Opinion of television managers about their viewers and their interest in science: audience images and lack of scientific content on television

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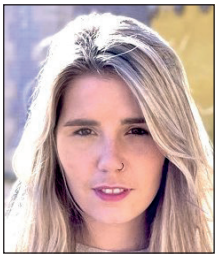

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Abstract

Science does not occupy a prominent place on Spanish television, possibly due to those in charge of the creation, production, organization, and programming of content. Previous research has shown that television executives have mental images of their audiences that they actively use in their professional practice. This study adopts a mixed, qualitative-quantitative method to determine the beliefs of Spanish television executives regarding the attitudes of their audiences toward scientific programs and content. The study began with two focus groups, each made up of five professionals, to identify a wide range of attitudes. A Likert-scale questionnaire was then applied to examine the level of agreement with those attitudes among 450 employees of different types of private and public networks from six different regions of Spain. The main findings are that Spanish television managers do not believe that their viewers enjoy scientific topics or have any interest in them. However, professionals with previous experience of the production of scientific content tend to have a slightly more positive attitude about the opinion of general audiences regarding televised science. Hence, familiarity with televised science positively impacts the appreciation of such content on television. This research highlights the fundamental role of network managers in explaining the lack of science on Spanish media. Its results are coherent with previous studies confirming that TV professionals have preconceived images about their audiences that are derived from their own preferences and that guide their decisions.

Keywords

Audiences; Science communication; Science contents; Science television; General audiences; Spanish television audiences; Attitudes towards science; Audience images; Television professionals; General television; Spanish television; Producers; Directors; Programmers.

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1. Introduction

Science does not feature prominently on Spanish television screens (**Soto-Sanfiel**; **Villegas-Simón**, 2018), and several previous studies have tried to find out the reasons why (**Grosso-Mesa**, 2017; **Gutiérrez-Lozano**, 2002; **León**, 2002; **Moreno-Castro**, 2007; 2009; **Revuelta**; **Mazzonetto**, 2008). Compared with that of other European countries, the little scientific content on Spanish television tends to be of poor quality, produced on a low budget and broadcast at off-peak times (**Lehmkuhl** *et al*., 2012). The public broadcaster, *RTVE*, has always offered science shows, but since private networks arrived in Spain, these have been relegated to uncompetitive times and channels (**Gutiérrez-Lozano**, 2002) due to the need to compete for audience share (**Lehmkuhl** *et al*., 2012) in a highly fragmented television market with a wide variety of channels (**Lehmkuhl** *et al*., 2016). These private Spanish networks tend to promote the image of science as risk and spectacle through their offer of infotainment (**Berrocal-Gonzalo** *et al*., 2014; **Coca**; **Valero-Matas**, 2010). However, although science audiences are low compared to those of other specialist topics, a general increase in interest in science and technology has been observed in recent years (**Francescutti**, 2014). Paradoxically, Spaniards claim to get most of their scientific information from television (**Cano-Orón**; **Portalés-Oliva**; **Llorca-Abad**, 2017; **Revuelta**; **Corchero**, 2015), although they do agree that their country's TV networks show scant regard for science and that there are better media options for finding out about such matters (*Fecyt*, 2015). Hence, the relationship between science and television in Spain is well worth exploring.

Cortiñas-Rovira *et al*. (2015) cite a variety of reasons for Spanish television's lack of interest in science: 1) The recent economic crisis has triggered a significant decrease in R&D funding throughout the country, which has led to a lower presence of science not only in the media but also in society in general; 2) There are structural problems in the Spanish science and technology system, which date all the way back to the 40 years of the Franco dictatorship and the notion that it was wiser to let other countries do the research and then take advantage of their progress. This may be the reason why Spanish people are somewhat scientifically uncultured, and 3) the Catholic Church, which has played such a prominent role in the education system, has also been accused of opposing the secular thinking, methodical skepticism and challenging of the established order that are so inherent to a scientific culture.

The Spanish media market itself has also been blamed for the lack of science on TV. It has been argued that the aforesaid economic crisis may have affected employment in the media, and that this has had a knock-on effect. Also, that the recent digital television licensing process paid little heed to the audiences' cultural interests (**Francés-Domènec**; **Llorca-Abad**, 2017). Other studies have encountered claims that scientific content is financially unprofitable (**León**, 2002; 2008; **Lehmkuhl**, 2014) due to the lack of interest among Spanish audiences (**Cortiñas-Rovira** *et al*., 2015), and both public and private networks maintain that science-based shows struggle to attract advertising (**Moreno-Castro**, 2004). The assumptions of television managers would therefore appear to play a relevant role in decision-making about scientific content. Indeed, a recent study has noted that an understanding of the relationship between the supply and demand of televised content requires consideration of the influence of these professionals and their attitudes to their audiences (**Lehmkuhl**, 2014).

It is worth considering the social perception of science in Spain. According to the latest report from the *Fecyt* (2018), 16.3% of Spaniards spontaneously declare that they are interested in science, and most respondents consider science to be one of the most valued professions in society. Likewise, half of the population feels it is important to know about science and technology for use in everyday life, although they are also revealed to have difficulty understanding these subjects. Indeed, the study reports that the higher a Spaniard's level of education, the greater the importance they attach to scientific knowledge. The survey also finds that television is the most widely used media for learning about science, but the use of Internet has increased significantly in comparison to previous reports. The latter is the most used media for this purpose by people under 35 years of age, while the use of digital media specialized in science and technology is also rising (*Fecyt*, 2018).

It is worth clarifying that, in Spain, public broadcasters (e.g., the national *RTVE* and some other regional TV stations) are freer than private to include science and cultural contents on their offer. This is mainly because public channels do not depend on advertisement revenues to economically survive. Also, that is because they have the legal and moral mandate to offer contents which satisfy the informative, educative, cultural and entertainment necessities of all audiences (**Cano-Orón**; **Portalés-Oliva**; **Llorca-Abad**, 2017; **Moreno-Castro**, 2004, 2007). In fact, public media operate in accordance with the *European directive 2010/13/UE of audiovisual communication services* and the national *General law of audiovisual communication 7/2010*. Both legal instruments regulate the mission of public service of television and the

rest of media. Moreover, the *Law 17/2006* of radio and television state ownership specifically establishes that one of the primary functions of *RTVE* is "to promote the knowledge of arts, science, history and culture" (Art. 3). On the contrary, neither in their original purposes nor in their regulatory legal framework, private televisions are obligated to produce or program non-economically profitable contents. Actually, commercial broadcasters do not include scientific contents in their offer since they appear not to attract majoritarian audiences and advertisement investments (**Coca**; **Valero-Matas**, 2010; **Gutiérrez-Lozano**, 2012).

> This study is theoretically grounded on others that have also found that media managers generate ideal mental images of audiences and their preferences that they actively use in their professional lives. These mental images are largely based on such professionals' own tastes and social experiences.

This research recognizes that the European Union (EU) views science popularization as a priority (**Cortiñas-Rovira** *et al*., 2015). The authors also believe that true democracies need their populations to understand general interest topics related to science (**Cámara**; **Muñoz-Van-den-Eynde**; **López-Cerezo**, 2017) and that a greater presence of science in society would generate a more positive perception of scientists, would help them to gain more support, would improve people's lives while encouraging more researchers to get involved in dissemination (**Greenwood**; **Riordan**, 2001; **Poliakoff**; **Webb**, 2007), on the understanding that a large section of society can only access science through the media (**Besley**; **Tanner**, 2011).

2. Media professionals and science

The relationship between science and the media has traditionally been studied from the perspective of journalism (**Besley**; **Tanner**, 2011; **Poliakoff**; **Webb**, 2007), while the influence of media professionals with executive, creative and organizational responsibilities has been ignored (**Soto-Sanfiel**; **Latorre**, 2014), However, it is not only reporters, but also producers, managers and executives who decide what TV networks show (**Jones**, 2011).

Fortunately, attitudes to science among media professionals are a growing area of study. Recent research by **Soto-Sanfiel** and **Villegas-Simón** (2018) specifically examined the topic and found that their opinions about scientific content and its dissemination on television are unclear, shallow and inconsistent. These researchers claim that these attitudes reflect indifference, incompetence, lack of prior consideration and limited interest in these matters. Nevertheless, their subjects do believe that television is a suitable medium for disseminating science and that it would be positive for it to do so, although **Soto-Sanfiel** and **Villegas-Simón** argue that these statements are products of social desirability bias.

Within the same Spanish context, a previous study observed attitudes to science among final year Audiovisual Communication undergraduates. In Spain, students on these programs are trained in the creation, production and direction of media content of all genres, as well as being coached for organizational positions, typically making them the natural employees of the Spanish media industry. An analysis of their perceptions revealed extremely negative attitudes towards science and its suitability as a media topic, and these students had absolutely no interest in using science as a source of inspiration for their future media work (**Soto-Sanfiel**; **Latorre**, 2014).

3. Audience images

Since the mid-20th century, it has been widely accepted that television managers form ideal mental images of their audiences that they actively draw upon in their professional activity (e.g., **Caldwell**, 2008; **Dornfeld**, 1998; **Gans**, 1957; **Pool**; **Schulman**, 1959; **Ross**, 2014; **Schramm**; **Danielson**, 1958; **Zafirau**, 2009; **Zimmerman**; **Bauer**, 1956). Media producers theorize about their audiences (**Caldwell**, 2008).

Research indicates that such images may be based on market data and subjective knowledge about audiences' consumption habits. However, this knowledge is often also supported by first-hand experiences (**Gans**, 1957). In fact, it has been found that TV professionals' decisions are also based on their own tastes or those of their immediate social circles (**Gitlin**, 1983; **Zafirau**, 2009; **Ross**, 2011).

Research has also shown that producers tend to encourage the kind of media content that they personally enjoy (**Hesmondhalgh**; **Baker**, 2011), draw on preconceived beliefs and intuitive knowledge, and view their audiences as they would view themselves (**Dornfeld**, 1998). This is despite that knowledge not being objective (**Zafirau**, 2009) and merely serving to dissuade them from processing or accepting new information about their audiences (**Zimmerman**; **Bauer**, 1956) and make them disinterested in learning more about their viewers (**Brake**, 2009). In theory, these professionals are viewed as talented (**Mayer**, 2016), to the extent that they are assumed to have such a high degree of awareness of their audiences' preferences that they are allowed to pass judgment, speak and act on their behalf (**Ross**, 2014) despite the potentially broad socio-demographic divide (**Zafirau**, 2009).

The wisdom attributed to network managers about their audiences also relates to their internalization of what the industry views to be creative. Whether they do so consciously or not, TV producers working for networks recognize the kind of creativity their seniors expect from them and act accordingly by aligning themselves with a production culture based on unspoken priorities. This recognition is grounded upon familiarity with the established rules of a working cul-

ture that imposes high demands in terms of expected attitudes and behaviors, and which leads to the hegemonic persistence of particular contents and ideologies (**Draper**, 2014) through the reproduction of established production standards (**Caldwell**, 2008), which ultimately affects television scheduling patterns (**Havens**, 2013).

> The media managers' mental images of their audiences are also fed by beliefs and expectations about what is suitable or not for being televised, which leads to the hegemony of certain content and ideologies over others, with the corresponding effect on schedules

All of the above justifies the observation of attitudes among Spanish professionals with executive, managerial and organizational responsibilities to audiences and their interest in science. This study concentrates on the people who decide which shows are to be created, produced and scheduled for Spanish television, observation of whom could help to uncover other reasons that might contribute to a better understanding of the traditional absence of scientific content on the country's TV screens. It should also be made clear that this does NOT include reporters or news teams. The study specifically draws on suggestions made by **Soto-Sanfiel** and **Latorre** (2014) and **Soto-Sanfiel** and **Villegas-Simón** (2018) and seeks to answer the following research question:

RQ1: What are the attitudes of Spanish television professionals with creative, production, managerial and organizational responsibilities to their audiences' views of scientific content for adult audiences and science in general?

By scientific contents this research means TV programs of any audiovisual genre dedicated to adult audiences that present scientists, scientific knowledge or scientific procedures with the aim of informing and educating audiences. As informed by preliminary research, science is portrayed on TV through different genres and formats (**Moreno-Castro**, 2004; **Seguí-Simarro**; **Poza-Luján**; **Mulet-Salort**, 2015).

The authors are aware that some previous literature suggests that the presiding philosophy in the television industry is unfavorable towards scientific dissemination. According to **Grosso-Mesa** (2013), the predominance of pictures over words on television, together with the quest for a spectacular televisual narrative, are unsuited to science, whose main achievement is less about specific results than it is about the methods by which they are obtained. This would imply that when science is disseminated on TV, it cannot be disassociated from the discourses, participants and channels through which it is broadcast (**Calsamiglia**; **López-Ferrero**, 2003; **Calsamiglia**; **Van-Dijk**, 2004; **Myers**, 2003; **Salvador**, 2002). Television employees therefore need to adapt scientific knowledge and practices into messages that are tailored for their audiences (**Calsamiglia**; **Van-Dijk**, 2004), and view this as a difficult and arduous endeavor (**Soto-Sanfiel**; **Latorre**, 2014). However, it should also be noted that other authors maintain that pictures help to get scientific knowledge across on television: they can be very useful for presenting the facts in a visual manner or revealing invisible aspects by means of graphics and simulations, for data comparison (**Sheppard**, 2005) and for covering high-impact topics (**Greenberg** *et al*., 1989). Images also hold symbolic value that can trigger emotions and help to add meaning to scientific matters and make them easier to interpret (**Boholm**, 1998; **Oring**, 1999). They also keep the audience's attention and enhance public engagement with scientific affairs (**Höijer**, 2010).

4. Method

This research was designed in light of the lack of available preliminary instruments that can reliably define, collect and measure attitudes among TV professionals to the topics being discussed. Therefore, in order to achieve its goals and answer the research question, a mixed approach was adopted involving two successive data collection phases and techniques (**Creswell**, 2003; **Creswell**; **Plano-Clark**, 2007).

The first phase was qualitative and featured two focus groups made up of employees of TV networks working in creative, production and scheduling areas. The idea was to elicit opinions, attitudes and beliefs (**Osborne**; **Simon**; **Collins**, 2003) that could be used as the basis for a questionnaire that would be applied in a subsequent quantitative phase aimed at assessing the degree of agreement with the aforesaid opinions and determining how widespread they are. This latter phase employed a convenience sample of professionals from national, regional and local TV networks based in different regions of Spain, and with different types of ownership. The full design is explained in detail in the quantitative phase section. The data collection took place on December 2018.

5. Qualitative phase: Focus group

Five TV managers participated in each of the two focus groups. The first gathered professionals from local networks, while for the second the subjects were from national ones. None of them received payment for attending. They were asked questions based on previous studies on attitudes to science (**Soto-Sanfiel**; **Latorre**, 2014) and the associated literature.

Three researchers participated in each focus group. One of them asked the questions, one sought to provoke discussion and the third was an observer who made notes on the participants' non-verbal communication and the frequency and intensity of their answers.

Both focus groups took place in September 2018. They lasted for about an hour and a half. They were recorded and transcribed verbatim. A content analysis using the Atlas.ti software package was applied to the transcribed texts. Following **Onwuegbuzie**, **Bustamante** and **Nelson** (2010), this analysis used: 1) inductive codes derived from the previous

literature and the topics and opinions addressed during the focus groups, and 2) deductive codes, which emerged from the transcribed texts mainly due to the reiteration of topics and opinions, controversy generated between the participants and/or the energy with which they expressed their feelings (**Morgan**; **Krueger**, 1997).

> "TV managers are credited with special knowledge about their audiences and are granted the capacity for action. To our knowledge, this theoretical approach has yet to be applied to the study of scientific communication"

The codes were analyzed across successive phases in which they were inter-related and re-coded, and eventually filtered down into ten categories that were used as items for inclusion in the questionnaire. These ten items were formulated as statements representing the attitudes, perceptions and opinions gathered from the focus groups (**Onwuegbuzie**; **Bustamante**; **Nelson**, 2010), covering a range of topics related to the TV professionals' perceptions of the relationship between TV audiences and science. These items are shown in the results section (Figure 1).

Before measuring these items in the second phase, a pilot test was run with a group of similar professionals to the study population in order to assess the proposed questionnaire's validity and feasibility.

6. Quantitative phase

6.1. Participants

The quantitative phase involved 450 subjects of whom 50.4% were men (*n* = 227), 46.7% (*n* = 210) were women and 2.9% (*n* = 13) did not state their gender. 56.3% were university graduates, 19.6% had postgraduate diplomas, 14.5% had vocational training, 5.6% had PhDs and 4% had only attended high school.

85.5% worked for public networks, 9.1% for private ones and 4.2% for both. In the European context, this is an important variable since public networks are duty-bound to include scientific affairs addressed at all ages (*Open Society Institute*, 2008). The participants were from six regions of Spain [Andalusia (*n* = 79), Canary Islands (*n* = 2), Catalonia (*n* = 159), Extremadura (*n* = 49), Galicia (*n* = 21) and Madrid (*n* = 137)], and from 26 municipalities.

Regarding coverage, 55.3% of the professionals (*n* = 251) worked for a regional network, 37.4% for a national network (*n* = 170), 2.4% for local television (*n* = 29), 3.1% worked for both national and regional networks, 1.1% for all three types, and 0.7% for local and regional ones. 85.5% of the participants worked directly for a TV network, 7.1% for a production company that worked for a TV network and 7.4% for both. 72.3% stated that they held a production/creative position and 24.8% a managerial/organizational one. Moreover, 2% described their jobs as managerial/creative, 0.5% as managerial/production and 0.5% as production/organizational.

As for the creation, production, scheduling and/or management of science-related shows, 64.4% of the participants stated that they had never been associated to these roles. The other 35.6% said they had.

6.2. Materials

The perceptions extracted from the analysis of the focus groups were used to create five-point Likert scales (1 = Totally disagree to 5 = Totally agree). The questionnaires were anonymous, although participants were required to state their age, gender, and type of job.

6.3. Procedure

The researchers visited the offices of national and regional networks (*Canal Sur*, *Canal Extremadura*, *Telemadrid*, *Televisió de Catalunya*, *Televisión Española*, in Madrid and Barcelona, *Televisión de Galicia*, *Televisión Canaria*) and local networks (*Barcelona TV*, Mataró TV, *Televisió a l'Hospitalet*; *Televisión de Badalona*; *Televisió Sant Cugat*), whose employees were asked to collaborate by filling in the questionnaires, which they were allowed to do in private. Although the study invited a large number of such professionals to participate in the study, the final response was very poor.

6.4. Data analysis

We used the *R* software to perform the quantitative analysis, and the tidyverse package for data manipulation and visualization (**Wickham** *et al.*, 2019). To describe the variables, we performed boxplots that consider the ordinal nature of data to represent quartile 1 (Q1), quartile 2 (Q2, median = Mdn) and quartile 3 (Q3). We performed a Kruskal-Wallis test to assess the differences between groups, since the variables were ordinals, and the independent groups had different size.

7. Results

One of the main observations derived from the focus groups was the lack of discussion about science and television among the participants. This was evidenced by the difficulty that the researchers had getting the participants to talk about science during the sessions, and the lack of variety in the subjects they debated, as reflected by the variables and questions included in the questionnaire.

Figure 1 shows the items derived from the content analysis of the focus groups. Those items correspond to exact statements made by the participants during the two sessions and are presented according to the participants' degree of agreement during the quantitative phase. The items that received the most agreement (median 4) are listed above those that received less (median 3).

The results show that the vast majority of participants agreed that science is interesting for everyone (Q1 = 4, Mdn = 4). They also agreed that audiences of scientific programs are highly specific and that audiences need to be more scientifically literate in order for such programs to be successful (Mdn = 4).

However, the participants were neutral when asked whether audiences from other European countries are more receptive to scientific content than Spaniards (Mdn = 3, Q3 = 4). Their responses were also neutral (Q1 = 2, Mdn = 3, Q3 = 4) to three other statements: (i) that general audiences are not interested in scientific information in the media, (ii) that science shows do not work for mass audiences, and (iii) that there is no social demand for science programs. Neither do they believe that Spanish television audiences like scientific content (Q1 = 2, Mdn-Q3 = 3).

We then examined whether there were differences in the distribution of items according to the 10 observed variables. We did not find significant differences for gender (see Appendix A, Figure A1), area of work (see Appendix A, Figure A2), level of education (see Appendix A, Figure A3), or type of TV (see Appendix A, Figure A4). Therefore, none of these aspects impact the participants' opinions.

However, the type of firm they work for (see Figure A5) did cause differences in agreement that "science is interesting for everyone" [χ^2(df) = 9.1(2), p = .01]. Although professionals working for TV Networks, production companies, or both types of firm did agree with the statement, those working for production did so to a lesser extent (Q1 = 3, Mdn–Q3 = 4) than the other two groups (Q1–Mdn = 4, Q3 = 5).

We found significant differences in 5 out of 10 items depending on the type of TV network that professionals work for (see Figure 2, public *vs.* private *vs.* both). Specifically, when asked whether science is interesting to everyone [χ^2(df) = 11.8(2), p = .002]: participants who work for public networks agreed with the statement to a greater extent (Q1–Mdn = 4, Q3 = 5) than participants who work for private networks (Q1 =3, Mdn = 4, Q3 = 5) or both (Q1 = 3, Mdn–Q3 = 4). Moreover, participants who work for private networks agreed to a greater extent (Q1 = 3, Mdn–Q3 = 4) than participants who work for public networks or both (Q1 = 2, Mdn = 3, Q3 = 4) that science shows do not work for mass audiences [χ^2(df) = 9.3(2), p = .01]. However, participants who work for both types of network agreed to a greater extent that there is no social demand for science programs [Q1 = 3, Md–/Q3 = 4, χ^2(df) = 6.7(2), p = .03] than participants who only work for private networks (Q1–Mdn = 3, Q3 = 4) or public networks (Q1 = 2, Mdn = 3, Q3 = 4).

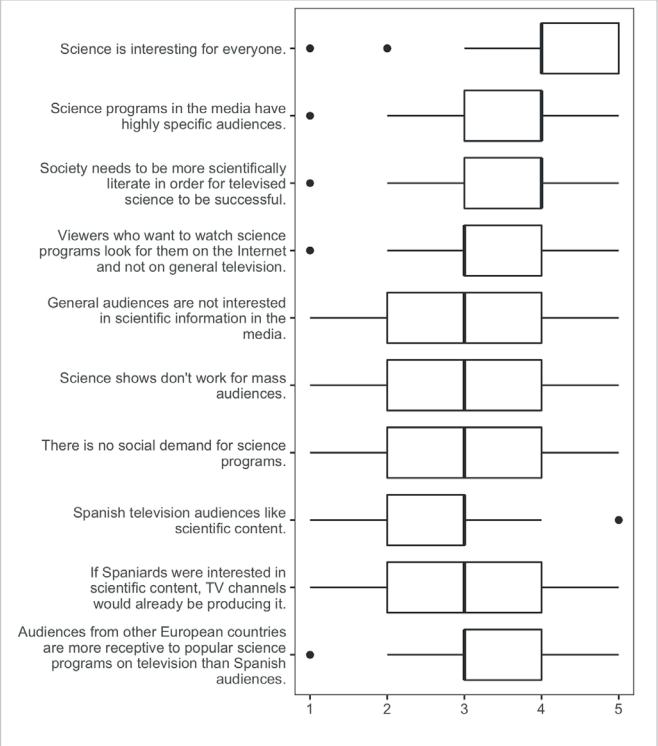

Figure 1. Item content and distribution of responses

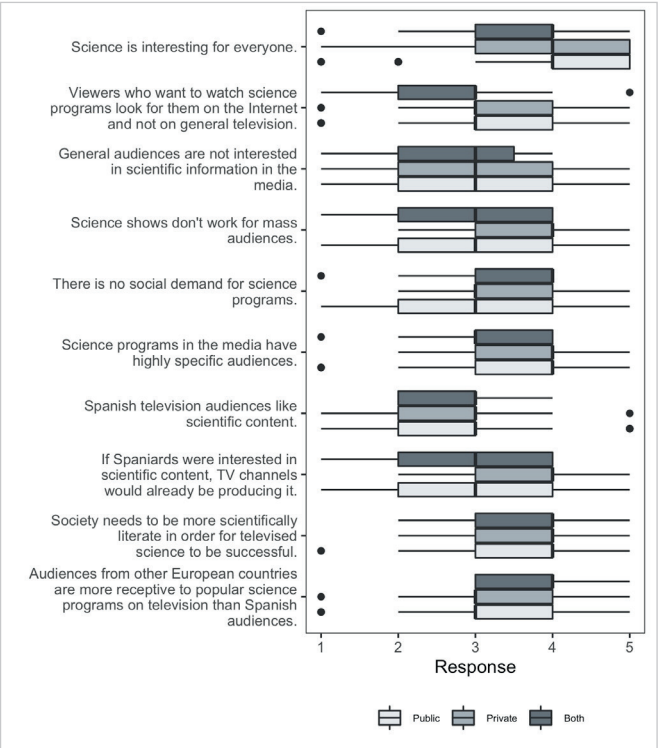

Figure 2. Items by type of network

We also found differences regarding the view that if Spanish society was interested in scientific content, networks would already be producing it [χ^2(df) = 16.8(2), p < .001]: participants who work for private companies agreed to a greater extent (Q1 = 3, Mdn–Q3 = 4) than those who only work for public networks or both (Q1 = 2, Mdn =3, Q3 = 4). Finally, we

found different views as to whether audiences from other European countries are more receptive to popular science programs on television than Spanish audiences [χ^2(df) = 6.4(2), p = .04]: participants who work for both kinds of TV network agreed with this to a greater extent (Q1 = 3, Mdn–Q3 = 4) than those who work for private or public TV networks (Q1 = 2, Mdn = 3, Q3 = 4).

Regarding previous experience in the production of science content (Figure 3), we found differences in 4 variables. Although not appreciable in the item distribution there were differences in considering that Spanish television audiences like scientific content (χ^2[df] = 5.59[1], p = .02). Similarly, there were also significantly different views as to whether greater scientific literacy among society is necessary in order for televised scientific content to be successful with audiences and as to whether there is no social demand for science programs (χ^2[df] = 4.00[1], p = .046). However, the only appreciable difference in the item distribution was that regarding the belief that general audiences are not interested in scientific information in the media (χ^2[df] = 8.81[1], p = .009), which was not as strong among participants with previous experience in the field (Q1–Mdn = 2, Q3 = 3) as among those who had never produced science contents before (Q1 = 2, Mdn = 3, Q3 = 4). So, familiarity with the production of science content affects TV professionals' perceptions of audience attitudes to such content.

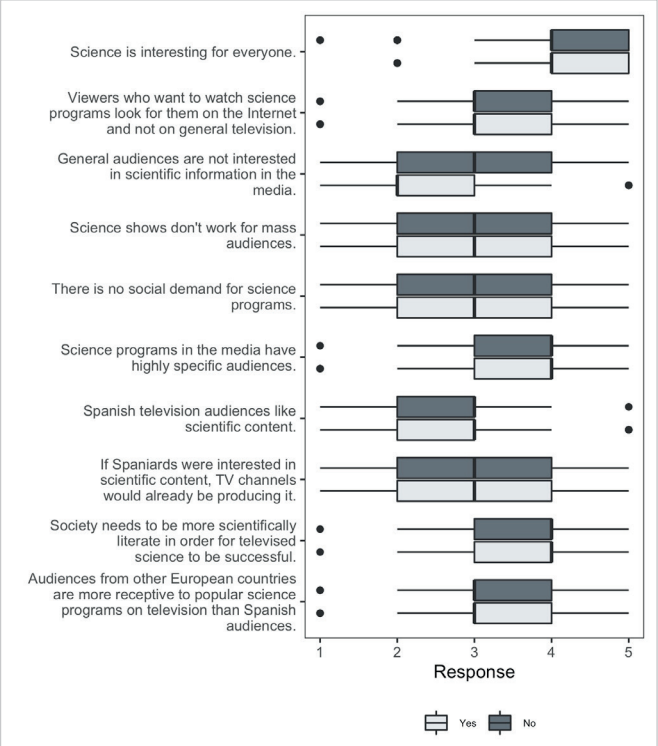

Figure 3. Items by previous experience of science content production

8. Discussion

This research has explored the ideas of Spanish TV professionals about the relationship between Spanish audiences and scientific content on television. Until now, these subjects' opinions on the matter have only been marginally studied, despite their influence on decision-making as to the form and content of TV schedules (**Soto-Sanfiel**; **Latorre**, 2014; **Soto-Sanfiel**; **Villegas-Simón**, 2018). This research has helped to identify reasons for the absence of science on Spanish TV screens (**Grosso-Mesa**, 2017; **Gutiérrez-Lozano**, 2002; **León**, 2002; 2008; **Moreno-Castro**, 2007; 2009; **Revuelta**; **Mazzonetto**, 2008; **Soto-Sanfiel**; **Latorre**, 2014; **Soto-Sanfiel**; **Villegas-Simón**, 2018), and also confirms the validity of considering such professionals' attitudes in the study of scientific communication, as suggested by the little previous research (**Soto-Sanfiel**; **Latorre**, 2014; **Soto-Sanfiel**; **Villegas-Simón**, 2018).

The study is theoretically grounded on others that have also found that media managers generate ideal mental images of audiences and their preferences that they actively use in their professional lives (see **Caldwell**, 2008; **Dornfeld**, 1998; **Gans**, 1957; **Pool**; **Schulman**, 1959; **Ross**, 2014; **Schramm**; **Danielson**, 1958; **Zafirau**, 2009; **Zimmerman**; **Bauer**, 1956) and that claim that these mental images are largely based on such professionals' own tastes and social experiences (**Gans**, 1957; **Gitlin**, 1983; **Hesmondhalgh**; **Baker**, 2011; **Zafirau**, 2009; **Ross**, 2011) and that this prevents them from acquiring further information about their audiences (**Zimmerman**; **Bauer**, 1956). These images are also fed by beliefs and expectations about what is suitable or not for being televised, which leads to the hegemony of certain content and ideologies over others (**Draper**, 2014), with the corresponding effect on schedules (**Havens**, 2013). TV managers are credited with special knowledge about their audiences and are granted the capacity for action (**Ross**, 2014). To our knowledge, this theoretical approach has yet to be applied to the study of scientific communication.

The most remarkable finding is that the respondents hold the view that Spanish audiences do not enjoy scientific content on TV and are not interested in it being shown. They also consider that there is a need for greater scientific literacy among Spanish society in order for televised scientific content to be successful, and that audiences of such content are highly specific. Given that these professionals are so largely responsible for deciding what content is produced and scheduled, one would not be wrong to believe that these ideas help to explain the lack of science on Spanish TV screens. Future studies should contrast these opinions with audience studies.

The idea that TV producers' mental images of audiences are influenced by their own experiences is evidenced by the fact that familiarity with the production of televised science influences their views about the topic. Previous involvement in the field makes professionals believe more that general audiences are interested in science

"The most remarkable finding is that the respondents hold the view that Spanish audiences do not enjoy scientific content on TV and are not interested in it being shown"

content in the media. Hence, and as claimed in the literature, past personal experiences influence the formation of mental images of audiences (**Gans**, 1957; **Gitlin**, 1983; **Hesmondhalgh**; **Baker**, 2011; **Zafirau**, 2009; **Ross**, 2011), although in the case of scientific content, they do not totally transform them. Future research should look in specific depth at these perceptions, and should particularly compare them with what audiences really feel about science. As mentioned earlier, a recent survey of perceptions of science among Spaniards yielded somewhat contradictory data, for while only 16.3% spontaneously declare that they are interested in science, most of the population say that they receive scientific information from TV, that science is a highly appreciated profession and that science and technology are necessary for everyday life (*Fecyt*, 2018). Therefore, future studies should measure the extent to which the limited presence of science on Spanish TV is due to a lack of demand for it.

> "TV managers consider that there is a need for greater scientific literacy among Spanish society in order for televised scientific content to be successful, and that audiences of such content are highly specific"

Although network ownership does not totally change the professionals' ideas, employees of public networks believe more strongly than those of private networks that science is of interest to all audiences. This is consistent with recent suggestions regarding the effect of producers' social and production environments on their audiences (**Draper**, 2014; **Ross**, 2014). Science dissemination on Spanish TV has traditionally been left in the hands of the national public broadcaster, *Radio Televisión Española* (*RTVE*), and to a lesser extent to the regional public networks, and especially *TV3* in Catalonia (**Grosso-Mesa**, 2013). Pursuant to current and contractual regulations, it is *RTVE*'s public duty to foster scientific knowledge (**Cano-Orón**; **Portalés-Oliva**; **Llorca-Abad**, 2017). Unfortunately, compared to other public broadcasters in Europe, *RTVE*'s scientific content is typically more influenced by commercial criteria and the range of scientific programs is limited (**Lehmkuhl** *et al*., 2016).

That said, it should be noted that most of the sampled professionals' opinions tend to be in the middle-neutral range of the scale, which reflects the general mood observed of a lack of consideration of or interest in matters related to science dissemination. As reported previously (**Soto-Sanfiel**; **Villegas-Simón**, 2014), the respondents have very few clear attitudes as to whether:

- science is interesting for everyone;
- televised science audiences are highly specific; or
- the need for greater scientific literacy in order for such content to be successful.

The apathy among the sampled subjects was also reflected in the focus groups, where the researchers found it difficult to get the members to address these issues. The lack of variety in the topics discussed in these sessions also confirms that science dissemination is not something that TV professionals hold in particularly high regard.

It can also be discerned from the results of the questionnaire that the sampled professionals have little or no clear idea about the nature of viewers who are interested in science shows. Paradoxically, these findings contrast with another that the respondents do consider science to be of interest to everybody. This latter finding is explained by the social desirability bias generated by the idea that science is good for society (**Cámara**; **Muñoz-Van-den-Eynde**; **López-Cerezo**, 2017).

Although this study has identified and weighted the beliefs of TV professionals, it should be noted that attitudes are complex psychological issues. Therefore, future studies will need to look in greater depth at these aspects.

9. Conclusions

This study seeks explanations for the lack of science in the Spanish media by examining the attitudes of TV professionals with creative, organizational and production responsibilities. Until now, the study of science communication has essentially been conducted from the perspective of journalism, while other media professionals have been ignored (**Soto-Sanfiel**; **Latorre**, 2014; **Soto-Sanfiel**; **Villegas-Simón**, 2018). This research fills this gap and recommends that future studies should view the attitudes of such media professionals as predictors of the inclusion of scientific content in the media.

This study has found evidence that Spanish TV professionals assume that their audiences have a negative view of televised scientific content, or simply dislike it, and that this is why networks do not offer it. Remarkably, the types of job (creative, executive or organizational) performed by these professionals do not influence their perceptions, for they all think along similar lines. These results are consistent with those of the study by **Soto-Sanfiel** and **Latorre** (2014), who observed that Spanish students who were about to start working in the media sector had extremely negative views of the possibility of science being a source of inspiration for their creations, of science being an attractive subject for their potential audiences, and of audiovisual language being a suitable method for transmitting scientific content.

The study also finds evidence that TV professionals are indifferent, imprecise and ambiguous in many of their opinions about the way their audiences relate to scientific content. Consistent with previous studies (**Soto-Sanfiel**; **Villegas-Simón**, 2018), the sampled professionals do not appear to have given much thought to the matters they were asked about. However, despite this apparent lack of concern, they do agree with the statement that science is of interest to everyone. Social desirability bias may be the reason why they recognize this importance of science to society, for there is little implication of any greater intention to tackle the issue in their professional lives.

Both the perception that audiences have a negative view of science dissemination and the absence of clear-cut opinions on many of the topics of discussion are products of the limited amount of science in Spanish media and society. It would therefore be simplistic and unfair to blame TV professionals for thinking that way since they are immersed in a culture that fosters specific values. Nevertheless, future studies, particularly with professionals working for publicly owned TV networks and/or at C-levels, should look in greater depth at how TV managers justify these attitudes, their ethical responsibility and their perceptions of the public service that Europe's public television networks are legally obliged to provide. Other studies should also investigate these professionals' views with regard to the production and creation of scientific media and TV shows about science.

> "As claimed in the literature, past personal experiences influence the formation of mental images of audiences, although in the case of scientific content, they do not totally transform them"

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11. Appendixes

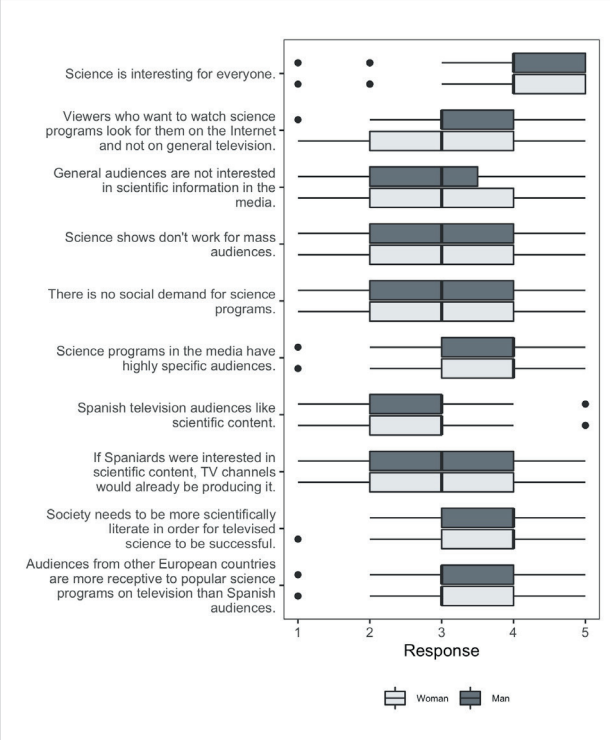

Figure A1

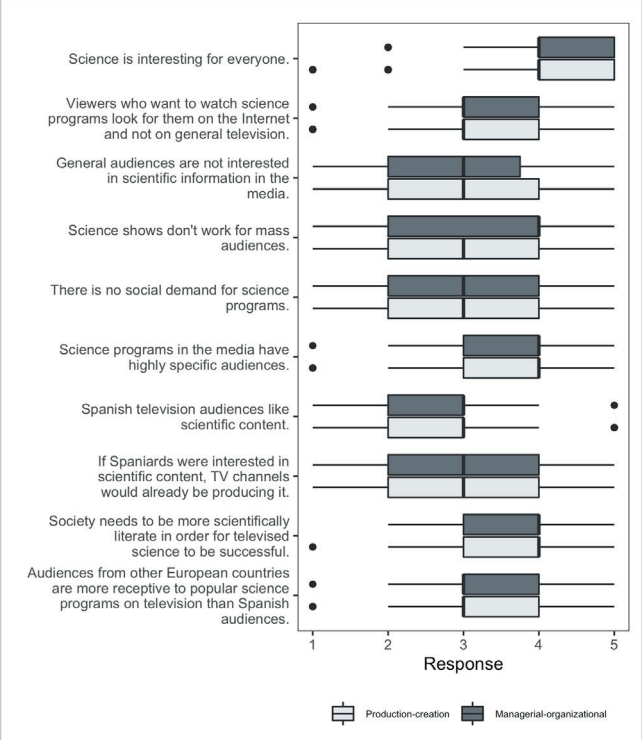

Figure A2

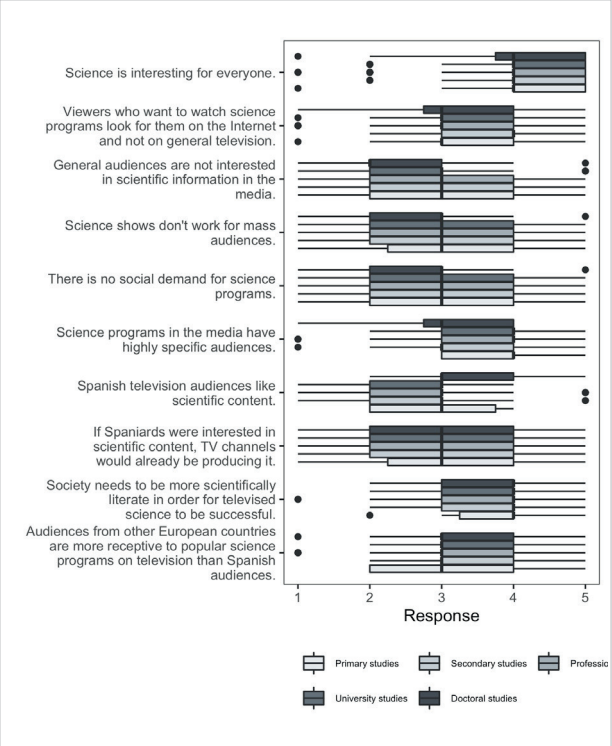

Figure A3

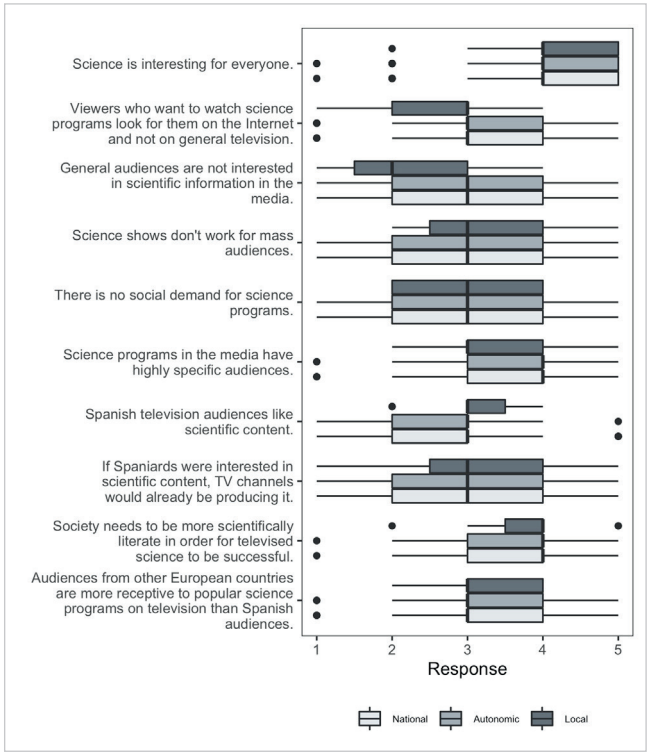

Figure A4

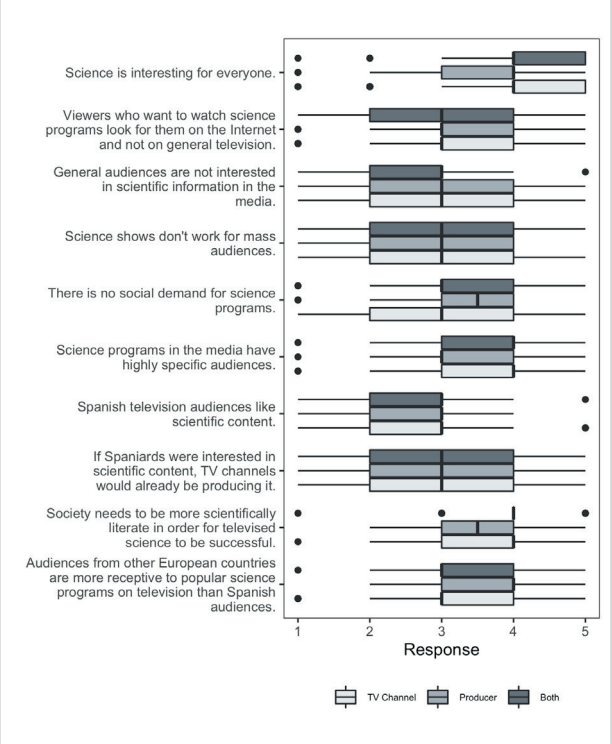

Figure A5