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Interview: Antonio Augusto Passos Videira¹



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(UFRJ). He worked as a professor for the Graduate Program in the *History of the Sciences, and Health* at the Casa de Oswaldo Cruz/Oswaldo Cruz Foundation. He was a researcher at the National Observatory (Rio de Janeiro) from 1994 to 1999. He works in the following fields: philosophy of nature, philosophy of science, history of physics and astronomy, scientific biographies, and popularization of science. He is a member of the *Center for Philosophical and Humanistic Studies* of the Faculty of Philosophy and Sciences (Braga, Portugal), and of the *Center for Philosophy of Sciences* of the University of Lisbon. He has a research productivity scholarship granted by National Council for Scientific and Technological Development (CNPq). He was editor of the Brazilian Journal of History of Science.

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Interviewed by

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Heráclio Tavares³

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Ivã Gurgel (IG) and Heráclio Tavares (HT): In your undergraduate studies, you studied physics and philosophy. Likewise, your graduate studies and teaching career are in the area of Philosophy with an emphasis in the Philosophy of Science. Tell us a little about this path in

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which science was already present from the beginning. How were your choices made?

Antonio Augusto Passos Videira: First of all, as a very young boy, from about the age of 10, I had wanted to be a scientist. I started with oceanography, then moved on to archaeology and finally reached astronomy. This was largely through reading introductory astronomy books, and because I took introductory courses in astronomy at the Planetarium in Rio de Janeiro. Talking to my father, at that time I was about 14 years old, he told me that the best thing to do would be to study astrophysics, and in order to study astrophysics, he recommended that I study physics. So, around the age of 15, I decided to study physics, and I kept pursuing this interest my entire time at high school.

I took the university entrance exams for physics successfully at the Federal University of Rio de Janeiro (UFRJ). However, I had already started studying philosophy before entering college. From the age of 14, I began to read philosophy books, like Aristotle's *The Sophistic Topics*, Plato's *Republic*, Kant's *Critique of Pure Reason*, Marcuse's *Reason and Revolution*, among other authors. I didn't understand much of what I read. They were solitary readings that I didn't discuss with anyone, yet these readings left a deep impression on me. In large part, these studies were motivated by the desire, the will, or even the need that many teenagers feel when they try to understand the world in which they live. I had certain, shall we say, "existential crises" in which I was quite dissatisfied with the world that I lived in. Social inequalities, environmental issues, political differences between countries, all of these concerned me, and I tried to understand the world at that time through philosophical readings.

So, when I went to college for physics, I had already a certain inclination to philosophy. What does this inclination mean? It means a willingness to understand things in the deepest possible way. Arriving at the physics course, I obviously encountered the so-called Physics 1 course, where the most important notions of classical physics are presented, as in the case of Newtonian mechanics, kinematics, and dynamics. And in this study, I certainly came across the meaning of force, which caused me to ask a series of questions, because I wanted to understand what force was.

I was trying to understand that through physics classes, and I couldn't. Physics courses are very focused on solving exercises. It's like a course focused on the operationalization to teach how to operate in mathematical terms through formulas and mathematical equations, as well as the basic concepts of physics, among which is force. There was no room for reflection about the significance and meaning of the concept of force. This began to make me feel tense, uncomfortable, and even a certain amount of insufficiency of content. I felt that the physics course didn't meet my needs. Even so, I continued for two years, but my dissatisfaction was always increasing as I progressed through that undergraduate course.

Still as a physics student, I decided to go to the philosophy department, which is in the Largo de São Francisco in downtown Rio de Janeiro. I knew the discipline called Philosophy of Science was taught there, so I enrolled, and, to my surprise, many of the questions I asked myself were discussed, though not answered, in this course of Philosophy of Science. I was delighted with this course, which was taught by Professor Alberto Oliva. I decided then, at the age of 19 – which was in 1983 – to study philosophy, and so I changed majors. I still tried to continue with the physics course. I took the university entrance exam for physics at the State University of Rio de Janeiro

(UERJ) again. It was not possible to have two majors at UFRJ, where I studied physics, so I moved to UERJ where I started the physics course, which if my memory serves me correctly, in 1985. Nevertheless, the physics course at UERJ followed the same pattern, so to speak, it was organized in the same way as the UFRJ course, as most courses in Brazil at that time were. It was very focused on teaching how to solve textbooks problems. The same dissatisfaction came back, and I abandoned the physics course at UERJ.

I continued in philosophy, where I later graduated in 1986. I have always resented not having finished the physics course, because my basis of understanding in physics is not enough for me to discuss certain topics, especially those of contemporary physics, quantum mechanics, quantum field theory and its applications – such as nuclear physics, particle physics and others. So my choices were made mainly because of my desire to try to understand things in the deepest possible way as well as to understand the meaning of physics concepts, ideas and theories in physics. Unfortunately, at the time, the physics course didn't provide that. The scientific initiation was also very practical, in the sense that it didn't allow for conceptual discussions, and it was geared a great deal towards learning certain techniques in physics, whether theoretical or experimental techniques. It was a painful journey. My choices caused some personal problems, but they weren't huge because I had felt satisfied with what philosophy could provide me with. I wasn't entirely satisfied, but as is well known... philosophy allows for conceptual discussions. And these questions can be formulated freely, as can attempts to get answers to these big questions.

It is good to say that in the first year that I enrolled in the Philosophy degree, in 1984, I also did two disciplines, Fundamentals of Physics 1 and Fundamentals of Physics 2, with Professor Alexandre Sérgio da Rocha, who is a physicist of the Institute of Physics that was assigned to the Philosophy Department. These two disciplines reinforced my decision to dedicate myself to philosophy, to the philosophy of science, with its characteristic of trying to understand the fundamental concepts of physics. For example, the concept of inertia was also a concept that gave me a lot of headaches. Professor Alexandre was a very important person in my training during my undergraduate work. With him, I did an introductory scientific research into trying to understand the concept of time, and I learned a lot from him.

Thus, it was a somewhat random journey, as happens most of the time, and in this journey, I was lucky to find in philosophy some support from people and the environment that allowed me to discuss my concerns, though, of course, within the limits imposed by my knowledge and also the fact that philosophers, for the most part, don't have much of a specific understanding of physics. So, it was the training that I would say was reasonable, even if not completely satisfactory in terms of obtaining the necessary knowledge to have an in-depth discussion on the fundamentals of physics.

IG and HT: Much of your intellectual production also revolves around the History of Science, especially the History of the Physical Sciences. How do you understand the interactions between History and Philosophy of Science?

Antonio Augusto Passos Videira: It's good to begin by saying that my interest in the History of Science was also partly generated, so to speak, by the readings I had done as a high school student, when I was between 15 and 17 years old at the time, and so this was before I had entered college. However, I must also mention that being the son

of a physicist, having lived with important people in Brazilian physics, such as Jayme Tiomno, José Leite Lopes, Elisa Frota Pessoa, Jorge André Swieca, Erasmo Ferreira, and Sarah de Castro Barbosa, and always hearing my father talk about Plínio Sussekind da Rocha, of whom he had been a student and personal friend, as well as being friends with other physicists, such as the couple Ernesto and Amélia Hamburger in São Paulo. I had also wanted to study physics and was interested in knowing who these people were. Besides, it is good to say that I, in a certain way, suffered personally from, let's say, some of the effects caused by the 1964 Coup in Brazil, and then by the Institutional Act Number 5 (AI-5)⁴ and its persecution. My father, as Tiomno's assistant, was a friend of Plínio, who had been [Mário] Schenberg's assistant in São Paulo, which is where we were between 1967 and 1968. And my father was a friend of them all, so it was natural that I heard about the personal, political and professional difficulties that these people had suffered. So, I was also quite interested in learning about the development of physics in Brazil, or even of science in Brazil. On the one hand, my interest in the history of science stems from my desire to better understand science, but on the other hand, from my personal circumstance of being close to many proponents of Brazilian physics as well as to practically all of those who had suffered with the persecution under the AI-5.

Even so, when I did my doctorate in France, which I started in Germany and then later moved to France when I arrived in Paris in 1989. The group that I joined, had as one of its leaders, Michel Paty, who ended up being my doctorate advisor. It was in that group that the history of science was greatly encouraged. It was an effort to establish a fair and balanced relationship between the two areas, philosophy and history of science. I took advantage of this opportunity and soon realized that the philosophy of science – which already, at that time, was beginning to become a very technical area – has two major aspects: one resulting from the influence it had received from the Anglo-Saxon analytical philosophy and the other from the need to understand current physical theories, and that furthermore, these two areas often do not dialogue with each other. The philosophy of science has also turned out to be something sterile for me. I thought that many of the issues were artificial. From one point of view, they were issues that concerned the individual agendas formulated by philosophers. On the other hand, as well, more technical discussions – concerning relativity, quantum mechanics, quantum theory of fields, among other areas of physics – had an intention that I considered positive, and were trying to contribute to the resolution of scientific problems, but to me, they often seemed to get lost in technical discussions with many technical details that I didn't understand. Perhaps it was because of my ignorance, my technical insufficiency, and it didn't seem to tackle the core problem of the issue.

So, history had also found a place in my life somewhat, because, as I'd said, the philosophers' agendas, from my perspective, didn't seem to be the most adequate way to understand what science was. Well, and it's also good to say that, during my undergraduate studies, I read Kuhn and Feyerabend, and I was very impressed by the fact that they naturally resorted to the history of science. That is, for them, it was necessary to understand the development of science in order to understand what science was. From then on, I started to fall back on, whenever possible, to the history of science to try to understand science.

⁴ Institutional Act Number Five (AI-5) was the fifth of seventeen great decrees issued by the military dictatorship in Brazil in the 1960s and 1970s. It was the most radical of all Institutional Acts and was issued by President Artur da Costa e Silva on December 13, 1968.

Of course, I also read Lakatos. For him, both – history and philosophy – are like the two sides of the same coin. They need to talk to each other so that the questions concerning the nature of science can be properly answered, because science transforms itself, and it transforms itself in a way, often radical, as it happened in the 20th century, particularly in physics, where there was a tremendous difficulty from which, from this transformation undergone by physics, to arrive a single answer. That is, the development of science is done in a plural form, and this pluralism seems to me to be better described by the history of science than by the philosophy of science, even though, depending on the perspective adopted in the philosophy of science, this pluralism, which seems intrinsic to science, is often confused with relativism. Which in most cases is seen as something that shouldn't be admitted. Relativism would be like an inadmissible stance when it comes to understanding science.

So I would say that the history of science helps us to realize that, when we want to understand what science is, namely, to answer the question: “What is science and what is its nature?” The best way to answer this question is by perceiving, understanding and describing the processes by which science has been done, has been transformed. Moreover, the current forms acquired by science during its development process aren't definitive. This idea that it's not definitive is often better worked out by history than by the philosophy of science.

I would say that science takes many forms. An appropriate diversity is intrinsic to it, which is better described by history than by philosophy. This diversity seems, in my opinion, to make the history of science an inescapable element when it comes to understanding the nature of science.

IG and HT: In your PhD thesis, you studied Ludwig Boltzmann's science and epistemological thinking. How did you come to this subject of study and what were the main “lessons” obtained from the research? Do you consider Boltzmann's case similar to that of other “scientists-philosophers”?

Antonio Augusto Passos Videira: I came to Boltzmann a bit by chance. As a philosophy undergraduate student in Brazil in 1985, I attended a seminar on Wittgenstein's *Tractatus Logico-Philosophicus* given by Professor Raul Landim, who's an authority on Wittgenstein's work. I was very impressed with the book; it was a very remarkable book in my formation. At that time, by chance, I read a paper by an American author, Andrew Wilson, in which he discussed the influences of Hertz and Boltzmann on Ludwig Wittgenstein. That's when I first heard about Boltzmann and Hertz. And perhaps it was one of the first times as well that I came across philosophical thoughts produced by professional scientists with the prestige of those two.

When I went to Germany for my PhD in 1988, during the first semester in Heidelberg, I attended another seminar on the *Tractatus*, and had decided as a working subject that I had to return to this discussion of the influence of Hertz on Wittgenstein as well as Boltzmann's influence on Wittgenstein. Then, at that time, I read Boltzmann, which I had not done before, and I was very impressed with Boltzmann's ideas. Several items caught my attention. First and foremost, there was the depth of the ideas, while alternatively, there was a frankness, and openness with which Boltzmann discussed certain problems.

Boltzmann had a way of presenting the questions that seemed very interesting to me, because they conveyed the vivacity and energy of science. Science was seen by

Boltzmann as a living thing. He didn't try to turn it into a dead, finished, definitive and tidy structure. That caught my attention. When I went from Germany to France at the end of 1989, I had to choose a dissertation topic for my doctoral research. What I had done in Germany was no good for me. Since my advisor, Michel Paty, was already supervising a doctoral dissertation on Boltzmann, I thought that Boltzmann would be a good choice. I had already read Boltzmann; I was interested in his thinking and I decided to delve deeper into these ideas. Above all, I thought that Boltzmann was an interesting author because he discussed a central concept in physics, and also something very important in chemistry, which was the concept of the atom. This was how I decided to analyze the concept of the atom in Boltzmann's work and see how it related to a thesis very dear to Boltzmann, which was the theoretical pluralism. That is, the same natural phenomenon could be described in different and even contradictory ways by models, and by different physical theories. I decided to try to understand if there was any relation between atomism and pluralism. I also found interesting that Boltzmann defended that notions in physics, in particular that of the atom changed their meaning over time. So, it seemed to me that Boltzmann could be an interesting case of discussion in favor of pluralism. I had already adopted this posture and this philosophical attitude at that time, and I would like to be able to reinforce the need for us to be pluralists in science by studying Boltzmann through my PhD dissertation.

As to whether Boltzmann can be considered a similar case to other scientists-philosophers, this is not a very trivial question. I would say yes and no. No – I'll start with the negative part of the answer – because Boltzmann, as I said before, was a person who was incredibly open and frank when presenting and defending his ideas. Boltzmann was a passionate person. He didn't hide that passion when he wrote about science nor when he philosophically analyzed the content and structure of theories, models, and ideas in physics. This openness seemed quite interesting to me because Boltzmann realized that perhaps the answers are given by science through philosophy as well. They could never be definitive. They might carry with themselves, in an intrinsic way, a certain ambiguity, incompleteness, and inability to be formulated in a completely convincing way.

It's as if this impossibility of offering a fully satisfactory answer were part of science itself, and the scientist should live with this situation which, in one sense, could cause on him a certain discomfort, a certain sadness since he would not be able to carry out his work fully. Yet, this openness, this insufficiency, this impossibility would also, when perceived in another way, encourage him to seek out more convincing, less unsatisfactory, less uncertain answers.

So, I think that Boltzmann, in that respect, seems to me to be quite different from other authors. If we compare Boltzmann to Hertz, Poincaré, or Ostwald, he is less categorical and less incisive than these authors. He also resembles these physicists-philosophers in that he discussed scientific theories, and the results of physics in a very profound way. In this respect, he resembles other scientists-philosophers to the extent that he realizes that for science, particularly in physics, to reach certain stability, it is necessary to resort to a philosophical discussion. That is, physics and philosophy are intertwined and entangled in such a way that it is often difficult to understand who is who, what physics is and what philosophy is. I found that very interesting.

Nonetheless, it's also important to say something about Boltzmann, who I've only come to understand clearly a few years after I had finished my PhD dissertation, about

two to three years later. I had finished the dissertation in 1992, so by 1994 or 1995, it seemed to me that Boltzmann also wanted to give a dimension or recognize that there was an existential dimension in science. When I say existential, I'm saying that scientific activity concerning the way of being all human beings, as well as how human beings are in the world. In other words, it seeks to understand about nature and what is natural for human beings. That said, unlike many authors in his day, Boltzmann laid it out explicitly and with passion. As I said before he was a passionate person, and that seemed to me to be very interesting and very meaningful. Like other ways of being, science is a way of being in the world. This might make us think that there shouldn't be an intrinsic difference between science, art, philosophy, and politics, and this also seemed very interesting to me, because it'd make us think of a certain oneness within humanity that was lost, or rather, explicitly abandoned when the modern period started. When modernity appears, it seems to me that there was a rupture between knowledge and existence, and Boltzmann wanted to overcome that rupture. Although he was not very clear on that, I think the way he spoke made it seem as though he was trying to recover the union between knowledge and existence. For example, I think that this idea of Boltzmann was later recovered by Heisenberg, who clearly wrote about this in the book called, *Reality and its Order*. He sought to recover this reality, which would have been abandoned, and many authors, many scientists, criticized the search he had carried out in trying to recover the unity between knowledge and existence.

IG and HT: Throughout your career, you have always maintained close contact with scientists in the so-called *hard* area of science, especially physicists, by being a collaborating researcher at the *Brazilian Center for Physics Research* (CBPF). What is the role of these partnerships in your career and intellectual production?

Antonio Augusto Passos Videira: In fact, I have always searched for and tried to be in close contact, as much as was possible, with scientists. In a way, because I was raised among physicists and scientists, I feel very comfortable among them. I feel very close and identify with the scientists. It's as though my way of being in the world was very close to the one that scientists have. However, my relationship with scientists is not only because I have been at the CBPF since I returned from my PhD in 1992.

At that time, I was invited by a friend of mine who then worked at the National Observatory, a Portuguese physicist, José Pizarro de Sande Lemos. He had been my father's graduate student, and had invited me to give a seminar at the National Observatory (NO) about my doctoral thesis. I gave that seminar in 1993, and some people who were present had really enjoyed what I had talked about, and, as I was already interested in creating an area of history of science and philosophy of science at the Observatory. At that time, they invited me to work there with a recent doctoral scholarship from *The National Council for Scientific and Technological Development* (CNPq). I was accepted, got the scholarship, and went to the Observatory in 1994. I stayed there for five years, mostly supported by the CNPq and the Ministry of Science and Technology at first with a post-doctoral fellowship and later with an Institutional Training Program fellowship.

I had an interest in trying not only to contribute to the formation of Brazilian astronomers by offering an understanding of history and philosophy of science, but also by trying to somehow enter into a discussion about some science topics with them. I wanted to have discussions with scientists, and recover that previous interest of mine to discuss the foundations of science.

On the other hand, there was an interest in understanding the development of astronomy in Brazil. So, the idea of doing the history of science in Brazil, and the development of science as it happened in the country was reinforced. Even in this sense, there was a request from researchers at the National Observatory for this to happen. So, I ended up dedicating myself to the history of astronomy in Brazil. As far as the CBPF was concerned, my presence was initially, because I was invited by Moysés Nussensveig, to organize the Austrian physicist Guido Beck's archive. He had passed away years before, so he had left his papers and documents at CBPF. Beck had wanted the CBPF to be the guardian of his papers and to organize an archive for them. Moysés Nussensveig invited me to do this, and I accepted, also right after I got back from my doctorate. So, soon after I returned, I ended up getting involved with the history of science in Brazil, particularly the history of physics and astronomy, due to my institutional work at both the CBPF and the Observatory.

Unfortunately, I wasn't able to do more rigorous research in the area of foundations of science. There was an important exception that brought me a great deal of joy, which was the fact that I met the physicist, Marcelo Byrro Ribeiro, at the Observatory. Today he is a professor at the Physics Institute at UFRJ. At the cafeteria, having conversations with Marcelo about Boltzmann's ideas, he liked the idea of pluralism and invited me to work together with him on the following problem: Could these ideas of pluralism be applied to cosmology? We did some work on this subject in the second half of the 1990s trying to understand some of the difficulties experienced by cosmology. Specifically, the fact that frequently the ideas of models in cosmology weren't well received. There was a kind of *mainstream* in cosmology that prevented certain ideas, considered as heterodox, from being discussed. There was even difficulty in publishing these ideas. Feeling bothered by this, Marcelo decided that Boltzmann's pluralism could be a kind of a remedy to avoid the orthodoxy in cosmology, which was not only counterproductive, but it also didn't concern the very nature of science. So we did some work discussing the nature of cosmology as a science, thinking on whether it could be considered a science like the others. This discussion was very interesting, and perhaps the best and only example of my attempt to be in close touch with scientists to discuss topics of their own science, and of their own practice.

This attempt of mine to maintain a close relationship with professionals in the area of *hard* science was not only in physics and astronomy. In the mid-1990s, I met a biologist, Charbel Niño El-Hani, who was already working in education, teaching science and philosophy of science. He's a professor at the Institute of Biology at the Federal University of Bahia (UFBA), and we discussed issues related to certain fundamental concepts of biology, such as the concept of function. We also published a paper in this area in a Spanish journal of history of science, and our collaboration didn't go further, mainly because I felt even more insecure about my knowledge of biology, which was considerably smaller than my knowledge of physics. But also I must mention this collaboration with Charbel, because I'd always like to keep a dialogue, and partnership with scientists. This desire to do so remains to this day.

My interaction with scientists is also because I'd like to convince them that philosophy and history of science are important for their own practice, for their formation. And when I say practice, I think that many of the issues they discuss would be better discussed if they knew philosophy and history of science, and applied that knowledge to their questions. On the other hand, there's a sociological and political dimension that I think should also be taken into consideration.

I often think that the arguments that scientists try to use in favor of their positions, demands, and needs, especially concerning funding, are answers with insufficient arguments, because they have a somewhat poor conception, insufficient to their own practice, of what science is. I think that philosophy, history and sociology of science help to improve the discussion by making the arguments stronger and better. In particular, I think a lot about what scientists, in general, consider to be a given. The questions are the following: Why do we have to do science? Why is it important to support science? Is science only important because it helps to improve the quality of human life? I don't think so. As I said when I commented on the Boltzmann case, it seems to me that science also has an enormous existential dimension. Doing science is like... it's like opting for a certain way of being in the world. It's like an option for a certain kind of life. This existential dimension needs – even more nowadays – to be known and discussed, even by scientists themselves.

IG and HT: Based on the assumption that philosophy and history of science are home to researchers with essentially different backgrounds (scientists from very diverse fields, such as historians and philosophers), we sometimes wonder who is “authorized” to practice them. How do you see this question about the legitimacy of writing philosophy and the history of science? What do you think should be done so that existing partnerships can be expanded, and the field strengthened in Brazil?

Antonio Augusto Passos Videira: On the question of the legitimacy of the writing of philosophy and history of science, I take a rather liberal position – liberal not in the economic or political sense of the term – because, strictly speaking, I think that anyone can talk about science, as long as they have a university education, and, in particular, an academic training dedicated to the sciences. I think that scientists, regardless of their areas of education, can talk about their own practice, although, as I had mentioned earlier, many times this happens, but what they talk about, the way they talk and what they describe as their practice seems to be insufficient, because they do not have a background in philosophy and history of science. Thus, their information sounds naïve, insufficient, and even poor. Even so, I recognize that they have legitimacy because they are practitioners of science – their legitimacy comes from the fact that they are institutionally sanctioned for it. The fact of being in a scientific institution authorizes that person to talk about science, regardless of the quality of the response.

Evidently, when a person knows the history and philosophy of science, they can improve their response in a way that seems extremely important to me, because their response becomes more meaningful. It's a response that considers the nuances, difficulties, which is more cautious, and all this needs to be affirmed and reiterated. I don't despise or disregard the descriptions that scientists make. On the contrary, I try to incorporate the descriptions and definitions that scientists themselves make of their practices and the theories they formulate, test, and so on.

Concerning what can be done in Brazil so that partnerships can be broadened, and the field of philosophy and history of science can be strengthened in the country, it is important to break internal resistance on both sides. When I say both sides, I mean the sides of scientists and the sides of historians and philosophers. I think everyone has to recognize that reflecting on science should be a collective activity. Not one voice is more authoritative than another one when talking about the nature of science. If the practice of science is collective, then the practice of history and philosophy

should be as well. Philosophers and historians in Brazil still carry a certain rancor of thinking that reflections on philosophy, on history, and that the practice of philosophy and history is separate. That is not so. In philosophy and history, we are always in dialogue, whether with a close colleague or with dead colleagues. When we read Descartes, Kant, Crombie, Koyré, whoever they are, even if these people are dead and have been so for a long time, we are arguing with them. That discussion is a living discussion. Using a well-known and current idea, they are always alive. To be a classic is not to be dead, it's to be alive.

All this reinforces the idea that scientific answers need to be built collectively. What's important is that scientists – and the greatest difficulty lies in them, for they are often arrogant, and think that the sciences, especially the natural sciences, are more important than the human sciences – recognize the history and philosophy of science as part of their own scientific knowledge. In other words, without history and philosophy of science – or even sociology, which could generate much discussion – physics does not fit in. We cannot discuss physics without discussing it from a historical and even sociological perspective. In order to give stability to the answer, so that it can have internal coherence – since it's never definitively solved – it's necessary to make use of the philosophy and history of science. Therefore, this dialogue needs to be encouraged.

As for the question, “How do we extend that?” That's a difficult question. There doesn't seem to be a set of rules and regulations that could be used for this expansion. Contrary to popular belief, this needs to be built. The rules are being made during the game and so they can change during the game. Which is often difficult, creating some instability, even emotional, but we need to accept that risk. The rules of the game will be built while we are playing. It'll depend a lot on certain local circumstances, which will be determining what rules will be formulated, chosen, for that particular game.

I think it's better to adopt a cautious attitude and say that the best thing is that physicists, mathematicians, astronomers, biologists, among others, realize that there's an inherent instability in their sciences that can never be completely extinguished, but it can be transformed into certain stability. For this to occur, for this stability to emerge and become something effective, it's necessary to refer to philosophy, history and sociology, and for this to happen, it's necessary to consult those people who have greater intimacy with history and philosophy of science. Of course, this intimacy could emerge more naturally if scientists, during their formative period, received more information on history and philosophy of science, that is to say, more disciplines in this area should be encouraged. The students of sciences should be encouraged to attend seminars, courses and congresses in history, philosophy and sociology of science. However, being able to establish a set of rules determined beforehand, I find that difficult.

IG and HT: Your production in History of Science reflects your interest and concern with the History of Science in Brazil. What are the challenges of writing about Science in Brazil for you?

Antonio Augusto Passos Videira: In a previous question, I referred to my own biography, when I said that I'm a son of a physicist, I lived with important physicists, and I grew up among them. In part, my curiosity about the history of Brazilian science, or the development of science in Brazil, is explained through my personal circumstance. Evidently, as time went by, this concern of mine was reinforced by the

fact that I've worked at the National Observatory, and by working at CBPF. Many times in corridor conversations, drinking coffee, and unpretentious conversations, I was asked about certain events regarding the development of physics in Brazil. There is, therefore, a natural demand on the part of scientists concerning the development of their own science. Of course, this natural curiosity partly corresponds to a need to understand what they are, and to comprehend the working conditions they have at the moment they ask the question. That is to say, I also sought to be useful to these communities of physicists and astronomers by trying to answer the questions they asked.

In the case of the National Observatory (NO), it was a relatively underrated institution until a few years ago. Astronomy in Brazil was a small area. It grew a great deal from the 1990s until now. When I went to the NO, few institutions did astronomy in Brazil. There was little access to larger astronomical instruments. The big observatories were in other countries. Everything started, or at least got an institutional impulse, exactly by this time I started to work at the NO. In the case of the NO, there was a certain resentment that the researchers had concerning the fact that the NO wasn't given the recognition it was due by the Brazilian scientific community, in particular, by the astronomy community.

So, when I went to study the history of the NO, I tried to show that the NO had a prolific and difficult history with many failures. For a long time, it harvested more failures than successes. I tried to understand why. I tried to show that, in part, this was not just a characteristic of the NO. Those failures existed in the communities that were part of the science. Of course, in a country like ours, maybe due to certain political realities, certain social and cultural characteristics of our country, those negative circumstances, which produced the failures, were stronger. However, I tried to show that, even so, the NO had a rich and interesting history and could be useful to help us to understand how the science could be advanced. In other words, how the science could be "sold" to the governments to get more support.

The attempts that Henrique Morize made in the first decades of the last century tried to show to the federal government that it was important to study astronomy and meteorology, as well as establish the Hour Service Division, as it was called at that time. All this made me realize that Morize was an extremely complex and sophisticated person from the perspective of his knowledge of the nature of science and its institutional dimension. Undoubtedly, the NO had inserted in history, although it's risky to say this, what lessons could be used to advocate for science in Brazil, particularly the so-called pure science, which was one of the goals Morize set as a scientist as well as a defender of the cause of pure science. Besides, being able to contribute to pure science to receive the necessary support for it, and promote an effective and real existence in the country, which he did.

With regard to the challenges of writing about science in Brazil, these challenges relate in part to a shortcoming in our libraries. This is a shortcoming that's still being overcome concerning the archives that are needed to make the history of science – the archives of scientists as well as the institutional archives. When I started to work in the history of science in the 1990s, there were few institutions dedicated to the preservation of archives. This concern wasn't widespread. There were people in Rio, at the Museum of Astronomy and Related Science – MAST. There were people in São Paulo, such as Amélia Império Hamburger at the Physics Institute, and in the history department of USP with Maria Amélia Dantes and Shozo Motoyama, who realized the

need to preserve the archives and primary documents absolutely necessary for the history of science to be a reality in Brazil, and to meet the criteria and quality standards created in other countries.

However, as I said, this difficulty has been overcome. Today, there are many archives scattered in countless Brazilian institutions that already allow good work to be done. Another difficulty is that historians majored just in history often have no scientific background. The history that's made in Brazil is still very social, and institutional. It's a history focused on understanding the development of scientific institutions in Brazil, which were the locus from which science became a reality in Brazil. This can be difficult, as historians lack, in some cases, the scientific knowledge to be able to delve a little more into the sciences themselves. Some exceptions are interesting and important ones; but I won't mention names here, so as not to be unfair to those I don't mention. However, I will say that it would be interesting for the history of science to receive students, especially in history, philosophy and sociology with a scientific background – built according to their needs. In other words, those young people who show an interest in the history of science should be encouraged, already at the undergraduate level, to seek a complementary formation. For that, our curricula should be reformed; they should be a little more open. Our curricula are very closed. I resented it when I studied physics. The physics course was very old-fashioned. It had many prerequisites with many prior requirements. That was discouraging in the end. Often it was as if you entered in a road where there were no side roads, and with less possibilities of going somewhere else. An exploration that could be random – and that should be obvious within a university, since the university should've provided some free transit through all the areas didn't exist, and it still doesn't exist today. University education is very professional. Designed to train people with a certain level of intelligence that are capable of doing some activities within some professions in society. This isn't good for science and especially not good for the history of science. The historian of science must be a person with knowledge of different areas. I often tell my students that the historian of science needs to be a learned person. Culture is not acquired by following a curriculum plan.

So, the challenges are huge. I wouldn't say that the challenges are intrinsic just to Brazil. I think these challenges have existed elsewhere. I'd say that the main requirement for us is to make the history of science a priority that would be able to give more freedom to those who want to study the history of science. I mean, we should trust these people and guide them in a way that may seem naive and puerile – “Go there, take that course. Read that book. Take that seminar. See if you can find what you want there.” Something will always come out of it. A person will learn something, acquire it and carry with them. I think it's hard to have a teaching program for the history of science that meets all the demands. There needs to be an openness and freedom, that is, a certain incompleteness.

IG and HT: Your research also places the production of scientific biographies as a relevant theme. What is the role of this type of textual production and what precautions should we take with it?

Antonio Augusto Passos Videira: My interest in biographies is quite widespread. Everyone is curious – which can be morbid – about the lives of other people, even more, so people who were considered important for humanity. People want to know how Einstein lived, and about Beethoven, Bach, Pixinguinha, Gandhi, among others. On the one hand, there is a certain curiosity. Yet, as far as science is concerned, I think

that these biographies were written all the same so that scientists would be considered exemplary people, who had fulfilled all the necessary requirements for their projects to be considered beneficial for mankind. The biographies, at the same time, were hagiographic, especially in the 19th century. Scientists needed to be model people. This, as much as it is criticized today – and there are reasons for this criticism – has a definite basic concern. With the specialization increasing since the nineteenth century, scientists began to not only play a preponderant role in society, but to also have difficulties in interacting with other scientists.

At first, I want to call attention to the fact that the specialization of science made it extremely complex for an ordinary person, even if this person had received some university-level training. It was often difficult to understand what a scientist did. What were the results of his practice. So, one of the ways found by people who were dedicated to science, who fought for science, was trying to show what scientists did through their biographies. Yet, it's also good to say that there was the problem of a moral formation of scientists. That is, how to make those, who, during their training, received a set of extremely specialized skills, realize that this knowledge could and should be taken beyond the boundaries of science. The scientist should receive training, and that's why I'm calling it moral training, which would allow him to realize that he had to look beyond the boundaries of science. Biographies often served to show this. For example, when they stated that scientists were good parents, good husbands, that they cared about the fate of other people who were not scientists, that is, that scientists also looked at other human beings who were not scientists, and all that made science part of or could be part of the society. That was very important, and it's still very important. For a long time, the biography was an instrument cultivated by scientists to show that they integrated into the societies in which they were living and working. I think that is an important point. The power of the biography to this day stems from that. It's as if, to put it bluntly, scientists are human beings like others, and this allows us to see this relationship of scientists belonging to the society in which he is acting, and in which he lives.

From another angle, when you study a person's life, especially if you live in the same place as that person, certainly not at the same time anymore, but in the same place, you can also use the biography to see how science has developed in that country. I wrote a biography about Morize, and my concern was to understand what strategies Morize formulated, proposed and applied to try to make science receive more support from the federal government. And, as I said before, particularly for the so-called pure science, that he considered essential for the development of science and society. Morize saw science as a fundamental element for the country to be considered civilized. This is a very 19th-century idea. Later throughout the 20th century, the idea of civilization lost a lot of power. I think it's an idea that should be recovered today, which would be the subject of another conversation, but the biography often allows us to perceive the goals and strategies that scientists set for themselves.

Besides, we can also change the notion of biography. The biography can and should be focused on a single individual, a single human being. However, we don't need to think that the biography should only talk about that individual, glorifying him. We can use this individual's professional trajectory to enlighten his time, and through this enlightenment, for example, understand the relationships he had with other scientists, institutions and also with society.

I'll give you an example. I'm currently starting work on a biography on Guido Beck. He

was a man who lived in ten different countries, worked in many cities throughout his professional life, which began in the year he received his PhD in 1925, and lasted until he died in 1988. Throughout this period, which covers two-thirds of the 20th century, Beck, as I said, lived in several places. In many of those places, he was absolutely essential because he was the introducer of certain theories. He was the diffuser and pioneer of certain criteria that he considered necessary for the scientific practice to be, as he said, “healthy, fruitful and lasting”. Thus, I intend to show in Beck’s biography that he was not only an introducer but, conversely, he chose the epistemic and non-epistemic values that he sought to transmit to the people with whom he lived, in particular his students. That’ll allow me to look at those places. For example, in Odessa, Lyon, Porto, Cordoba, and Rio de Janeiro itself, and how Beck acted in these places. And when I study and try to understand how he behaved in these places, I will try to understand these places. When I try to understand these places, I will see other people and other situations. In other words, using an image, I’m going to use Beck as a flashlight, and through him, illuminate other places that could be obscured, therefore invisible. He as an extremely powerful person for that – not just because he was such a great physicist – but more significantly because he was convinced of what his role was. This conviction in his mission, so to speak, is important because it allows me to look at these places and illuminate them so that I can see these places better.

Beck may be more powerful than others precisely because of his ability to illuminate these places. I think that’s a relevant point because the biography allows me to perceive a collectivity, not just the individuality. The care that must be taken is the care that is known; we should not praise biographers for making them better scientists than they were or for trying to correct mistakes that they had made. On the contrary, their mistakes, problems, and failures are also instructive. They’re also part of life. I think a scientific biography is ultimately about life, about a person, about a community, in a certain place and at a certain time. That’s the great power of a biography.

IG and HT: In the CBPF, you organized and made accessible a collection of documents that belonged to Guido Beck, who taught in Brazil and Argentina in the middle of the 20th century. Considering the massive production of objects of memory and the neglect to preserve these vestiges of our past, how do you see the relationship between scientific memory and the history of science in Brazil today?

Antonio Augusto Passos Videira: This seems to me to be a somewhat complicated question, insofar as, to answer it, it seems to be necessary to try, instead, to conceptualize, define and characterize what I understand about scientific memory. I understand scientific memory or this massive production of memory objects as the production of primary documents, that is to say, documents that are produced during the scientific practice itself. It includes, for example, texts, statements, interviews of scientists about their own activities, their results and their view of science, while they lived and practiced it.

As I said before, I think that the production of scientific memory - namely, the reports, and testimonies produced by scientists concerning their own practice - should be taken into consideration. I think that history should be critical and attentive to these statements. It shouldn’t use them naively, as though scientists had the last word about their own practice, which was often not the case. We aren’t the best analysts of ourselves. So scientists aren’t the most capable individuals to understand what they do and what they are. However, we need to respect them, because scientists are often educated, well-trained, experienced, open mind and critical people. So, we also can’t

disregard or previously adopt an attitude of carelessness regarding what they say about themselves.

Thus, scientific memory needs to be respected. Nevertheless, I think that we actually have a very big problem with the fact that, although the situation has improved, there is still a certain carelessness regarding the preservation of documents necessary to do the history of science. This neglect is mainly translated by the insufficiency of financial, human, material and institutional resources for these materials to be preserved. There are many documents to be preserved, and there are different types: paper, etc. The support that materializes this production and this memory are the most varied; photographs, films, which are also materials of different types. All this makes it necessary to have a very large institutional complexity and human resources so that this scientific memory is not lost and, not being lost. What's more, it can be used by professionals of history, sociology and philosophy of science.

This is a point that actually contributes to a situation that transcends the boundaries, whether of history and philosophy of science or of science itself, and concerns the country as a whole. I don't think we value ourselves enough. It seems to me that Brazil, and what is perhaps the main characteristic of an underdeveloped country, we don't value ourselves enough. We don't value what was done here, so to speak. It seems that we are always looking out for models, for inspiration, to correct our defects. We're people who consider ourselves insufficient. That's very bad. Basically, this neglect is because we aren't able to realize that there are different ways of doing science and different ways of achieving academics and science excellence. I have the impression that, in a way, this neglect is explained by the fact that we don't have a project of what we want to be. We don't know what we want to be because we aren't satisfied with what we are today. So, I'm saying all this to justify the fact that it appears that this neglect stems from a situation that is political and existential. That's the point. We're always negatively criticizing ourselves, even more so today. The number of people who want to leave Brazil, and who have already left Brazil, because Brazil is experiencing this, is very complicated.

IG and HT: What is the role of History and Philosophy of Science in public debate?

Antonio Augusto Passos Videira: I believe this query has a direct relationship with the previous question. I finished my previous answer by saying that I think negligence is paramount because we aren't satisfied with what we are, how we live, and what we have already done. This is because we lack a national project on how this Brazilian community should be organized – what it should produce, to whom it should produce, and how this product should be distributed. It's a political problem, as I had mentioned before. The main role that the history of science has today is to discuss this; the reasons why we are dissatisfied with it. I think that science could do this, due to the relevance it has in the world. Based on this relevance that has been going on for many decades, the science produced in Brazil can show that we're better than we think we are. I don't mean that we are the best, but to use an expression by Nelson Rodrigues, I think that science can help us to overcome our “mongrel complex”. That would be quite interesting; to demonstrate that we are capable and competent to do things – to do them well, and to do them in a way that pleases us and that gives us joy. I think that's important and essential in these days. The history and philosophy of science, when done realistically by showing our failures and our successes as well as the silly things that we have already committed and are committing today, can show in interesting, complex and meaningful ways how we're able to overcome those obstacles. Obstacles that

always make us criticize, belittle and underestimate ourselves. It would be interesting for the historians of science in Brazil, and also the sociologists of science to try show their work more often to the public via papers, interviews, and material distributed through the Internet and in exhibitions. I myself, for some years, organized some exhibitions that gave me a lot of satisfaction, but they didn't circulate a lot, because there wasn't much of a possibility for that. At that time, the Internet wasn't as it is today. There weren't so many social networks like today, but I tried to have exhibitions aimed at a university public in which I showed how science was present in Brazil, even before the creation of the first faculty of philosophy in the 1930s. I tried to demonstrate that science was already a reality in the so-called colonial Brazil, and in that, I accompanied other colleagues of mine, historians of science, by showing how there were positive results: how there was positive transformation, how science tried to integrate itself in nation projects, how it tried to help understand what Brazil was, what the specificity of Brazil was, and what the positive and negative characteristics of what we call "Brazil" and "Brazilian" were.

Yes, history and the philosophy of science have a very large contribution, because they help us to understand our history in such a way that it contributes to the constitution, formulation and organization of an identity, that is, of a specificity, which is ours. To put it another way, I think we aren't capable of formulating a Brazilian identity properly and coherently without resorting to science.

If we think broadly about the sciences, and not only about the natural sciences, but also about the human sciences, we can easily see that sociologists, historians, anthropologists and economists, among others, in Brazil, have sought to understand Brazil. Brazil is a problem for the sciences themselves. In contrast, natural scientists, even before the foundation of the first colleges of philosophy and Brazilian universities, tried to contribute to the understanding of Brazil. That is, what we call Brazil, this structure and this current setting, which can only be understood if we appeal to the sciences, the natural or social sciences.

IG and HT: In a recent publication, you bring the notion of "scientific nationalism". What does this notion consist of and how does it help to think about the History of Science in Brazil? Would it be possible, from this notion, to be able to think about the role of science in Brazilian society at this time?

Antonio Augusto Passos Videira: I thought or conceived this notion of "scientific nationalism" working with Heráclio Tavares. We were discussing the collaboration between Brazil and Japan during his PhD project, trying to understand the contributions of César Lattes and José Leite Lopes, as well as other Brazilian physicists. We identified that these scientists were nationalists, in the sense they wanted to improve the general country's condition. They thought that Brazil should have a strong, vigorous, active and flourishing science to develop itself, which should be made by Brazilians and foreigners who lived here and who wanted to work and collaborate together.

I had already discussed this idea before, in a work I've done at the beginning of the 21st century. I tried to show that this category of nationalism was present in the scientific practice of scientists, not only Lattes, and Leite, but also in the work of Tiomno, Schenberg and others. With this category, I wanted to demonstrate how the strategies they thought about and tried to apply to the country as well as the idea of development needing to be thought of as inclusive, and not only as a scientific and economic

development, but also as a social and cultural development. It had an important part in this notion of nationalism, because it would help us to understand the practice of science made here in the country. All the concern with teaching, not only at university, but also at the high school level, which has always been a defining characteristic of physicists – if one thinks that this notion would help us to try to better understand this practice that has been performed here. Practicing science in Brazil has always been something that was explicitly thought about, not only with the objective of understanding nature, but also to utilize this knowledge related to nature in order to improve the living conditions of the Brazilian population. This was a dominant tone in scientific practice then.

I hope this is enough as a definition and characterization of what I think scientific nationalism is. I believe this notion reiterates and seeks to clarify, as well as helps us think about the history of science in Brazil. I assume it helps us to think, for example, what the conception of society and government were, as well as what the social relationships that these scientists had, implicitly and explicitly, were in a sophisticated or naive way. Whatever nation-building project that these people had in mind, it doesn't matter.

The category of scientific nationalism allows us to think about how the scientist sees his own world, his insertion in society, and the other, whether he be another scientist or a layperson. Naturally, this notion allows us - since it stems from scientists' own words and actions – to identify how scientists see their surroundings. So this is an essential contribution.

How would it be possible, from this notion, to think about the role of science in the current period? As I had said earlier, science in Brazil is very important, not only because it will help us to solve problems that afflict society and the Brazilian population – in terms of health, food, environmental preservation, but as a fundamental characteristic that is this new category of scientific nationalism, which can help us try to understand Brazil's identity. The question of what Brazil is has been answered within the domain of social scientists, sociologists, anthropologists and historians – that is, with this category of scientific nationalism, which allows us to look at the so-called natural scientists as well as ask what these natural scientists understood when they spoke of Brazil. We can ask the natural scientists: “What do you think Brazil is?” Through this category, we can try to understand the answers they have given to this question. It is as if the category of scientific nationalism allowed us to understand the answers that weren't formulated often, or were formulated in a fragmented manner to the question: “What is Brazil?” This is an important question for us – Brazil suffers greatly from the misunderstanding of what it is.

This category, which is neither the best nor the only one, can help us to try to resolve satisfactorily this question which bothers us, and which is a very heavy question: “What are we?” as well as “What can we aspire to be?”