museums.

Final considerations

The divergencies identified in this study can show a lot about the expectations for the way spectators may receive the theatre work. The audience's view is a key issue for science communication, which needs to be explored more in detail — beyond the evaluative dimension — in research on theatre conducted in this context. In this sense, it is worth mentioning that a reception study was carried out with the spectators of *Life of Galileo* in the Museu da Vida, and its results will be presented in a separate publication later.

It is important to emphasise that such divergences are far from being an obstacle to collaboration, which occurred organically and was considered positive and stimulating by the subjects involved. On the other hand, they reveal important issues that are at the heart of the debate on theatre in the context of science communication and deserve reflection. Although there is often no clear distinction between "science theatre" staged within and outside the scope of science communication — whereby categories and terms are easily confused — our results indicate that there are peculiarities in this type of theatre, even when there is concern in balancing science and art, content and form. In the case reported in this article, we noticed that there was, on the part of the professionals linked to the institution, an attempt to adapt the production to the logistics of the museum, its visitors and its mission to communicate science. Therefore, we argue that intentionality should be an important criterion for defining and establishing a space specifically focused on the study of this theatre, regardless of how this is named.

It is worth pointing out that the theatre that is performed outside the context of science communication responds to other requirements and is evaluated differently, following the logic of the field of arts, in which the success of a show is measured by critics and box office figures and the immediate return of the public becomes tangible in the theatrical game during the show and in the applause at the end. Moreover, in contemporary theatre, there is hardly any intention of control over the public and over their theatrical experience and the performing arts are rarely expected to have an immediate result with regard to the transformation of the spectator and society. In the field of science communication, there is an increasing expectation to measure and prove the immediate transformation of the public — be it in a greater knowledge of a specific subject, or in a citizen more engaged in science. The measurement and proof of this transformation have functioned, in this field, as a certificate of efficiency.

We can therefore state that the theatre performed in the context of science communication is subordinated to a logic closer to that employed in the scientific field than that employed in the artistic field, maintaining a distance and an imbalance between the two fields. In this sense, we believe that new ways of conceiving and evaluating the theatre performed in this context are necessary, forms that distance themselves from the desire for control and efficiency, in order to truly bring together science and theatre. Reception studies, little explored in theatre in general, are important allies for this purpose. On the other hand, science communication can learn from the field of the arts the importance of keeping

messages open and exploring the emotional aspects of communication, since these are generally more important dimensions in the reception of the public than the understanding of concepts and the message itself.

Finally, we argue that collaboration between artists and scientists inside and outside this environment, and the study of these collaborations are important in that they give visibility to these contradictions and can stimulate the debate about new ways of conceiving and investigating this hybrid field. Just as the concepts and methodologies of theatre can be useful in this endeavour, science, associated with science communication, can offer theatre new ideas and tools to think and analyse its role and its relationship with the spectators.

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