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Do lado de fora do teatro

ART AND SCIENCE: ANALYSIS OF PHYSICAL CONCEPTS AND COLLABORATIVE WORK ON THE PLAY *AS RUAS DE BAGDÁ OU ARANHA MARROM NÃO USA ROBERTO CARLOS*

ARTE E CIÊNCIA: ANÁLISE DE CONCEITOS FÍSICOS E TRABALHO COLABORATIVO NA OBRA AS RUAS DE BAGDÁ OU ARANHA MARROM NÃO USA ROBERTO CARLOS

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Abstract

The relation between art and science and their respective creative processes have aroused great interest in both artists and scientists. In this article, the relation between physics and performing arts is discussed by considering my participation on the play *As Ruas de Bagdá ou Aranha Marrom não usa Roberto Carlos*. The impact of scientific concepts on theater is discussed firstly on broad terms, and afterwards by focusing on such play, highlighting the advantages of a dialogue between the areas.

Keywords: Collaboration, Physics, Relativity, Reference Frame, Theater.

Resumo

A relação entre arte e ciência e seus respectivos processos criativos despertam interesse tanto em artistas quanto em cientistas. Neste artigo é discutida a relação entre a física e as artes cênicas a partir da minha participação no espetáculo *As Ruas de Bagdá ou Aranha Marrom não usa Roberto Carlos*. O impacto de conceitos científicos no teatro é discutido primeiramente de forma ampla, para então ser focado nesta obra, ressaltando as vantagens do diálogo entre as áreas.

Palavras-chave: Colaboração, Física, Relatividade, Referenciais, Teatro.

Resumen

La relación entre arte y ciencia y sus respectivos procesos creativos estimulan interés tanto de artistas cuanto de científicos. En este artículo se discute la relación entre física y las artes escénicas a partir de mi participación en el espectáculo *As Ruas de Bagdá ou Aranha Marrom não usa Roberto Carlos*. Se expone el impacto de conceptos científicos en el teatro primeramente de forma amplia, para después centrarse en esta obra, resaltando las ventajas del dialogo entre áreas.

Palabras clave: Colaboración, Física, Relatividad, Referencias, Teatro.

The figure of a scientific consultant is not normal nor obvious in a creative process of theater. Except for some specific works, a scientist almost always ends up being a foreign body, strange to that reality. My participation in the creative process of the play *The Streets of Baghdad or Brown Spider does not use Roberto Carlos1* occurred almost entirely for personal reasons. It was not resulted from my academic formation, nor that of the actresses, nor because of our environment or any institutional incentive of the academy, nor even from the advice of a common friend. It just happened because my current wife was in the cast, and as such, I wanted to help in the process. Nevertheless, I was already interested in theater, because I was used to going to see plays on my childhood and even met my wife participating in an amateur theater group while I was in physics undergraduate school. Nonetheless, the group had proposed a collaborative creative process, including as many people as possible, which motivated my participation. Without this factor, I would probably only have access to what happened in the rehearsals through my future wife and any opinion of mine would be only personal; hence, this report would never be possible. The collaborative process was, therefore, fundamental for my participation. I will use this opportunity of writing this article to propose a discussion on the relationship between art and science and the advantages that the collaborative process can provide in this dialogue. All the same, this article is almost a defense of the importance of both, being almost impossible to separate my participation from the ideas that inspired me.

From this initial thought, it seems obvious to me remembering that there are not few parallels that could be traced between art and science. Among similarities and differences, it is difficult to quantify how exactly art arouses interests in scientists and how science arouses interest in artists. In fact, there are many examples of scientists with interests in arts, such as the physicist Mário Schenberg, a critic of the São Paulo Biennial of arts of 1962; as well of artists with interests in science, as the famous example of Brian Harold May, who, besides being an astrophysicist, is a musician. However, both

1. The group had no preferences for the use of upper- or lowercase letters in the title. A quick search led to the finding of different versions. I opted for the version that most pleasured me, in which, in addition to own names, Brown Spider also appears capitalized. In my opinion, this reinforces the symbolism proposed by the group.

academic communities and most of their members do not converse much on the daily routine, each remaining within their own comfort zone, many times demonstrating a certain alienation about the outside. In the case of arts, it could be true that there is some communication with other human sciences, but this communication decreases much with the biologic field and is practically non-existent with exact sciences. On the other hand, some scientists have interests in music, as recalled by João Moreira Salles (2010) in the essay *"Um documentarista se dirige a cientistas"*, referring to a sentence by the English physicist and writer C.P. Snow. However, the interest in other areas like painting, theater, and dance is not even close to the one in music, and even less when we consider some collaborative aspect. It is true that more modern academic communities, like the computation community, can arouse in some sectors of arts motivation to collaborate, while they dialogue with the classical art of Astronomy. Nonetheless, multidisciplinary dialogue remains rare.

A necessary question that the exposed proposal brings up is if a dialogue should or not exist. It must be put in an explicit way, even if it is logical or intuitive, that collaboration and creation are essential practices for scientific and artistic formation. Science depends on the creative process as well as the art does, each with its own rigor. It must also be said that art and science are not the same thing, and they do not intend to be. The changes in scientific theories happen in a peculiar way, attempting to obtain the maximum knowledge from the nature of an object. Many times, depending on the impact of these changes, the paradigm transformations carry an ideal of progress, as wrote by Thomas Kuhn (1969) in *The Structure of Scientific Revolution*. In arts, we can describe changes through the scenario described by Julian Bell (2007) on the preface of *Mirror of the world – a new history of art*, where the history of art would reflect the world history, with all their proportional changes to the values of a given society in a given time. The own difficulty in finding a better definition for the artistic changes typifies the claimed differences[2]. While science searches the knowledge within paradigms that could be changed after a scientific revolution, the art searches the act of questioning, but also within

2. At this point, we will not extend the discussion concerning description of artistic changes, since the relevance of this argument is just to point out that art and science alter themselves in a different way.

certain current paradigms that can be altered from time to time and bring a quality parameter. Any attempt to analogy is seductive, so that even being evident the difference between them, it is almost incomprehensive the few amounts of dialogue.

It is in this context I intend to explore the relationship between theater and physics, having as start line my participation in the creative process of the piece already mentioned: *As Ruas de Bagdá ou Aranha Marrom não usa Roberto Carlos*[3]. Physics and theater are two areas that are almost intuitively posed as opposite, despite all the creative (and collaborative) processes that are involved in both. Two communities that, in fact, work in different ways and styles, but that are far from the simple dichotomy between reason and feeling, or accuracy and subjectivity. As discussed in the previous paragraph about art and science, theater and physics, specifically, have similar aspects, and the intrinsic differences should not avoid the dialogue. In Brazil, perhaps the theater group that most tried a direct dialogue with physics was the group *Arte e Ciência no Palco*, highlighting the staging of *Copenhagen*[4] that debuted in 2001. In this case, the text itself already brought the involvement with physics, different from the process I am now reporting, in which the need to involve physical concepts arose during the construction of the play. It is up to this moment to begin the dialogue between areas, to understand the influence of the general overview of physics during the creative process.

The lifestyle of mankind in this century is a direct consequence of the scientific revolution in physics in the first half of the twentieth century. The knowledge obtained in the so-called field of modern physics triggered a whole technological and computational revolution that now lead us to an era of fast information and almost unlimited access to content of any quality. Almost contemporaneous to the physical revolution, with the appearance of the quantum theory, special and general relativity, and the advances on the theory and observation of particles, also the theater went through its own revolution. Constantin Stanislavski redefined the interpretation in theater almost simultaneously to the elaboration of Albert Einstein's theory of special

3. We can translate to English the play title as *The Streets of Baghdad or Brown Spider does not use Roberto Carlos*.
4. Text from the English Michael Frayn.

relativity, although the piece wrote by the Russian *metteur en scène* was published only decades later. The revolution on the *mise-en-scène* followed Stanislavski, with a series of *metteurs en scène* and scholars who marked the performing arts on the Twentieth century: Bertolt Brecht, Antonin Artaud, Jerzy Grotowski, among others, showing agreements and disagreements about their respective theories, which changed the art of interpretation. On the same way in physics, Einstein shared his protagonism with Niels Bohr, Max Planck, Erwin Schrödinger and many others, also showing agreements and disagreements about the given science. The fascination caused by the physical revolution reached the whole society in the beginning of the last century. The interest by the exact sciences, which with the quantum mechanics turned to be not that exact anymore and became more probabilistic, touched the collective social imaginary. Naturally, by reasons already mentioned, this fascination is reflected on the artistic activity in general and, as could not be different, on the theater, that was also living its own revolution. An almost obvious example of this influence on the imaginary is the piece of the *metteur en scène* Robert Wilson, on his famous work *Einstein on the Beach*, which modifies some performing concepts, playing with the thematic of the Einstein temporal relativity.

Among theater researchers, perhaps Bertolt Brecht was that one who most revered the scientific rigor and most got inspired by science for his theory and work. His play Galileo Galilei is about a previous scientific revolution, with impressive accuracy even when we compare it with current outreach material, with the difference that he did it with great artistic value. By the way, Galileo himself used dialogues and characters to explain his theory, what is another interesting interface between physics and performing arts. More recently, other theory from the world of exact sciences aroused interest at the theater world. The chaos theory, with origins in mathematics and with many applications in physics and astronomy, has its concepts applied to the dramaturgy in the study of Rubens Rewald. On painting, the concept of chaos was already explored to exhaustion in the Maurits Escher fractals and, not by accident, his work is presented in the walls of almost every math department worldwide. In the performing arts, Rewald uses the concept of chaos within the collaborative dramaturgy to explain the creative process of a collective work, but cohesive at the same time. Rewald wrote:

> In such information flux, fluctuations or noises are fundamental ways of evolution, because they compel the process to re-articulate itself from this new information, creating new possibilities of reaction (in terms of text, *mise-en-scène*, interpretation). The order is disturbed by the disorder, originating discussions, re-elaborations, misunderstandings, solutions, and discoveries. This perturbation forces the process to re-organize itself in a new level. (REWALD, 2005, p. 22)[5]

This concept, when transcribed to the performing arts in the form of collaborative process, motivated the play *As Ruas de Bagdá ou Aranha Marrom não usa Roberto Carlos*, following the same proposal of collaborative creation. To understand the context in which the play started: it was the final work of the performing arts bachelor course at the Faculdade de Artes do Paraná by the actresses Emanuelle Sotoski, Ligia Oliveira, and Rubia Romani, with professor Márcio Mattana as advisor-collaborator. The work also had the collaboration of the actresses Ana Ferreira and Uyara Torrente, and the director Nina Rosa Sá, in addition to my already mentioned participation as collaborator and scientific consultant. It was also the piece that originated the ACRUEL CIA. Notwithstanding any description of the people involved, the work was the result of many discussions without any defined hierarchy, and even a blog was created to allow the participation of everyone in the creative process, without any restriction of format and content. This broad opening, that in fact would lead to a chaotic text creation, had as a result a collective piece filled with collages, but with a single conducting line that was initially proposed by the group: the concept of multi-eyes. This game of viewing with other eyes concepts that are sometimes so deep-seated in our society was transformed in a funny joke on the view of public and critic. During the creation process, a part of the work was presented at the IV Mostra Cena Breve[6] of theater groups from Curitiba, being theme of a critical review by Valmir Santos entitled "Mistura e Manda", where he wished "That this shattered collaborative dramaturgy, without being inorganic, can be kept in the constitution of the final work[7]." (SANTOS, 2008). In my modest opinion as collaborator from outside

5. In his study, Rewald detail the difference between noise and fluctuations. This fragment was a free translation into English from the original work.
6. We can translate the festival name into *Show of short scenes*.
7. Free translation into English from the original in Portuguese.

the performing arts field, the characteristics described for the dramaturgy were kept in the final work. It is useful to remark other passage from Santos' text: "The dramaturgy is not a toboggan for sliding to common places. Rather, it makes them a forbidden existential anguish, suffocated by the 'everything is for yesterday' demanded by the technological digital era"[8] (Ibid.).

It was at this moment, in the days following the Mostra Cena Breve, that my relationship with the process was more intense. Participation in a festival is not only important to give visibility to a new company and to actresses at the beginning of their career, but it also opens space for discussions and debates on the work and on theater in a general way, through the organizations of round tables and debates. Today, it is difficult to say how much these debates have led me to my participation in the process. It might have happened regardless of the Mostra Cena Breve. But undoubtedly, the debates that took place during the process, not only regarding the work of ACRUEL companhia but also of the other plays, instigated me to rethink the theater, to look at it more intuitively, to think of a mean of dialogue. I confess that during the discussions I had a comfortable position, because as I was from another field of knowledge I felt comfortable to speak without shame, claiming to be just an "external eye" of the process.

At that moment, however, it is important to note I was not the scientific consultant of the project, and the group did not even have a proposal in which I would became one. There was just a collaborative work under development, where the existence of the blog allowed me to participate as a collaborator. At that time, I had already my physics degree and was at the end of my Master's degree in Astrophysics, with all the stressful emotional load that one has at the end of a dissertation (I got my Master's degree 5 days before the first day of the Mostra Cena Breve). The blog was initially an escape zone, after my defense it turned into leisure, and then a fixation. When I realized, I was already so submerged in the process that I had difficulties in providing the "external eyes".

A recent Master in Astrophysics participating in a high-level process of theatrical creation (as attested by the comments and criticisms in the round tables). Two different realities then collided. Of course, it is necessary to detail

8. Free translation into English from the original in Portuguese.

how this process of non-obvious communication between artists, interested people, and a scientist took place. When we speak of any interdisciplinary relationship, it always involves a language problem. To communicate, both sides need to understand what the other person is talking about. This process is not always easy but, within what was proposed by the group, the simple attempt already served as a reference for the process. Whenever possible, I witnessed some rehearsals, which almost always combined discussion and practice. It was in the discussions that I was interested and, sometimes, from simple comments unexpected ideas came up to be worked on. Sometimes, given my background, I was asked about concepts in physics and astronomy. Often the conversation was enlivened and ended up invading the rehearsal time. After one of these conversations, held at the university of arts, I wrote a text, in which I tried to explain some of the physical concepts in a playful and poetic way to awaken the group's creativity, providing what I believed to be my multi-eye vision. The text ended up being part of the final text of the play. I will refer to this passage later.

The intimate relationship the group ended up having with an external collaborator shows all the complexity of the creation involving multiple artists and society; and takes me to be a defender of the idea of collaborative theater. When the group opened the creation process to all the society through the blog, unexpected questions arose, what is natural for a new creator which they had no control of and, many times, not even familiarity. At this moment, the emitter, in this case the artist, gained a deeper contact with the receiver, transforming him in part of the same art work. In each text posted in the blog, the generated reaction depended upon personal values of those who read it and many times was unanticipated by the group, which started to be interested on who was once a passive receiver. For example, simple concepts like the one suggested by the word "base", which could represent a substructure when we think in building a construction but could also be the opposite of an acid when we think about chemistry, as well as it could simply refer to a triangle in trigonometry. Obviously, not all texts produced in this way entered in the final version of the play, but all of them were considered in the discussion that led to the final piece and to the maturation of the show as a whole. It was all this discussion that enabled my integration with the group.

The entirely process lead us to a short discussion about the way to create final spectacle of a working process that is always in movement. Obviously, the definition of a central theme and the creation of a communication interface with the world were not enough for the play to achieve its final format. Text production happened almost uninterruptedly, what required some creativity from the artists to keep the blog always active. Simultaneously, the rehearsals tried to characterize the whole creation until the moment, transforming texts into scenes. The final text was the result of this whole process, but it represents only a part of all the dramaturgy created for the play. It is impossible to quantify how many of the fragments and discussions that did not enter in the final piece influenced the characters and the *mise en mise-en-scène*. The sequence of scenes and the training to break each truism resulted from many planning meetings and practical rehearsals where everything was proposed and experimented. Many times, the obvious was there but it was transformed in surprise when showed. In the parallel with science, we need to remark that this kind of process is rare for a scientist, that always has as the final objective of his creation searching for solutions or even problems, but almost never for surprise. Searching for solutions intending to surprise, as we did in the related play, implies in a completely new reality to whom comes from outside the theater, but nothing that hinders the collaboration.

The performing experiment as itself, independently of the local it arrived, could lead to different conclusions depending on each one of the authors. It is already clear that the group was responsible not only for the organization but also for the definition of the artistic character of the final work. But about this question, one needs to remark the double game of the artists, who were receivers of external collaborations and also treated the concepts on a different way from what each external collaborator imagined. This is part of the collaborative game. And this net involved also more elaborate concepts, as the concept of chaos itself. The trend of the results followed the group proposal to work with the idea of multi-eyes, since each receiver was an eye and at the same time an emitter. It was not by chance that the group chose the analogy with a spider, because of the eight eyes. The title of the piece jokes with frames, first to propose two names, second to make relative the fact that the singer Roberto Carlos never uses brown from the point of view of the spider and the

multi-eyes of the play. It is funny to think that maybe for a biologist, the symbol of a fly with a million of eyes compiled in two would be more appropriate, what would bother the astronomers that prefer to treat such eyes like mosaics, as they do with their telescopes. One more time, the final concept of the play itself is dependent on the receiver, although the central idea seems to be the same: the diversity of interpretations.

However, how can the concept of multi-eyes be related with physics? The simplest thought leads to the word "relative", or to the frame dependence, and putting all these concepts together with the relativity was a big temptation that made necessary to transform a collaborator into a scientific consultant. As my involvement as a contributor to the creative process increased, it was natural that questions and topics involving physics and related fields were intended for me. On the other hand, my participation in the collaborative game also produced a fluctuation that aroused an interest on the part of the group in introducing physical concepts into the multi-eyes joke. Far beyond the chaos on the dramaturgic formation, the play as a whole led to a metaphoric joke with the concept of relativity, making a poetic approximation between the difference in the detection on each referential frame and the new vision on a same subject.

It is now clear why there was not a specific moment in which I became a scientific consultant. It was a kind of intuitive transformation by my part and by the group. Even when the play was presented, my name was only as a collaborator, without this bothering me or the group. It was a creation without hierarchy and I was an equal, even if I did not have the training in arts expected for an author of a theater text. It was only a few months later, when the adviser-collaborator Márcio Mattana was filling out a technical form about the play in some bureaucratic terrain, that he had the idea of appointing me as a scientific consultant. And, I must confess, I liked that title.

But the position of scientific advisor almost always leads me to answer other questions. How does a physicist consider this relationship between multi-eyes and relativity? We need to have some scientific rigor with the physical concept of relativity, this is mandatory before discussing the free inspiration it causes on the stage. In physics, the concept of relativity is older than people usually imagine. The Galilean Relativity and the Newtonian physics already

bring the idea of different measures for differences referential frames. The classical example: two trains with distinct velocities, side by side, the first at 80 Km/h and the second at 100 Km/h, and a third person outside both trains. The first train will see the second one to move away with velocity of 20 Km/h, while the person outside will see that second train it at 100 Km/h. Who is correct? Which is the real velocity of each train? It is missing on the problem description something many times forgotten: one needs to define a referential frame. What are the velocities of 80 and 100 Km/h relative to? Therefore, the concept of relativity came earlier than Einstein's. The Einsteinian theory introduced the temporal relativity, that is, not only the velocity is relative to the frame, but also time is. Furthermore, Einstein re-interpreted the speed of light, postulating it as a universal constant. The Galilean relativity brought with it the question if some absolute frame exists, in relation to which all measures should be considered, what led to the posterior concept of ether after the work of the physicist James Maxwell. In the Einstein theory of special relativity, the speed of light is now a constant to any inertial frame (an inertial frame is a frame that does not experiences any acceleration). The Einstein's concept of temporal relativity becomes apparent only when inertial frames move relatively to one another with velocities comparable to the speed of light, and that is why we cannot experience it in the daily life. Obviously, the exploration of this concept is far from the scope of this article, but one can find it easily in textbooks of any physics course.

It seems evident that, strictly speaking, the Einsteinian special relativity is not related with the multi-eyes approach worked in the ACRUEL play. However, it is at this moment that the art as a piece separates itself from the physics and use it as simple source of inspiration. If physics shows that even time can be relative[9] (although this is not experienced in daily situations), how to treat each view as equal to other view? Each person is now treated as a referential frame, not isolated in the sense that he or she lives in society, but with its own idea and reaction when facing each one of the exposed facts. What sensation

9. We need to make one more caveat to keep the rigor. The laws of the physical phenomena are the same in all inertial frames. The physics does not change from one referential frame to another and all the inertial frames are equivalent. The relativity of velocity and time does not mean a different physics for each referential frame.

does *Baghdad's street* or *Brown spider* awake in each entity, which one with its own values and past? An almost chaotic net that lead reaction per reaction, submitting the public to common views of our social life, but at the same time that each individual lives his own relation. When the play seemed to go to one side, a new frame was pulling everyone to the other side, avoiding falling on the common toboggan mentioned by Valmir Santos. At the end, we must emphasize that the play also brings more rigorous physical concepts. Maybe because of an intuitive objective to bring the physical relativity in fact to the proscenium, the idea of finite speed of light and astronomic distances were also worked. In a specific scene of the play, an off voice calls the attention of the public to a fact not always remembered: that we always look to the past. The text I wrote, mentioned in the previous paragraphs, entered at his moment. Since the speed of light is not infinite, it is necessary to consider the light travel time before the it arrives at our eyes, and even when an object is so close to us that this past means a very, very tiny fraction of a second. The simple idea of "looking to the past" leads to more inspiration inside the artistic community than an astrophysicist can imagine, and we will leave this as an open question.

What became evident in the ACRUEL creation process is that physical concepts can be worked and, almost always, they serve as inspiration for the artists. It is very common that science arrives as an inspiration to the artistic community through the society and, thus, it arrives already modified and reinterpreted (many times in a wrong way), bringing conceptual errors that bother the scientific community. On the other hand, it is common that scientists do not accept science as a simple inspiration seed of an artistic work if not represented with a formal rigor. The dialogue is hard, but necessary. It bothers to see on the proscenium discussions about misunderstood scientific concepts, but it is necessary to separate errors about the ideas and leave some free space to the metaphors. In other words, it does not matter the inspirator fact that led to a performed work, but if this concept is presented, there is no reason to do so in a wrong way. The fascination that science produces with quantum physics, gravitational waves, other planetary systems, universe expansion, dark matter, are already interesting enough in such way that is unnecessary to invoke mysticism, as usually happens. On the contrary, the

contact between physicists and artists can lead to new ideas and the scientific rigor, if well explained, helps more than disturbs.

Besides diminishing the noise in the information transmission, a direct dialogue between artists and scientists also allows a discussion about the topicality. As discussed by Kuhn in his work, after a scientific revolution it is necessary to rewrite part or almost the totality of the manuals. It is possible that years of delay may exist before the society can absorb the impact that a given scientific community has already overcome. This period of years can easily become decades. It is not accidental that the concepts discussed in this article involve physical revolutions of almost 90 years ago and that just now the society begins to understand. The thump felt by the public on the question that we look to the past refers to a scientific discussion from the past century. The relativity theory itself has already completed its centenary.

But how a scientist should work at the moment he becomes a consultant of a given play, or any other art work? Obviously, there is no simple answer, one in which all scientists agree. It would be better to relate my own experience. Before I began to get directly involved with the theatrical creation, my idea about the theater was basically rational. I thought a play should be political, have something to criticize; more than simply showing, it had to make something evident. Almost a Brechtian view of the theater. At the time of ACRUEL's play, this concept was already changing inside me. Gradually, I came to understand the power of theater as far beyond politics, but as social, as feeling. As Renata Palotini says about the content of the playwright, we often "do not know what, but we know that something is to be said"[10] (PALLOTTINI, 2005, p. 3). And this "saying something" is important by itself and can provoke different reflections and feelings in the public that watches. One must understand this issue to be able to understand the fascination that science causes in the art environment. Often, a theory, a scientific explanation, an idea, is only a way the artist finds to express himself. The movie director Lars Von Trier was inspired by a scientific study of collision between planets to create his movie *Melancholy* (Melancholia 2011). The film has nothing to do with science, no rigor and almost every mention is out of context. But the goal was to use science as

10. Free translation to English from the original in Portuguese.

an inspiration and not to make a movie about science. Likewise, here, the relativity of referential frame in physics depends on the speed at which they are, and this is not a concept that depends on subjectivity. The subjectivity of the multi-eyes only used it as an inspiration seed, it was just a joke. No further rigor was needed at this point. On the other hand, when it came to really approach the scientific concepts, they ended up using a more rigorous text written by me for one of the practical rehearsals. When it was shown, the concept discussed was placed in the center of the subject, being discussed with the necessary rigor, but without losing the poetic language established by the group. Returning to the cinema, something similar happened to the film *Gravity* (2013), by director Alfonso Cuarón, which, although faithful to science, had its name jokingly questioned by many physicists bothered by the excess of poetic license. Let's be honest, a movie called Angular Momentum would not arouse as much interest in the public as a movie called *Gravity*. In the play, the astonishment that the speed of light and time caused has nothing to do with Einsteinian relativity. Here also the group used a poetic license. The postulate of relativity treats the speed of light as constant, being equal for different inertial frames. The discussion whether the speed of light would be finite or infinite is more recent. We use only the symbolism of the speed of light to Einstein's restricted relativity. In fact, it was interdisciplinarity itself, not relativity, which was related to multi-eyes.

The scientists also have something to win with this dialogue. In science, collaboration is understood as an indispensable way to produce and change knowledge. It is natural to a scientist change quite frankly ideas and proposals, at same time that is possible to criticize them. However, in science, collaboration turns out to be almost restrict to its own environment and the idea of a horizontal creation is still not commonly used, although there are some efforts to avoid such hierarchy effects[11]. There is no doubt that the creation process of the performing arts can help in this issue. It is also necessary to cite the improvement of improvisation in the creation process and the ability to question the obvious that the theater as an artistic work can offer, which is of

11. In this sense, stands out the Cosmostatistics Initiative (COIN), formed by researches of different fields who search for interdisciplinarity as an effective form of democratic collaboration between their members.

great importance for the scientist to question the current paradigms. The art of theater has also conditions to provide an important via of outreach, a way that is almost ignored, and if worked together with pedagogy, could also be an important didactic tool in a thematic that is many times abstract.

When I faced the collaborative creative process on performing arts, I identified a window to multidisciplinarity and a way to bring the artistic creation to sectors of the society where this is uncommon. While that removes the passive character of the general public, it takes the artist off from a work-related comfort zone. Group creation goes beyond group working. The process described in this article shows that in theater is possible to both having a creative process restricted to artistic elements as reaching an unimaginable amplitude, without diminishing the artistic characteristic of the work. The whole interface created during the creation of the piece was only possible because of the broad collaborative creation process.

The work, detailed and discussed in this article, led the show *As Ruas de Bagdá ou Aranha Marrom não usa Roberto Carlos* to a short season in Curitiba. It worked with scientific questions, many times rationally, as in the concept of chaos/dramaturgy or in the case of the speed of light, but in other times in an intuitive way, as when looked to the concept of relativity as a version of the multi-eyes to the physics. It is true that scientific revolutions bring fascination, and not by accident the examples using trains, used so many times also in relativity, ended up being present on *Einstein on the Beach*. It is left as an open question if the performing arts can get inspiration from the scientific rigor, but also to produce its own science, with appropriate methodology and language to its own referential.

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