

## IS JOURNALISM AN INTERFACE BETWEEN SCIENCE AND SOCIETY?

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### **Abstract**

Several studies about the power of media influence on public opinion, especially on issues related to S&T and health, provide an earnest discussion far from conclusions. However, they point out important points for reflection and practice of science communication. It is unquestionable that the scientific journalism plays a role as an interface between science and society nowadays. But is it possible that the media is influencing the way that society is thinking science? In this study, we tried to ascertain the views of 107 individuals of three different groups (scientists, journalists and lay people) in Brazil. In parallel, we investigate the science news broadcast by a 24 hours news radio station in the country. We identify categories presented in the 107 speeches and compare with the kind of science broadcast on the radio discussing presumed media influence, agenda setting and media frame.

### **The Media and Stereotypes of Science**

The stereotypical views of science that combine scientific scenarios as aseptic laboratories, workbenches filled with glassware, chemical reagents, sophisticated equipment, through which male scientists work, dressed in spotless white coats with glasses and disheveled hair, working isolated from the world in endless journeys generated, over the decades, a number of studies in several countries. (Haynes, 2003; Lannes, Flavoni & De Meis, 1998; Losh, 2010; Mead and Metraux, 1957; Nisbet et al., 2002; Steinke et al., 2007) According to Barca (2005), to this profile could be added, in Brazil and possibly in other countries, the following: clumsiness, genius, full of nervous tics and misunderstood by his students and peers.

One of the pioneering studies with great impact on this subject covers the opinion of

48.000 American high school students and was published by Mead and Metraux (1957) whose results also discussed the role of mass media and its effect on public opinion. In the end, Mead and Metraux say that:

Straight across the country there is a reflection of the mass media image of the scientist, which shares with the school materials the responsibility for the present image. Alterations in the mass media can have important consequences in correcting the present distorted image if such changes are related to real conditions." (Mead and Metraux, 1957)

In Brazil, Lannes et al. (1998) conducted a similar survey among five thousand students, being three thousand from public and private schools of Rio de Janeiro and two thousand from countries as United States, India, Mexico, Italy, France, Chile and Nigeria in order to identify the views of science of these students and compare them to teachers' and scientists' views. The participants of this survey were encouraged to draw a scientist, an artist and a human figure and describe three activities of a scientist. The results showed that despite the differences between the contribution to science of developed and developing countries, children of all parts the world seem to have similar image of scientists (male, wearing a white coat, lonely, surrounded by scientific glassware, sometimes crazy). The survey also showed that formal school education in science seems to contribute little to the genesis of this image, since it forms before children learn science as a separate subject, but was not able to identify the source of those images. Nelkin (1995), for more than two decades, incremented this debate on the stereotype of the scientist as a myth by saying that "... in interviews with journalist, scientists themselves reinforce the mystification of science by emphasizing the extraordinary complexity of their work."

Weingart, Muhl and Pansegrau (2003) conducted a study analyzing the image of scientists and science in fiction films from Hollywood. Scientists are usually white/Caucasian (96%), men (82%) and middle age (40%). A third is portrayed as single and another third is not clear if the character have had some relationship. Gallegos (2006) analyzed the comic books and saw that they transmit an individualistic image of the scientist, because science is done by only one person in 63.7% of cases, and an elitist image in 91.1% as the majority is always white men. This result corroborates the stereotype image of the scientists.

According to Oliveira (2002) it is time, in Brazil, to break with the culture of the stereotypical scientist and demystify the Manichean image of science carried by common sense. In this aspect, in her opinion, scientific journalism and the media in general have essential roles. Caldas (2010) complements this view by stating that it is

crucial that the public understand other aspects of science, including its processes and mechanisms for the production of science. The author states: "For this, the media has an irreplaceable role".

The communication of science to the public occurs at different places such as science centers, museums, books, arts, media, among others, and these places influence each other (Brossard, Lewenstein & Bonney, 2005). However, it is mainly through the media that scientific subjects reach the public (Steinke et al., 2007).

In Brazil, research on Public Perception of Science and Technology, held by the Ministry of Science and Technology, in 2010, with a national sampling, concluded that TV is the main source of information on S&T, followed by newspapers, magazines, internet and radio (Massarani & Moreira, 2010). The panorama of the media in the country, according to the National Household Sample Survey 2007 (PNAD 2007), published by the Brazilian Institute of Geography and Statistics (IBGE), is configured with a higher penetration of radio and open television stations. The percentage of households with radio is 88.1%. Across the country, televisions are present in 94% of the houses and just over four million newspapers are sold throughout the country.

It is possible to observe an increase of 2% last year, according to the Institute Checker Circulation (IVC, 2010). The radio is considered one of the most agile vehicle of communication, the radio in Brazil reaches 77% of the population of more than 190 million inhabitants (Ibope, 2010). In a comparison between the media vehicle, it is the leader of audience, beating television audience between 7 am and 7 pm. According to Ibope, 95% of the population over 10 years old residing in metropolitan areas of major cities, claims to be radio listeners and, from Monday to Friday, from 6 am to 7 pm, the radio has an average of 3,1 million listeners per minute. In Brazil, there is a 24 hour news radio station, Central Brasileira de Notícias (CBN) that has in its schedule programs that broadcast science news during the week.

According to Caldas (2010), science has such an enormous power of fascination that the critical sense of the journalist is often impregnated by the wonders of the latest discoveries from the scientific world. Because of this blind fascination, researchers often find themselves embroiled in poor narrated stories and complain of bias in reporting on science. However, the most surprising is the worry of scientists with some possible criticisms of their peers and not with public opinion. For the author, the fact is that the Brazilian media is doing its part with the dissemination of advances in science, technology and health, but Caldas is against a less critical and analytical media form in relation to this issue, without even showing the scientific

process with the rights and wrongs that are part of any research. This behavior, she concludes, ends up producing a mythical vision of science, as reported previously by Oliveira (2002).

### **Presumed Media Influence, Agenda Setting and Media Frame Theories in Science**

Several studies (Anastasio, Rose & Chapman, 1999; Chia, 2010; Choi, Yang & Chang Jeongheon, 2009; Tal-Or, Cohen, Tsfati & Gunther, 2010; Petersen, Anderson, Allan & Wildinson, 2009; Wilson, 2000; Yin, 1999) about the power of media influence on public opinion, especially on issues related to S&T and health, provide an earnest discussion far from conclusions. However, they point out important points for reflection and practice of science communication. Do the media have the power to influence public opinion or would this just reflect the common sense?

According to Tal-Or et al. (2010), for decades, there were numerous efforts to respond if the media really affects public opinion. Several authors (Gunther & Storey, 2003; Tsfat & Cohen, 2005) claim that media effects are indirect, others, as Davison (1983), played an important role in this area, trying to dissect and verify these correlations.

In this fruitful theme, theories of Agenda Setting and Media Frame (McCombs & Shaw, 1972; Entman, 1993) may be added and contribute constructively to the discussion on the presumed media influence. According to the agenda setting, the media, choosing to disclose certain items, determine the discussions in society. Thus, it acts as a window by selecting clippings in a world full of overlooked news, so selecting the issues that would come to a common agenda. Thus, the media would have the power of choices and prioritizing certain subject over others. "The real is given by what appears in the media" (Aguiar, 2010).

Considered by authors as a window to the world (Anastasio et al., 1999; Barca, 2005), the media has the power to make a cut and display a portion of the universe through their window. Media can create the world that they want to reflect, that is why it is so big the concern of their potential for distortion. In this context it is important to identify the passive reception of information by society and the persuasion exercised by the news.

In addition to the Agenda Setting, the media would still have the power to decide the framework for news (Media Framing). Thus, parallel to the process of choice of news, which implies in the presence and absence of some, the media decides which approach the news will get before its publication. In short, the media frame is:

select some aspects of a perceived reality and make them more salient

in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation. (Entman, 1993)

Facing this scenario, the purpose of this study was to determine which are the views of three different groups (scientists, journalists and lay people) about what is science in the XXI century and draw a parallel with the science stories broadcasted by a 24 hours radio news.

Media analysis is an important adjunct to opinion studies not because media directly determine (or ever fully reflect) public opinion, but because media accounts express relevant values and beliefs, help confer legitimacy to or discredit particular groups by treating them as part of the mainstream or as marginal, and therefore indirectly affect which perspectives do or do not ultimately come to dominate collective discourse and decision-making". (Priest, 2006)

## Survey

In order to understand the view that scientists, journalists and lay people (those who are not scientists or journalists) held of science, a questionnaire was developed with a qualitative open question: *In your opinion and experience, what is science?* This question was sent by e-mail, in the period of six months (1<sup>st</sup> of July to 31<sup>st</sup> of December of 2009), to 113 journalists from the cities of Rio de Janeiro and São Paulo and 100 scientists that are both researchers and professors at Federal University of Rio the Janeiro.

From the 113 journalists, 35 answered the question. Among them, there were 18 specialized in covering science and 17 that cover other subjects. From the 100 scientists, 35 answered the question. The scientists were from the areas of life sciences (12), physics (11) and humanities (12).

After these initial surveys, the question was sent to 37 lay people that had an university degree other than in science or journalism. These respondents were between 30 and 60 years old (the same age group as the others).

For the analysis of the questionnaires, the answers were separated into categories and their frequencies were analyzed. Keywords were chosen to represent each category and their frequencies were also analyzed. The categories were built by clustering the ideas of the answers that had the same kind of social representations (Moscovici, 2000). All answers were reviewed by four researchers (a journalist, a

psychologist, a physicist and a biomedical researcher), using the methods of analysis proposed by Bardin (1977).

In parallel, we analyzed news on science transmitted by a 24-hour radio news, Central Brasileira de Notícias (CBN) the most popular in Brazil. The CBN radio has an exclusive program for science and health news and this news channel has a website with all the interviews. In the CBN's website, there is a tool that allows you to download the news. In the website, a search was conducted with the keyword *science* during the period of six months (1<sup>st</sup> of July to 31<sup>st</sup> of December of 2009). Our research was narrowed down to two specific programs that broadcast *science and health* every Friday (24 programs) and *science and environment* every Tuesday (33 programs), both broadcasted at 14:55.

A guide of observation was created with some criteria that subsidize the researchers in the analyses of content of science news. The criteria were elaborated based on the information of all news and aim to categorize what is the image of science that is broadcasted (positive, negative or neutral) and what information are transmitted by the news (the process of science, research methods, the result of a research, the applicability of a result, the explanation of a phenomena or an ethical/political discussion). This categorization was based on the three categories found out by all researches when analyzing the answers data.

## Results

The answers to the questionnaire (*In your opinion and experience, what is science?*) were categorized into three categories by all four researchers that analyzed the responses: The first category involves subjective and philosophical questions of the scientific process, with reference to a broader view of science, typical of the cosmic vision of the natural sciences of the nineteenth century (table 1). The cosmic view of the nineteenth century can be defined as a finalist and theological as opposed to a rational and disenchanted view of nature.

See appendix for Table 1

The second category represents a technical view of science that focus in methods, work procedures, processes used and final goals as articles, book chapters, books and other products (table 2). This category refers not only to the necessary technology (material or intellectual), but also the process of transformation of products by technical procedures and the results achieved.

See appendix for Table 2

The third category represents the concern with the application of the products of science in the world (table 3). It refers not only to the applicability of knowledge as also sometimes dictates the importance of certain science subjects because of the social pressure exerted by the population.

See appendix for Table 3

These three categories are in constant interaction and are present in everyday institutional life, although in some instances and areas of knowledge, one can be seen more often than the others.

See appendix for Figure 1

It is possible to observe in figure 1, that the speech of scientists presented mostly two categories (54%). Of them, 89% are the first plus the second category and 11% are the second plus the third category. Regarding to the speeches that presented only one category (37%), 70% are the first category and 30% are the second category. In our study, the results show those scientists' speeches present mostly the first and second categories, which means that their view of science is more cosmic, subjective, philosophical and technical.

See appendix for Figure 2

On the other hand, journalists' speech presented a more homogeneous distribution (figure 2). From the 37% of the speeches that presented two categories, 76% are the first plus the second category and 24% are the second plus the third category. From the 31% of the speeches that presented only one category, 16% are the first, 29% are the second and 55% are the third. This results show that the journalists' speeches presented more of the third category than the scientists' speeches which means that they show more concern to the application of the science's knowledge and its importance to the society.

See appendix for Figure 3

The speeches of lay people (figure 3) presented mostly one category (57%). From them, 28% are the first (cosmic), 47% are the second (technical) and 25% are the third (science applicability). Regarding to the speeches that presented two categories (30%), 27% of them are the first plus the second category, 17% are the first plus the third category and 56% are the second plus the third category. This results show that lay people's speech is not as homogeneous as journalists' but also presents their concern to the application of the science's knowledge and its importance to the

society. This means that their view of science is more technical, methodological and social.

See appendix for Figure 4

Figure 4 shows that there is a difference between the frequencies of appearance of each category in all three groups. Journalists have a more homogeneous speech as presented earlier. It means that this group understands science as a process that begins with a more subjective and philosophical issue and becomes more technological as the experiments begin, but has to turn into some useful knowledge to society. Scientists, otherwise, understand science as a process that begins with a cosmic and subjective issue and turns to a technological matter as the hypothesis start to be experimented, but there is no immediate concern to their application to society, it's as if the scientists are more concern with producing knowledge for producing more knowledge. But lay people understand science more as a methodological problem with some ending in an immediate useful knowledge to society.

If journalists have this homogeneous view of science and some papers discuss their power to influence society, is this reflected in how science news are transmitted by journalists? To try to understand the role of journalism as an interface between science and society, we analyzed science news transmitted by a 24 hours radio news, Central Brasileira de Notícias (CBN) the most popular in Brazil.

On the CBN's website, when written the word *science* in the search area filtered between 01/06/2009 and 31/12/2009, 253 results appear. From all these results, to this survey, only the news transmitted from the editorials *science and health* and *science and environment* were chosen. In these editorials, this study was interest only in the programs that were transmitted weekly. Under the theme *science and health*, 24 news were found. The program is transmitted every Friday at 14:55 by a journalist who interviews other journalists about science and health news. Under the theme *science and environment*, 33 news were found. The program is transmitted every Tuesday at 14:55 by a journalist who interviews a scientist about science and environment news.

See appendix for Figure 5

Figure 5 shows that most of the news (67%) did not show science as a positive or a negative issue. The positive issue appears when there is a positive adjective to describe science or the scientist. The same criterion was applied to a negative view of science, but with a negative adjective to describe science or the scientist. When there



is no adjective or a neutral one, the news was categorized as neutral. The research on the website was conducted during the period of the Copenhagen Climate Conference, in 2009 (COP-15), so most of the news was about ethical or political problems or solutions to save the environment, as show in figure 6, which may explain why the view of science is mainly neutral.

See appendix for Figure 6

Regarding to the content of the news, we found out that, after *ethical/political* problem, what most appear on the news is a *result of a research or survey* (figure 6). The first category, the process of science, represents the first category of the speeches analyzed before, because it talks about the process from its beginning, as a cosmic and subjective issue. The second category, the method of a research, represents the technological view of science, the second category of the speeches. The third and fourth categories, the result of a research and the applicability of a result, represent the third category of the speeches, which has the concern with the application of the products of science in the world.

In comparison with the categories of the three speeches, science news transmitted by the radio seemed to mainly transmit the utilitarian view of science and some methodological views, but it is very rare to found some news with a more cosmic and philosophical view of science. There was no difference of content between the news transmitted by a scientist and those transmitted by journalists (data not shown).

## **Discussions**

The cosmic view found among the scientists of the areas of life sciences, physics and humanities corroborates the results of a survey conducted by De Meis, Longo and Falcão (1989), that suggests that during the progression of a professional career there is, in parallel with the person's general development, a greater preoccupation with cosmic components (i.e. universe and laws of nature), intuitive components (i.e. creativity and subjective), emotional components (i.e. pleasure and curiosity) and the world as a whole. De Meis et al. (1989) also highlight that at the beginning of the students scientific career, they seem to begin their interest in science by focusing primarily on how to evaluate a problem technically. This view, which we labeled as the second category, is not lost during the progression of the scientist professional career, as shown by our results, whereas the scientific method is the way to certificate the knowledge produced as scientific.

As much as the journalists have a more homogeneous view of science, when they have to transmit any science news, they show a bias in relation to how they are going to describe the news or what part of the whole process of producing knowledge they are going to publish.

The view transmitted by the radio is similar to the view of lay people, which suggest that the media may be influencing the way society sees the process of science. On the other hand, as the time and space of science in any media vehicle is very short, journalists have to choose what kind of science news they are going to transmit, and maybe the reason for choosing a more utilitarian view is that society is only going to buy that vehicle or be interested on that news if it has any kind of applicability or same impact on peoples' life. This would mean that society is actually influencing the media on what it wants to be on the news.

Regarding the Agenda Setting theory applied to selected news on the website of Central Brasileira de Notícias (CBN) radio, we identified that the editors of *Science and Environment* mirrored the international agenda when choosing the news to broadcast. During the period of this study, the World Climate Conference in Copenhagen, Denmark (COP 15) was underway and because of uncertainties arising in the discussions, the coverage of the conference comprised about 70% of all news in the program. As noted by Anastasio et al. (1999) "By showing only a tiny and unrepresentative portion of the world through its windows, the media may help to create the very world it seeks to reflect". However, the comments of Castelfranchi (2007) take a better place in this case that the popularization of science is not just showing the world a successful or brilliant discovery, but essentially is showing an activity that is human, immersed in society, tormented and made of doubts and struggles. So the CBN radio enabled its listeners the opportunity to follow the international debate.

On the contrary, the editors of *Science and Health* had the highest rate (50%) of reports showing research results as well as focus on the applicability of science (40%), showing the advances and new discoveries, excluding its processes and mechanisms for the production of science. The criticism of Caldas (2010) corroborates to the Media Frame theory, when pointing out that the "blindness" of the journalist facing the fascination generated by science applicable discoveries, limits the critical analyses about the applicability and the process or mechanism used to produce such discoveries. The approach of news about applicability of science deserves a closer look. Why is the "commercial" science news, to the media, the one that only present scientific applications? And on the other side, why does the basic science remain confined to the laboratory? This bias Media Frame, as stated by

Oliveira (2002), only reinforces the stereotypical view of scientists like Gyro Gearloose from Walt Disney.

The impact of this Media Frame was found when interviewing lay people and journalists about what is science. Over 50% of lay people answers and about 60% of the journalists pointed out the applicability of the sciences (the same rate as those found out in the news) as in the following example:

“Something that provides any good to society” (Lay people)

So, as Nelkin (1995) questioned: “does science journalism in fact shape, or even create, public attitudes – or does it simply mirror them?”

Nisbet et al. (2002) also reinforces this question on the influence of the media when asking, “does exposure to general print media or science media influence science knowledge and, therefore, indirectly influence perceptions of science and technology? In our study, we show that the influence of radio - a vehicle with highest penetration in Brazilian society - on public opinion can be pointed with some confidence, because although it is a case study, with a smaller sample, in a short time, the data emerged are extremely similar to those other studies.

## **Conclusions**

The results of this study show that media in general, have an important role in shaping the Brazilian public opinion, and that as the radio is a vehicle with a great penetration, theories of Agenda Setting and Media Frame in science have a wide field of analysis. As the science news broadcasted by the radio seem to have the same structure as those broadcasted by TV, the main source of information on science and technology, these results can assist in formulating proposals towards transforming the stereotyped image of the science.

Although the media analyzed in this study have proven to be receptive to discussions on global issues such as COP 15 and its possible repercussions in Brazil's future with climate change and challenges, we found that this same media that reflect the "conflict of the modern society" by Castelfranchi (2007) also confirm the stereotypical view of science with an ultimate goal for discovery and "utilitarian science".

Added to these considerations, the Media Frame adopted by journalists, not always experts in science, and scientists working at a 24 hour radio news, that regardless of the area of expertise and independent of being part of a science filed, are manipulated to perpetuate the stereotyped view of science. After all, who guides the

sensationalism of the media? This has been questioned a decade ago. (Jurberg, Verjavsky, Machado & Affonso-Mitidieri, 2009; Jurberg, 2001)

This stereotyped view of science of society, in our opinion is a reflection of this format of “commercial” science news, which shows mostly this "utilitarian science". But we do not discard the possibility that media choose this view because it is the only one that has any interest to society, maybe if they start to change this view, the society may lose interest in science and technology themes.

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Table 1. Keywords and examples that represent the first category

Category	Keyword	Journalists	Lay People	Scientists
First	Love	<i>"For me, science is trying to understand and explain reality..."</i>	<i>"Direct product of curiosity."</i>	<i>"...is discover, generate something new, is knowing the unknown."</i>
	Comprehend			
	Criativity			
	Curiosity			
	Discover			
	Explain			
	Understand	<i>"...is reflect critically about reality aiming to better understand the world we live in."</i>	<i>"Is understand all the phisical and chemical transformations that occur in our body and envoinment."</i>	<i>"...is answer your curiosities about some biological event of your choice, without impositions or obligations..."</i>
	Evolution			
	Inovation			
	World			
	Observe			
	Progress			
	Rovolution			
	Universe			
Truth				

Table 2. Keywords and examples that represent the second category

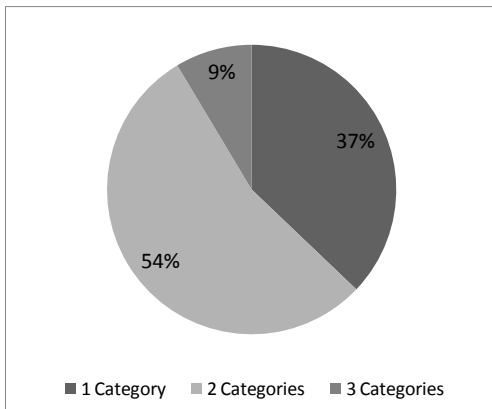
Category	Keyword	Jornalists	Lay People	Scientists
Second	Prove	<i>"...is identifying problems, come up with hipoteses, investigate, test, doubt, restart, be wrong and be right. "</i>	<i>"Is reasearch about something."</i>	<i>"Propose na idea and search for it's proof based on esperiments with proper controls (scientific method)."</i>
	Corroborate			
	Develop			
	Empiric			
	Study			
	Experiment			
	Hipoteses			
	Investigate			
	Method			
	Research			
	Process	<i>"...is search for answers to questions."</i>	<i>"Is reasearch, study, experiments..."</i>	<i>"...trating problems according to the scientific method."</i>
	Produce			
	Qualify			
	Quantify			
	Reason			
	Refut			
	Answer			
	Strictness			
	Sistematize			
	Test			
Variable				



**Table 1. Keywords and examples that represent the third category**

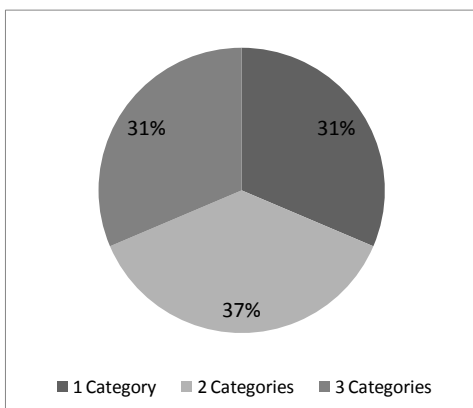
Category	Keyword	Jornalists	Lay People	Scientists
Third	Benefit	<i>"Generate original and social relevant knowledge."</i>	<i>"...Contribute to the growth and well being of society."</i>	<i>"...fill a blank in the progress of science."</i>
	Aware			
	Civilization			
	Contribution			
	Culture			
	Difusion			
	Ethics	<i>"...bring progress and a better life to mankind and to Earth."</i>	<i>"Something provides any good to society."</i>	<i>"...report what you find, in order to produce knoledge that can be add to the already existing and be helpful to other people."</i>
	Mankind			
	Improvement			
	People			
	Responsibility			
	Society			
	Useful			
Life				

### Categories in scientist's speech



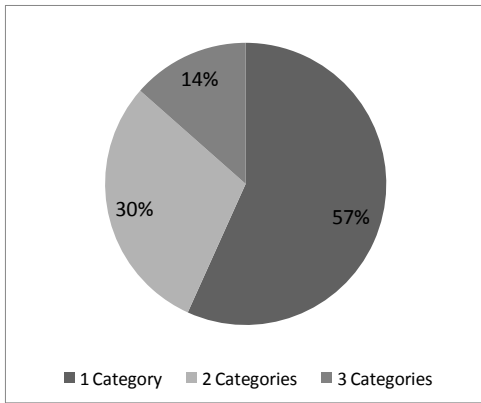
**Figure 1. Frequency of appearance of one, two or three concomitant categories in scientists' speech**

### Categories in journalist's speech



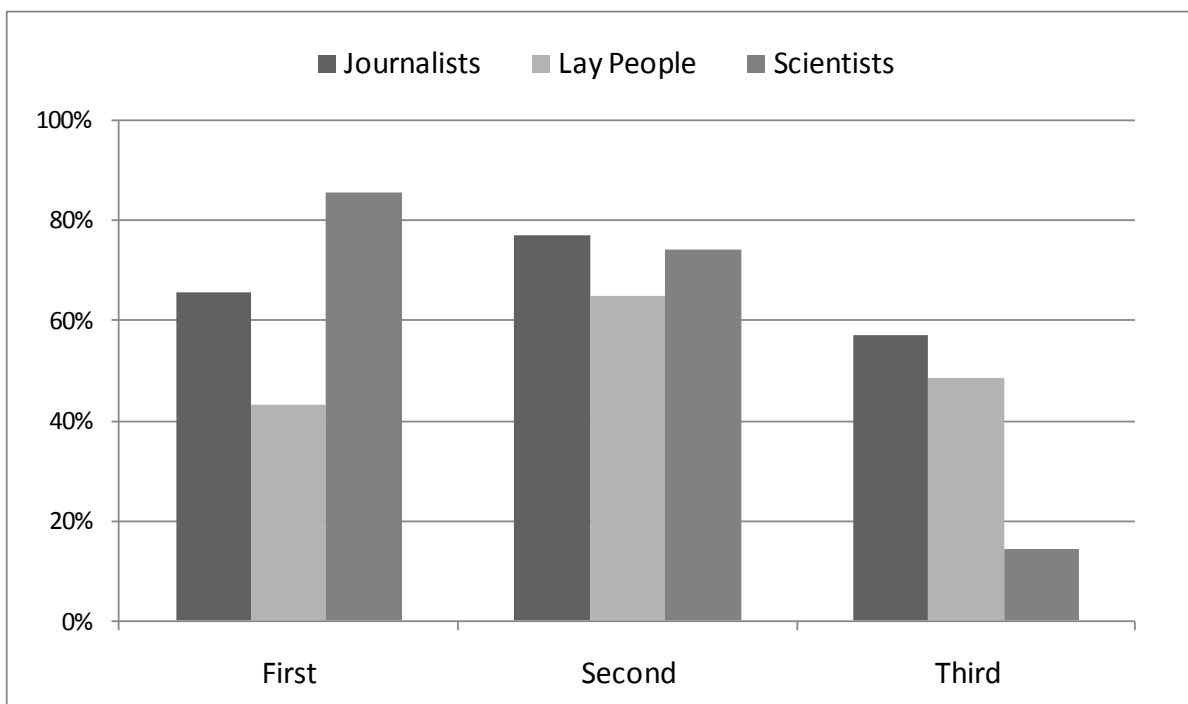
**Figure 2. Frequency of appearance of one, two or three categories in journalists' speech**

### Categories in lay people's speech



**Figure 3. Frequency of appearance of one, two or three categories in lay people's speech**

**The presence of categories in the three groups**



**Figure 4. Frequency of appearance of each category in the three groups of subjects**

### The views of science in the radio

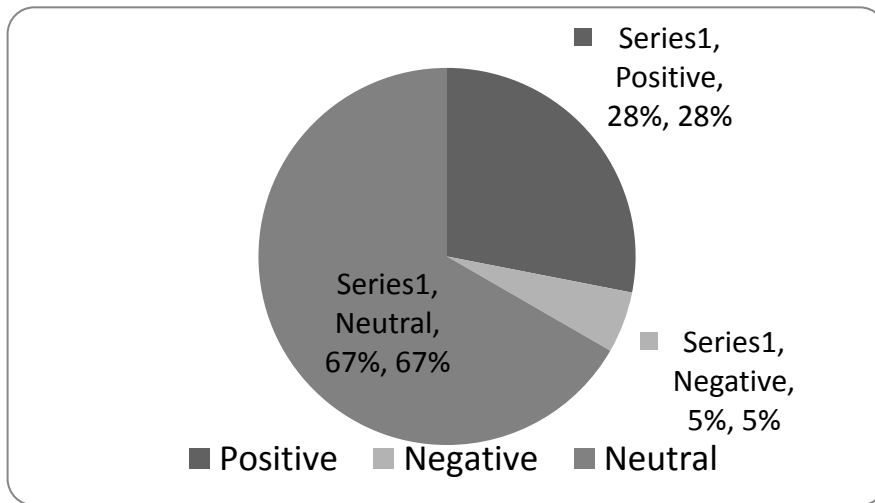


Figure 1. Frequency of appearance of positive, negative and neutral views of Science

### Science news in the radio

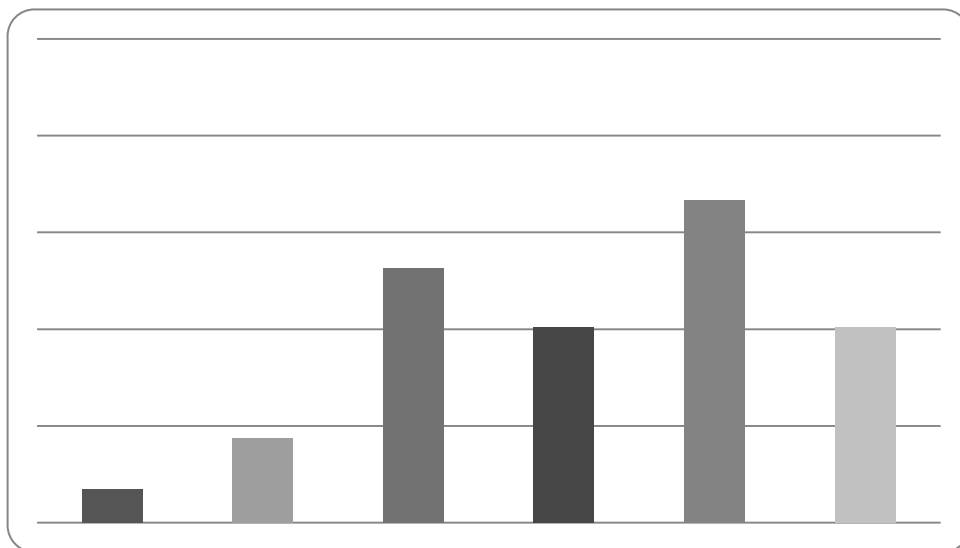


Figure 6. Frequency of appearance of contents in Science News