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SOCIAL SCIENCES

"I am a scientist, but nobody needs to know": towards an understanding about professional self-designation among university professors in Brazil

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Abstract: As in many countries, in Brazil science is conducted mostly inside universities by professors and their graduate students and post-docs. This article aims at assessing the circumstances under which university professors of a biological sciences institute of a public university are willing to adopt the term 'scientist' as a form of self-designation. Using an online questionnaire (n=21) and two focus groups (n=12) we investigated how these professionals call or describe themselves under different situations and for distinct publics. We found that most professors prefer not to call themselves a 'scientist'. They find it a natural choice not to use the term 'scientist' to designate their job in scientific research and believe that university professor is appropriate as well as it is a respectful title. However, the participants could envision possible impacts of this attitude on the general public and implications for the public perception of science and technology such as investment and science career choice. The origin of the word scientist and the history of the Brazilian scientific community are brought about to shed some light on the gathered data.

Key words: public perception of science and technology, representations of science and technology, science and media, science professionalism, University community.

INTRODUCTION

This article aims at assessing the circumstances under which professors and researchers in the field of Biological Sciences of a public university in Brazil are willing to adopt the term 'scientist' as a form of self-designation. We also investigate the outcomes of such practice for science and its publics: public authorities, the media, future scientists and so on.

The motivation for this research started during a science communication colloquium in Brazil when the audience was startled by the results of an ethnographic study that showed that most families could not recognize scientists in a TV news program despite their frequent appearance. The question one of us made to the speaker was to what extent we as university professors were to be blamed for this lack of identification. The rationale behind the question was that we rarely see, in TV subtitles, the name of the interviewed person followed by 'scientist' to describe him/her. Usually, the name is followed by professor (or sometimes researcher). Our concern was mostly related to the idea that we may be contributing to maintain science and the scientist away from the knowledge of the common person simply by not asking journalists how we wanted to be referred as. The term scientist is seldom associated to a university professor, be it in the drawing of a child or in a Internet search.

As in many countries, in Brazil, science is conducted mostly in universities while institutions from the private sector contribute to publications in a share not higher than 5% (Leta et al. 2006). Brazilian scientific community counts with a database for human resources in science called *Plataforma Lattes*. More than 130,000 curricula of professionals of Science and Technology (S&T) holding a doctorate degree (https://estatico.cnpq.br/painelLattes/) are deposited and most of these are, of course, university professors and their graduate students. Does the general public know that science counts with the hard work of professors and their grad students and post-doctoral fellows? How would the public know that these are the scientists nearby them? Is the work of a university professor uncovered to the point that society knows that he/she does much more than teaching? Is it clear that when a professor is supervising a graduate student he/she is acting as a scientist and is educating others to be a scientist? These questions are part of our conjecture on to what extent the academic community by not coming forward as scientists for society contributes to widening the lack of information about who the country's contemporary scientists and science institutions are.

The interest in knowing why someone should or should not call him/herself a scientist leads us to some questions around the relationship between science and society. Scientists and science communicators often point out the existence of a gap between science and the public. Surveys of public perception of science have been helping to have a better grasp on the popular views on the profession of the scientist and on how science is done. Although in the US some surveys date from the 1950s, they became more frequent in Europe in the late 1980s, for example, and more recently in Latin America, in the mid-1990s (Castelfranchi et al. 2013). The first survey was held in Brazil in 1987 supported by the National Council for Research (CNPq/GALLUP 1987) and was followed by four other studies in 2006, 2010, 2015 and 2019 (CGEE 2017, 2019, Ministério da Ciência e Tecnologia 2006, 2010). In most of the surveys, many of the questions were the same to guarantee comparability between editions and international studies. The research involved 2,000 respondents having 16 years of age and above. One question of interest in all of these surveys has been the knowledge about scientists and institutions of S&T. The percentages of the sample that could freely name Brazilian research institutions and scientists were used in these reports to assess the knowledge of science and technology. When asked about knowing (or recalling the name of) an important Brazilian scientist most respondents could not remember or point out a name (86%, 87%, 93%, 90%, in the last four national surveys, respectively). The most cited names were of historically important Brazilian scientists, such as Carlos Chagas and Oswaldo Cruz, revealing the public's difficulty to recognize contemporary researchers[1]. Although Brazilian research has not always been eminent compared to northern countries, academic indicators point to a great expansion of the scientific area in the country over the last 20 years (Leite 2014) - an expansion that is being threatened by the ongoing political crisis that imposes dramatic budgetary cuts in S&T. Yet, even in those countries in which sciences resources flourish, there seems to be a quite evident misinformation regarding the scientific realm and the daily routine of scientists themselves. A survey in the US has shown that only 35% of respondents consider that they have an 'excellent' or 'good' understanding of

1 In the Brazilian survey the cited names were: Oswaldo Cruz (41%), Carlos Chagas (16%), Miguel Nicolelis (7%), Vital Brazil (6%), Santos Dumont and Cesar Lattes (3%).

what the work of a scientist is (National Science Board 2012). More recently, a national poll showed that only 19% of the U.S. population can name a living scientist in a 2017 poll (Research America 2017)[2].

Another instance of this lack of understanding can be found in the perception of the image of scientists among children. A technique developed in early 1980s, DAST - Draw-A-Scientist Test, (Chambers 2006), has been extensively used across countries and has proven useful in pointing out how scientists are perceived in the imaginary of children. Children's drawings of scientists may impart an effective way to study how they integrate information from sources such as mass media and socio-cultural interactions to form stereotypes about scientists. In many studies the scientist is shown as a male odd person - also reflecting a gender-oriented perception of the profession of the scientist. In more recent research it has been shown that stereotypes of scientists persist in both children and adults in countries as diverse as Greece, United States, Brazil, Nigeria, India and Italy (Christidou et al. 2016, Lannes et al. 1998, Rodari 2007). Images about the scientists, however, may change when students meet them in person or through the Internet when a perception closer to reality is developed (Diniz & Schall 2003 and Maia et al. 2012). In the case of gender-oriented stereotypes of scientists it has also been changing over time as shown in a meta-analysis of the draw-a-scientist test over five decades in the US showing the influence of socio-cultural interactions and media sources (Miller et al. 2018). In this context, one should ask: will the choosing of a science career be more determined by the media, social interactions, science teacher or the actual knowledge about science and the work of the scientist? Also, is it possible that the public understands that science is made by scientists but ignores who scientists are? These and other studies try to understand how and whether students' choices are determined by the image of science and technology professionals and the quality of science teaching (OECD 2006).

Brazilians had and continue to have a high interest for S&T, and also have a very positive view on the theme as shown in a recent survey of public perception of science (Castelfranchi 2019). However, in the 2015 survey for example, only 13% of the respondents could name an S&T institution in the country. The most cited institutions were not universities (there were only two in the list). In the U.S. this number is much higher (33%) although only one university is mentioned among the most cited institutions (CGEE 2017, Research America 2017).

We believe the questions we raise here have impacts that go beyond avoiding portraying scientists as eccentric, obsessed, lonely workaholics. Surveys for public perception of S&T always use the term scientist to refer to the professional who works with science. However, we ask whether the general public knows who scientists are. Could scientists be hiding themselves from the public when they do not put themselves forward as such? Thus, to contribute with the research on the image of scientists for the general public, we investigated groups of university professors from an important Biological Science Institute in Brazil, asking how they call or describe themselves (self-designation) under different situations and for distinct publics and the consequences of these choices.

We discuss the results looking back at the constitution of the scientific community in Brazil, in an attempt to shed light in the present for the

2 In the U.S. survey the cited names were: Stephen Hawking (27%), Neil deGrasse Tyson (19%), Bill Nye (5%), Richard Dawkins (3%), Jane Goodall (2%), Anthony Fauci (2%), Michio Kaku (2%), Me (2%) and James Watson (1%).

debate of whether the recognition of science as a profession by contemporary Brazilian scientists may have effects on how the general public perceives science and whether this may influence youngsters in their career choices in science and technology.

MATERIALS AND METHODS

To assess the term prefered for self-designation in the university work context and possible implications of the use or not of the name 'scientist', we chose an approach that consisted of the following steps: 1) an exploratory quantitative assessment; and 2) qualitative focus group (Flick 2013). Our main target was university professors with an undergraduate background in the Biological Sciences field. All of them were, at the time of the interview, conducting teaching and research activities at the Biological Sciences Institute of the Federal University of Minas Gerais – UFMG, Brazil – a very productive institution of S&T research and teaching in one of the largest public universities of Latin America (QS rankings - 2020). The choice of this public was influenced by the fact that the researchers conducting this study belonged to this Institute, making it easier to understand the universe in which the subjects were inserted, including the university personnel database. In addition, one of them, being a professor of the Institute herself, has had anecdotal observations of the lack of the use of the term scientist as a form of self-designation among colleagues, increasing the motivation to scientifically study the case.

We began with an exploratory quantitative assessment aimed at university professors. The randomized selection of the participants was based on data gathered through the *Somos UFMG* online database, publicly available through the University (http://somos.ufmg.br/), the Institute web page (www.icb.ufmg.br) and the *Plataforma Lattes,* the Brazilian scientific CV database (http://lattes.cnpq.br/). For this quantitative study we invited by e-mail 28 professors from different departments of the Institute distributed in 12 areas of knowledge (according to CNPq). From these, 21 individuals - 10 males and 11 females - who had answered us were retained as our final sample (representing about 15% of the Institute faculty which were also medical doctors, pharmaceutics, and other life science professionals). Their age ranged from 30 to 60 years old. Most of them had between 41 and 50 years of age, five were in the group between 51 and 60 years of age, and four were less than 40 years old.

A semi-structured questionnaire with 14 closed and one open-ended questions was applied. The online questionnaire was uploaded into Google forms and after being validated by five biologists was sent through e-mail for the professors who had previously agreed on participating in the research. The questions are listed in the results section under each table of answers. The data were organized with the Microsoft Excel package and analyzed using the SPSS software version 19.0.

The second part of this research used qualitative methods and was based on the focus group methodology (Barbour 2009, Flick 2013, Gomm 2008). According to Flick (2013), in qualitative research the objective is not to obtain a pattern in the results to guarantee representativity but rather to capture the subjective meaning of the research question from the participants' perspectives. We chose to invite professors that were not involved in the first part of our research to avoid bias in the group. The homogeneity of the group consisted in that they were all biologists, worked as full-time professors, had been active in research

in the previous five years with intellectual productions attested by their academic CV at *Plataforma Lattes*. The heterogeneity of the group was that they represented different areas of knowledge in the field of Biology. Firstly, a randomized selection was conducted, but then we also intended an equal distribution of participants in the following areas (representing different departments): Biochemistry, Botany, Cell Biology, Ecology, Genetics, Microbiology, Pharmacology, Physiology, Parasitology, Pathology and Zoology. An invitation was sent by e-mail to 16 professors and among the ones who agreed on participating, two groups were formed with five and seven people each.

For the focus groups, a work protocol was developed and one of us acted as the moderator. The motivation material used was in the form of slides with some selected data - mostly research findings taken from the previous research phase. The discussions lasted for a maximum of one hour and were both video and audio recorded. The main questions proposed for discussion were:

- What do you think about the fact that most respondents of our previous study called themselves 'university professors' and rarely used the term 'scientist'?
- Are the terms 'scientist' and 'researcher' synonyms?
- Do you see any impact on society upon the fact that university professors do not call themselves 'scientists'?

The research was appreciated and approved by the local Ethics Committee for Research under the number CAAE 36703714.2.0000.5149.

RESULTS

In the quantitative phase of this study, the first part of the questionnaire was intended to characterize the professional, thus they were asked to complete an open field with their job titles (spontaneous). This allowed us to analyze how they self-designate professionally when participating in a scientific study.

Table I shows the frequency of the terms used by the respondents for this question. We found it remarkable that only one respondent wrote 'scientist' to describe the current profession. The most commonly utilized terms were: 'professor' (8); and 'biologist' (6). Other

Table I. Frequency of answers for questions 3 and 5*.

Answers	Question 3 (open field)	Question 5 (from list)
Biologist	6	3
Professor	8	-
Researcher	-	-
University professor	4	8
Professor/researcher	-	6
Scientist	1	2
Medical biologist	1	-
Biologist/University professor	1	1
Professor/Educator	-	1
Total	21	21

***Question 3: Profession (open field). Question 5: How do you call yourself as for your profession? (from a list).**

terms were related to the professorship such as university professor, for example. One of them included the two terms (biologist/professor); another one specified medical biologist.

Question 5 had to be answered by choosing from six alternatives (with the option of 'Other' and writing down other alternative name) to answer how they would call themselves in relation to their profession. We noticed differences in the way they initially called themselves in the open-ended question (Table I). The term 'scientist' was now elected to describe the job of two of them. The term 'university professor' was the preferred one (8), followed by 'professor/researcher' (6). Interestingly, 'researcher' alone was not chosen by any of the respondents. 'Biologist' was selected by three respondents. The alternative name forms are visibly related to the activities that they must face in their career, i.e. teaching, research and outreach.

We have also opted to ask about professional self-designation in formal and informal situations. This idea originated in our hypothesis that there would be differences in the image they wanted to show depending on the public or person with whom they were interacting. In the subsequent questions, six different situations were presented for the interviewees and he/she was asked how they would call themselves or, alternatively, how they would introduce a colleague.

The formal situations involved (a) an interview to a journalist; (b) filling out a bank form; (c) introducing a colleague to another fellow in a scientific meeting (questions 6 to 8 in footnotes of Table II). Some terms that were frequently utilized in one situation were apparently ignored in others. For example, the term 'professor/researcher' was chosen as the answer by 57.1% and 52.1% for situations (a) and (c), respectively, while only one person chose these same terms when filling out a bank form.

When the answers for the three situations are grouped (Figure 1) the terms that were the most and the least frequent are easily seen. There was an overall preference for the use of 'university professor' (44.4%) and 'professor/researcher' (38.1%). The least mentioned terms were biologist (7.9%), scientist (4.8%) and researcher (1.6%).

The informal situations were presented in the questions that followed: (d) introducing oneself in a sports or leisure environment; (e) introducing a colleague to a childhood friend; and (f) being introduced by a family member (questions 9 to 11 in footnotes of Table III).

Table II. Frequency of answers for three questions of formal situations.

	QUESTION 6	QUESTION 7	QUESTION 8
Biologist	1	4	-
University professor	5	16	7
Professor/Researcher	12	1	11
Researcher	-	-	1
Scientist	2	-	1
Other: UFMG professor	1	-	1
Total	21	21	21

QUESTION 6: You were invited for an interview about your work by a journalist. How would you like to be introduced?; QUESTION 7: You are filling out forms in a bank. How do you denominate your profession?; QUESTION 8: You are about to introduce a colleague to someone who is in the same congress/conference. You would say your colleague is a:.

The most common term utilized for all non-formal situations (Table III) was 'university professor' (12 or 13), followed by 'professor/researcher' (4 or 5) and 'biologist' (3 or 2). The term 'scientist' was mentioned only once and in the familiar situation. The grouping of answers in the informal situations is shown in Figure 2.

Overall, the terms more frequently used in either formal or informal situations were the same: 'professor' and 'professor/researcher'. The data indicate that the designation 'scientist' is, in fact, rarely utilized by the professors of the Institute and that, even in the family settings, there seems not to be a recognition of the professional as representing a scientist.

When it comes to the question of introducing a colleague, we hoped to know whether the interviewee would use a different term than the one he/she had used to self-designate. On one hand, the question could represent a mirroring situation in which one would introduce the colleague in the way he/she would expect or desire to be introduced. On the other hand, if the answer was different in both settings, this may indicate the existence of a value judgment, according to which response is given more of less importance than the other. Another possibility is that they may be using a term they considered more elucidatory. Comparing the answers to the two questions (Table III) one can see that 12 respondents have used the same term to introduce oneself or to introduce a colleague (either to another colleague or to a childhood friend). However, alteration or adaptation of the term was seen in the answer of nine respondents. Even the respondent that admitted introducing herself as a scientist in any of the four informal circumstances presented, used other terms when dealing with society in informal situations.

The last question invited the respondent to reflect on whether the terms 'researcher' and 'scientist' would be synonyms. Nine of them agreed while 12 disagreed with the affirmative. Only two of them commented: one agreed because, according to him/her, 'researcher' is the term used by funding agencies and research institutions; the second respondent disagreed and commented that "every scientist is a researcher but not every researcher is a scientist". Since there were no additional comments on the answer, we have assumed that

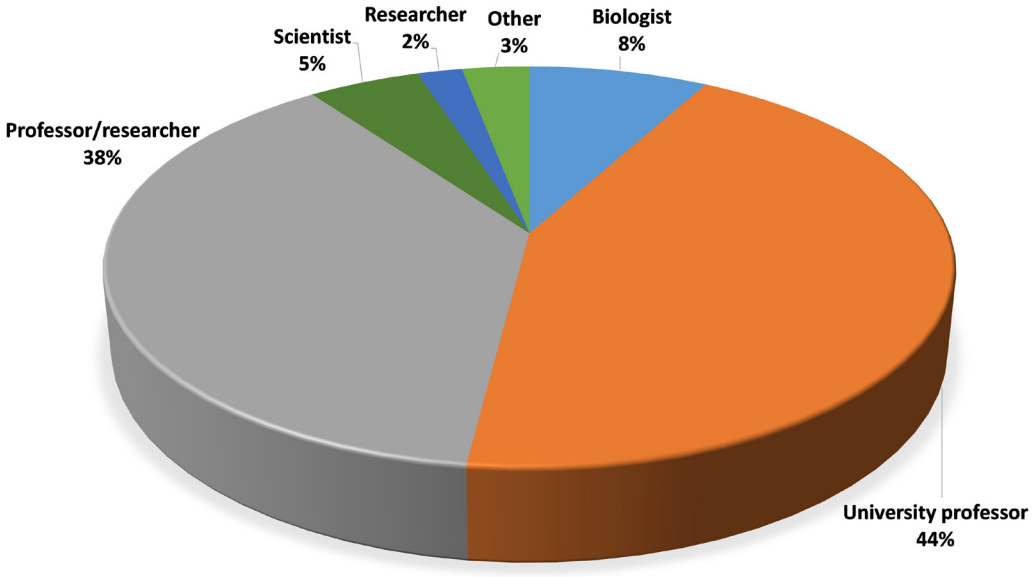

Figure 1. Grouping of answers for self-designation in formal situations.

he/she meant that the occupation of technicians or of those who conduct surveys and census, for example. This question pointed out the need to understand more deeply what was understood by these two terms.

The second part of this study was crucial to deepen on the findings we observed in the quantitative research. Participants of the focus groups were initially exposed to some of the data obtained in the previous research phase. Group participants related positively to the answers that most of their colleagues have made. For instance, they also thought 'professor' is the most adequate choice for naming the profession. All of them agreed that the term 'scientist' would not be chosen to designate their job. Several ideas were presented as the reasons for such. Most of them agreed that: 1) professor is an adequate term because that is the name of the position they were hired for; 2) there is no regulation for the profession of scientist in Brazil, making it a non-existing profession *per se*; 3) self-designation will vary and is dependent on the situation and to whom one is talking to (e.g. self-introduction will vary according to formal and informal daily situations).

In both focus groups there was much discussion on the use and the meaning of the term 'scientist'. Here we present some thoughts of the participants:

> *"The name scientist encompasses activities in many different areas in addition to Biology, such as Geology, Engineering, etc."*

> *"The name scientist is more utilized to designate researchers in private companies."*

The expression 'research scientist' was mentioned as being rather common in universities of the United States or for a junior researcher position in other countries. However, participants suggested that the term 'research scientist', as used abroad, lacks the type of labor stability that a tenure-track professor position has."

> *"It is simpler and more straightforward to say 'I am a university professor', instead of saying 'I am a scientist', which demands further explanations."*

It was said that being a university professor involves more respectability and that the title 'professor' means higher deference and

Table III. Frequency of answers for three questions of informal situations.

	QUESTION 9	QUESTION 10	QUESTION 11
Biologist	3	2	2
University professor	12	13	12
Professor/Researcher	4	5	5
Researcher	-	-	-
Scientist	-	-	1
Other	2	1	1
Total	21	21	21

QUESTION 9: In the gym or leisure activities how do you introduce yourself as for your profession?; QUESTION 10: You meet a childhood friend while you are in the company of a colleague. To introduce this colleague, you would say he/she is:; QUESTION 11: You are about to be introduced to a friend of a relative – parents, spouse, kids, siblings, etc. They would say you are a:.

recognition; however, participants believe that people, in general, are not acquainted with the array of activities that a professor does, including doing science.

Some people indicated that there is a pedantic element in saying 'I am a scientist' that ultimately will separate the person from the public.

> *"Participant: It is important to construct this idea of scientist indeed... this social idea. I see, with children, for example... I had nephews and nieces between 7 and 8 years-old that... for them, their uncle is a scientist. My uncle works in a laboratory...*
>
> *Moderator: You told them that, right?*
>
> Participant: No. I have never called myself like that. But sometimes we see it in a movie and then somebody tells them: - look, your uncle works in a place like that. – Oh, he is a scientist. Maybe a free, direct translation... Maybe in other countries the careers are better regulated or structured. Thus, the name scientist starts to appear to the members of the society."

Another participant pointed out the fact that in the United States research scientist is a position both in the industry and academic institutions meaning that, in a university realm, scientists can be both professors and research scientists.

Participants were also presented with the results derived from the question 'Are the terms researcher and scientist the same?' and were invited to give their opinion as well. One of the participants was categorical in saying that the term 'scientist' is hardly ever used in the media, as opposed to 'researcher', unless it refers to a generic stance such as: "scientists have discovered an important gene". Contrary to this idea, another participant stated that the term scientist is mostly adopted by the media

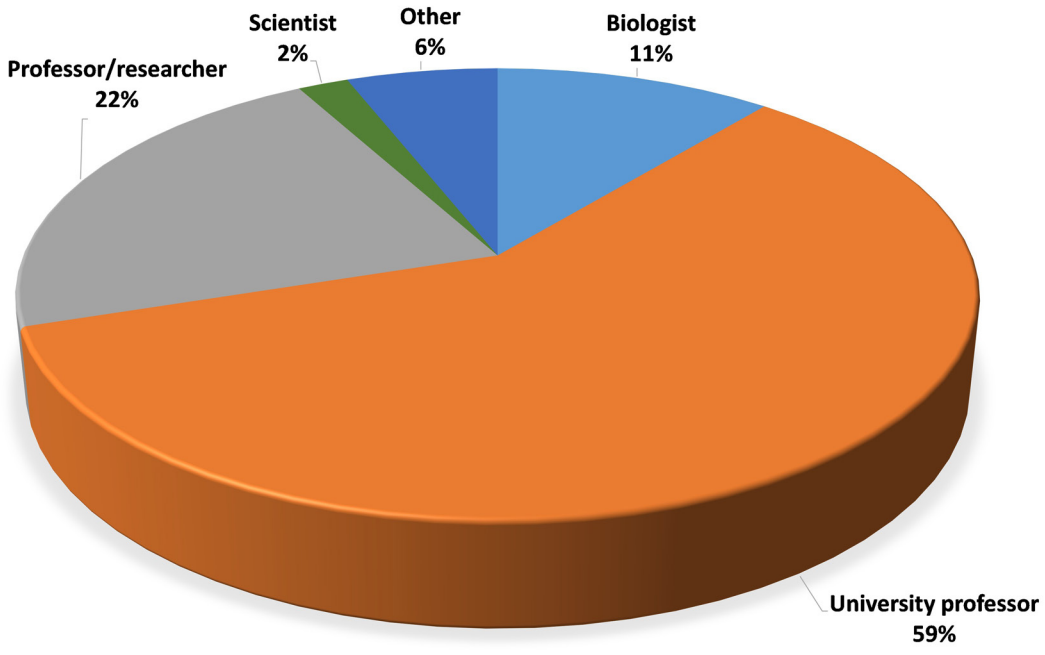

Figure 2. Grouping of answers for self-designation in informal situations.

and usually refers to someone who has made a really great contribution to science. The overall opinions towards media coverage reinforce the importance of the notion of 'scientist' as a 'license' to perform scientific consensus among peers, e.g. in the sentence given as example "scientists have shown that phosphoethanolamine did not prove to be efficient in all cases".

Another participant thinks that 'researcher' and 'scientist' do not really differ in terms of what they do, such as scientific method and rigor, but, perhaps, what differentiates them is the magnitude of their contribution. This idea is similar to the one mentioned in the previous paragraph inputting a greater responsibility for the name 'scientist'.

> *"Scientist is an attribution that the media uses and that we do not, I don´t know why. I think that scientist is the one who gives an impacting contribution that reflects on society... Scientist is the one who brings information, a discovery that breaks paradigms or that benefits society."*

Another fruitful discussion was also held around a question used in the 2015 Brazilian survey of public perception of S&T - "Do you remember the name of an important Brazilian scientist?" - and the overall answers of respondents. Some results (i.e. only 6% of them said that they could name an important Brazilian scientist) were presented to the two focus groups, and participants were not especially surprised with them. Some of them pointed out the word 'important' as being related to fame, suggesting the existence of a bias in the way the question was framed. Another participant indicated that different generations may remember names of famous people at one moment. Recollection of names that were on the media would certainly be easier. In fact, in the initial survey of 1987 the question related to knowing a scientist was "Do you know a famous scientist?" and this has been changed in subsequent surveys to "Can you remember the name of any important Brazilian scientist?" (CGEE 2017, CNPq/GALLUP 1987). Although the two situations cannot be directly compared because the questions are different, replacing the word *famous* by *important* in the last surveys only increased the percentage of Brazilians who could not point a name for a scientist. The participants of our study may be right in the sense that the two words are intrinsically connected, and fame is relative of time and socio-culture.

Following the conversation in the focus groups, a very different discussion was started after the presentation of the above-mentioned data (CGEE 2017) and the motivation of our research to the participants. The following question was raised: do university professors contribute to a deficiency of knowledge about science and lack of interest for science in young students when refrain to call themselves scientists?

Participants of both groups pointed out low investment in science popularization in Brazil as a reason for the lack of visibility of the scientists. The discussion was naturally drawn to the idea that science should be more publicized, that science journalists should be more numerous and better prepared, and that public science communication is incipient in the country; also, they pointed that scientists and university professors should be better supported to go public and be backed by a trained set of media professionals from their own university.

DISCUSSION

Birth of the name 'scientist'

The name 'scientist' is believed to have been coined by the theologian and philosopher

William Whewell in 1833. The history of the creation of the word is delightfully told and discussed in an early paper by chemist Sidney Ross (Ross 1962) who claims that the controversy around the word 'scientist', driven by Whewell, was largely of etymological stance. However, he points out that the historical and cultural context must be taken into account because the need for a new word is socially determined and the evolution of its meaning is also a response from society. Broadly speaking, the word 'scientist' came from a need to explain those who were the 'men of sciences'. This of course was preceded by the evolution of the term and the emergence of science as a discipline in its own, completely detached from Philosophy. In its origins, the use of the word science in common speech came to have the dominant meaning of natural and physical sciences.

The first suggestion of the word scientist was made on an anonymous review of a book (Ross 1962) but six years later, Whewell made his point more prominently:

> *"As we cannot use physician for a cultivator of physics, I have called him a Physicist. We need very much a name to describe a cultivator of science in general. I should incline to call him a Scientist. Thus we might say, that as an Artist is a Musician, Painter, or Poet, a Scientist is a Mathematician, Physicist, or Naturalist."* (Whewell 1840).

In our study, some participants understand that the use of the word 'scientist' implicates in further explanations since a scientist can be a biologist, geologist, chemist, mathematician, etc., as preconized by Whewell when coining the word, scientists comprise many professions since the start. Apart from the philological discussions about the new word brought by the author, the content in the following paragraph seems to be more relevant for the purposes of our research:

> *"The old ideals died hard, but they could not survive the educational reforms that placed technical education on the same footing as education for the learned professions of medicine, law, and theology. To the student preparing for a career, science was now presented merely as another alternative profession; and the word scientist carried no less desirable connotations than did physician, lawyer, or clergyman."* (Ross 1962)

This means that if the word 'scientist' was created to differentiate, to outstand man of the sciences among other professionals, the way that the careers had been set up in those days did not make 'scientists' special. These professionals would have connotations as simple or as grand as those of other professionals such as lawyers or physicians.

The name scientist and emergence of the scientific community in Brazil

Sá (2006), in her analyses about the emergence of science as a profession in Brazil in the turn of last century (1898-1935), points out facts that relate to the previous paragraphs. It is certain that the process of professionalization of science in Brazil was influenced by ideas from Europe but some facts seem to be exclusive of Brazil in regard to the ascension of scientists as professionals. The term scientist encompassed several types of intellectual, literate people who had abilities related to literature, rhetoric and philosophy. A new meaning for scientist had more to do with the labor of experimentation and observation of reality. A movement started to affirm a new identity for the scientist drawing a line between the earlier and the new meaning

of the word. The specialization of the scientific work, together with the affirmation of the scientist as a professional category, coincides with the creation of universities in the Country. Intellectuals such as Edgard Roquette-Pinto, Miguel and Álvaro Ozório de Almeida, Oswaldo Cruz, Carlos Chagas were engaged with this professionalization of the men of the sciences, being important for the foundation of the Brazilian Academy of Science (ABC) in 1916, a definite step towards a new era for science in Brazil. The fascination for scientific discoveries, both in Brazil and in Europe, helped to create the status of science as the most elevated form of human intelligence, capable of informing the origin and future of men and influencing or even being responsible for society´s conduct (Sá 2006). About 50 years after Whewell coined the word scientist, in the tropics the search for the identity of the professional of science was still an issue.

The history of science in Brazil in the early 20th century points out for some difficulty in having this professionalism of the scientist, since the scientific work had to be done in the spare time or together with other activities such as teaching, producing vaccines, constructing roads and buildings, and so on (Schwartzman 1979). In the 1930s the first universities had been implemented but had characteristics of the 19th century, meaning, education for the liberal professionals and no research. With few exceptions, professors were not inclined to the experimental aspects of teaching nor basic research. Science was then done outside the universities in institutes, museums and private or governmental laboratories (p. 217). Because of administrative changes in the governmental sphere, starting in 1937 a law was implemented that did not allow accumulation of jobs as a professor in a university and as a scientist in research institutions, revealing that the scientific activity did not differentiate nor had sufficient autonomy to be perceived as something valuable that needed to be preserved. It became evident that those who made science were first recognized as civil servants and not scientists and professors (p. 187). Due to the limited data and specificity of the group studied we cannot at this point indicate a clear relationship of our findings with the constitution of the Brazilian scientific community. But we can try to point possibilities of discussion around the subject. Presently it is clear, at least for the scientific community, that the job of a university professor (mostly public universities thus making them civil servants) includes the work of the professional of the sciences who is the scientist. For the group analyzed they seemed to consider themselves men (and women) of the sciences, the ones who do the science in the country although they do not use the term 'scientist' to identify themselves. In addition, the status of being a university professor was pointed as positive by the group and they seemed to feel comfortable and more identified as such. The title was, in fact, indicated as having a greater social respectability according to some of the participants which may be related to the history and social construction of the universities in Brazil.

Ross (1962), by looking back and forth into the history of the words 'science' and 'scientists', insists that these words continued to take a part in further socio-cultural evolution. Questioning the authority of science and scientists in 'modern days', he adds a note that continues being appropriate almost 60 years later:

> *"An abstraction named ' the scientist ' has been given form in people's minds as a new figure of authority, corresponding to the priest or witch-doctor of a more primitive*

> *culture, whose 'scientific' statements can be accepted with child-like reliance. The notion is dangerous not merely because it is untrue but because it is irrational.* (Ross 1962)

This "abstraction" turned into an authority figure may seem fine for some scientists but can be intimidating or snobbish for others. In an analysis of the configuration of the Brazilian scientific community, Barata et al. (2014) detect an interesting point:

> *Social recognition makes these communities of scientists visible, celebrated, admired, quoted, invited, etc. This recognition provides the privilege of being known/recognized. The scientists have the power to know/ recognize, declare what deserves to be known, and label what is known and in what it consists.* (Barata et al. 2014).

Despite this fact, some participants of our research think that the title 'scientist' should be used for those who contribute immensely to science. This creates a division of famous and non-famous, great and non-great scientists, a division well accepted among the participants. Thus, differently from professor, the title 'scientist' does not create a sense of belonging instantaneously. Does the name 'scientist' lack a strong social identity that could hold together professionals with completely distinct walks of life, different interests such as social scientists and engineers? It is possible that in the structuring of scientific communities the name 'scientist' is a too broad level as understood by Thomas Kuhn.

> *If science is the constellation of facts, theories, and methods collected in current texts, then scientists are the men who, successfully or not, have striven to contribute one or another element to that particular constellation. (...) Men whose research is based on shared paradigms are committed to the same rules and standards for scientific practice.* (Kuhn 1962)

Sharing practices and paradigms may be enough to create a sense of community but it may be that, individually, the scientist of the universities needs other bonds to include him/ herself as part of the group, to feel that his/ her contribution to science need not be great to deserve the title 'scientist'. Even though the biologists studied here are not used to call themselves scientists they seem to acknowledge that they are indeed part of the group of the professionals working with science.

Education of young people and scientific careers

Education for a career in science is more tangible nowadays but there is no clear definition of when one becomes a scientist. In the editorial of EMBO Reports molecular biologist Frank Gannon analyzes some aspects of the profession 'scientist' (Gannon 2002). He believes that when a scientist tells someone outside the world of science that he/she is a scientist, a reaction is a mix of confrontation and bemusement, exactly because of the lack of understanding about what scientists do and also because many negative aspects of technology are blamed on them. The author brings this theme into light in an attempt to justify the lack of attention of young people to this "underpaid, insecure and unappreciated science career". He encourages researchers/readers to act so that people in all layers of society be trained in science, although this would not mean that every student should aim at a professorship. Students that chose

other careers should also be considered scientists and be valued by former colleagues and society. He wraps up the discussion saying that "we should establish a system to ensure that the label 'scientist' is defined, recognized and sought after."

Certainly, these ideas are reasoned in the world and also in Brazil. Interest in 'school science' is one of the roads traveled to get to 'academic science'. If, on one hand, there is a lack of knowledge about the scientific career, it is known that in some countries the low interest of young people for pursuing such careers is due to unattractive science classes (OECD 2006). In Brazil, nonetheless, some studies have drawn attention to other concerns. For example, one study (Gouw & Bizzo 2016) points out that young Brazilians have a great interest in science at school but show little interest in a scientific career. Also in the study of Pinafo (2016) it was seen that Brazilian youngsters are different from those of other countries, specially developed nations, in that they have a lot of interest in science, are deeply motivated by science classes but are not motivated at all to pursue a science career. The same research group highlights a low concordance in the answers of 15-year-old youngsters when they were asked to agree or disagree with the affirmatives "I want to be a scientist" and "I would like to have a job on advanced technology" (Oliveira & Bizzo 2017). Many are the reasons for this, but, according to the authors, it is possible to infer that socio-cultural conditions exert an influence, particularly the sense and meaning of the term 'scientist'. The authors correlate the low concordance of Brazilian students with the sentence "I want to be a scientist" with the experience these youngsters have had with science including self-concept and image of scientists. As Rodari (2007) also points out, a teenager may think that he/she does not have the ability to be a scientist or may not be determined enough, or does not want to sacrifice him/herself, suggesting that being a scientist does not mean to lead a normal life. Thus, if a teenager does have the opportunity to meet a university professor and listen that "yes, I am a scientist and I lead a normal life", that may change the adolescent mind towards the scientific career. Positive and negative images have the ability to promote the thought that a scientist is not "someone like us," and rather is a member of an elite, omniscient and privileged group (Christidou 2010). It is also believed that valuable information for designing age-appropriate educational interventions can be provided by relevant studies in order to develop more accurate and realistic conceptions of scientists, which is critical for expanding students' understanding of the nature of science, and helping them choose a career in later life (Christidou et al. 2016).

Image of the scientist/researcher/professor and public understanding of science

Surveys are important tools to grasp what are the trends about a certain subject in a specific stratum of the population and may lead to direct changes in public policies. The precision of the terms for the actors being studied is crucial for the success of a survey being thus extremely important to know if the interviewee understands the questions. In surveys for public perception of S&T, the name 'scientist' is almost always used to refer to the professional working with science. The outcomes of such surveys have been important academically and for driving investment in S&T. That is why we thought it was important to question the groups in this study about the meaning of researcher and scientist for them. As shown, we did not have a consensus on the theme showing that the topic needs further attention from academics working with public perception of S&T.

Christidou (2010) analyzed the images that Greek children and teenagers made using the DAST (Draw-a-scientist-test) in a science and technology event called 'Researcher´s Night'. A curious fact on the methodology is that the test was described and reviewed according to the literature using the term 'scientist' but, for the study, the kids in the event were asked "Please draw a researcher". They found that researchers are represented with stereotypic characteristics, but participants' drawings tended to include fewer indicators of the stereotypic model on average. In a personal communication, Dr. Christidou explained that her group, on other occasions, uses the term 'scientist' (with the DAST), which has a slightly different connotation in Greek, meaning "anyone who has a degree". For that research, because data were collected in the context of the European Commission's 'Researcher's Night' project they preferred to use the word 'researcher' with an understanding that there are differences between the two words. Yet the author exposed a concern as to what extent the context, drawing task and instruction ("Draw a researcher" instead of "Draw a scientist") have influenced teenagers to draw differentiated and less stereotypic images of scientific researchers.

Our results show that there are socio-cultural aspects underlying the differences in the words 'researcher' and 'scientist'. Participant's opinions split in about half and half when they were asked whether the two words mean the same thing. One of the reasons pointed out in the focus group was that funding agencies and institutes use the term 'researcher' to identify the wide range of professionals in the S&T labor force and the understanding that not all researchers are scientists.

In a study in which popular images of science and the public self-image of science were analyzed using public databases for clipart cartoons and Internet photographs, it was noted that scientists may, knowingly or not, reproduce the stereotypes of even the most conservative type in their public self-images (Schummer & Spector 2007). The authors affirm that "Scientists – and more specifically chemists – have shaped a public self-image by producing and diffusing visual images comprising conventions easily associated with their profession."

In one of the earliest articles using the DAST in Brazil, basic education students, their teachers and scientists were asked to do the drawing and write three things scientists do (Lannes et al. 1998). The study concluded that children bore a notion about the scientist profession very close to what scientist themselves feel about their careers with the differences being that *thinking* and *teaching* were commonly quoted by scientists and not by children. Specially interesting for our study was to observe that *teaching* was a word highly frequent in the scientists reports probably reflecting the local conditions in which most of the science is carried out at universities. According to the authors: "it seems natural that scientists should associate research with teaching" (Lannes et al. 1998).

Clichés about science may be reinforced with the help of scientists themselves, although they often complain about it. If pictorially, scientists may participate in the perpetuation and dissemination of "wrong" ideas of the scientific environment and activities, linguistically they may be doing the same by not making it clear what is the link or the distinction of the words researcher and professor with the term 'scientist'.

Main contributions of the study

We have begun our research with an exploratory quantitative survey with biologists working with research at a public university. Even though the number of respondents was relatively low, this step was important for we were able to point out that several terms were preferred

over 'scientist' as a job description in nearly all situations regarding the professional occupation of the group of biological science professors considered. As they answered the questionnaire, most respondents altered the preferred term, probably as a way to adjust their self-expression to the new situation or the listener. This can be attested by the fact that only three interviewees mentioned the term 'scientist' in some of the suggested situations. The second part of our study, with the focus groups, was very helpful to elucidate the reasons for choices like that and on other matters that had arisen.

The ideas that came about in the discussions of the focal groups shed some light on our survey results since they pointed out some directions that we have not anticipated. A question raised was about regulation of the profession scientist in Brazil. There were a few interventions on whether it should or should not be regulated by official professional organizations. Another point related to this was the idea about the complexity of the word 'scientist', in that it can be used to designate a professional from different areas such as Geology, Engineering, Biology, Chemistry and so on. Since we focused on a specific group related to the field of Biology, (although belonging to a highly recognized center of research) we still do not know whether not calling oneself a scientist (when asked about their profession) is a general trend for university professors in Brazil and elsewhere. Is this similar in other science areas, such as other 'hard sciences' or the humanities? In a recent article a physicist from the University of São Carlos, Brazil, talks about the image and work of a scientist. The first paragraph is exactly devoted to the self-designation in daily situations. He says that depending on the curiosity of the interlocutor he would say he is a scientist, but he would rather say that he is a physics doctor and a university professor (Oliveira 2019). Would different country regulations and socio-culture interfere with this behavior?

Finally, could the occasional proximity or coexistence with a scientist that introduces him/herself as such contribute to alter the public perception of this actor of S&T? The hypothesis that the public we have dealt with (biologist, university professor and researcher of a specific university in Brazil) does not self-identify as a scientist in daily life was corroborated by our data. The public imagery formation may be damaged by the fact that so many "flesh and blood" scientists do not introduce themselves as such and might explain why so few people can name a contemporary researcher.

CONCLUSIONS

Considering the sample analyzed in this work, we can say that biologists that work as full professors at the Biological Sciences Institute of UFMG find it a natural choice not to use the term 'scientist' to designate their job in scientific research since they have been hired as professors and not any other job.

The group could not envision, at first, the impact of this attitude on the general public or the responsibility on the creation of a gap between science and the public. However, as soon as some data on public perception of S&T surveys were introduced to them and discussion progressed, some elements emerged linking the lack of visibility of the scientist with low investments on public science communication, including poor media training of science professionals and journalists. This elicited the idea that a program could be implemented, such as suggested by the European Commission, to involve researchers/professors/scientists to fight against *"stereotypical images* of *science* and *scientists* and to *promote realistic role*

models" of science professionals (European Commission 2014).

Interestingly, the year 2020 is presenting a very special situation with the COVID-19 pandemic when science and scientists are being urgently called to contribute with solutions to this threatening challenge. All over the world scientists have been put on the spot to explain, discuss, and recommend procedures and conducts getting closer to segments of the population through mass communication media perhaps as never before. The authority of university professors and researchers has never been so respected despite science negationist movements naturally questioning and doubting produced data and arguments. Many biologists have been called upon action both in the laboratory and in public science communication (showing their specialization as virologists, immunologists, infectologists and so on). No doubt that they represent a respected group, a group of scientists, the voice of science. Would biologists be willing to step further as scientists now more than before? Would this action give their voice more sound and credibility? As for the public in general, with all eyes and attention undoubtedly put on the news about the virus there is certainly a higher exposure to real life scientists that own a name and a job. It will be interesting to follow the perception about science in a next Brazilian survey. Specifically, as for the question that gave rise to the present study, will the number of people who can name a living scientist increase with their recent exposure to them? It will be interesting to observe whether some of the scientists that were recurring in the news these days will be recalled and named as important in the survey. It is possible that the pandemic is teaching, the hard way, where and how science is done and this may help to increase awareness about the importance of investments in S&T.

The absence of data similar to what we collected and considering the implications pointed by our study it becomes evident that this theme should continue to be investigated among other university professors. This could initially be done by Increasing the sample of biologists to include other universities and other countries followed by studies of other areas, especially the 'hard sciences' and the social sciences and humanities, which would certain bring different viewpoints and inferences. According to Barata et al. (2014), which bring the concept of habitus as knowledge acquired in the process of socialization, entry, and residence in a different field, it is possible that "Brazilian scientific field is constituted by different scientific communities that carry a scientific habitus responsible for differentiation between these collectives and other forms of social organization".

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A. V. B. conceived the study and wrote the manuscript with input from T. S. O. and a former collaborator who has declined to be an author. Both authors planned the study and analyzed the data and reviewed the literature.