Chapter 12

Public understanding of science and technology in São Paulo State

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Detailed Tables

The Detailed Tables for this chapter are available on the internet at: <http://www.fapesp.br/enindicadores2010>.

1. Introduction

This is the second consecutive edition of FAPESP's *Indicators of Science, Technology & Innovation in São Paulo State* to include a chapter on public understanding of science and technology (PUS). The indicators constructed as described in this chapter constitute a key input for public decisionmaking in democratic societies, encouraging science communication and fostering the development of systems designed to facilitate participation by different actors in issues linked to S&T, such as approval or rejection of stem cell research, investment in nuclear research or genetically modified organisms etc.

The work done since the last edition of this publication (FAPESP, 2005) inserts São Paulo State into the context of PUS surveys conducted in Brazil, by the Ministry of Science & Technology (MCT), and the world, using widely accepted international survey methodologies.

PUS surveys and research on public understanding of science are based on implicit or explicit models of what is known as "scientific culture". These models in turn relate to different concepts of science, culture and scientific literacy (Polino et al., 2006; Albornoz et al., 2003; Vogt, 2003). In many countries, especially in Europe, Asia and North America, for decades educational and S&T policy guidelines have included the measurement of scientific culture in a given region or country among their chief activities, with the aim of stimulating participation by citizens and their engagement with scientific and technological issues.

In Ibero-America surveys of public understanding of S&T are more recent but have been substantially boosted by the Project to Develop an Ibero-American Standard for Indicators of Social Perception, Scientific Culture & Civic Participation in S&T.[1] The idea arose in 2001 from a collaboration between the Organization of Ibero-American States (OEI) and the Ibero-American & Inter-American Network of Science & Technology Indicators (RICYT), culminating in 2003 with the first regional PUS survey and a workshop in Salamanca, Spain, to consolidate the research themes and develop a regional methodological standard (Vogt & Polino, 2003). Until the appearance of the OEI-RICYT network, there had never been any attempts in the region to develop a common methodology or construct quantitative indicators that could permit international comparisons.

The pilot PUS comparative survey (Vogt & Polino, 2003) was carried out and published in 2002 and 2003 in major cities of four countries: Campinas (Brazil), Salamanca and Valladolid (Spain), Buenos Aires (Argentina) and Montevideo (Uruguay). With FAPESP's support, personnel from the Laboratory of Advanced Studies in Journalism (Labjor) at the State University of Campinas (Unicamp) took part in the survey, applying the questionnaire in Campinas (for international comparison), as well as the cities of São Paulo and Ribeirão Preto. All three cities are in São Paulo State. The sample for Brazil comprised a total of 1,063 people. The results for the three cities served as a basis for the chapter on PUS in the previous edition of this publication (FAPESP, 2005).

A second Ibero-American survey was conducted in 2007, using a broadly discussed methodology and a larger sample. A new questionnaire was applied in major cities of seven countries – Argentina, Brazil, Chile, Colombia, Panama, Spain and Venezuela – and data for a sample of 1,076 people in the city of São Paulo compared with data from the other six cities.[2]

The analysis presented in this chapter also discusses the findings of an extension to the survey beyond the city of São Paulo, covering an additional 749 people in other parts of São Paulo State. Thus the total number of interviewees was 1,825. These people live in 35 cities located in all 15 of the state's administrative regions (RAs). The questionnaires were applied throughout São Paulo State by Instituto de Opinião Pública, Estatística e Qualidade (IOPEQ).

In sum, the chapter presents and discusses the key findings of the PUS survey in São Paulo and integrated with the Ibero-American network, as a result of Labjor's efforts to contribute to the development of a methodology for constructing PUS indicators. It contains three sections in addition to this introduction. The next section discusses the international and domestic contexts for the construction of these indicators and the process of developing a methodological standard for Ibero-America, outlining the common methodology and questionnaire. Section 3 analysis and discusses the main findings. The last section presents a compilation of the material presented and a summary of key points for future research.

1. This is referred to throughout the chapter as the Ibero-American Project. It is generally coordinated by Mario Albornoz (Centro Redes/RICYT, Argentina), Álvaro Marchesi Ullastres (OEI) and Eulalia Pérez Sedeño (FECYT, Spain); and operationally coordinated by Cecilia Cabello Valdés (FECYT, Spain), José Antonio López Cerezo (OEI/Universidad de Oviedo, Spain) and Carmelo Polino (Centro Redes/RICYT, Argentina).

2. The Methodological Annex to this chapter details the common methodology for Ibero-America and the questionnaire used in the survey.

2. Interest in measuring public understanding of science

2.1 International and domestic context

Strong S&T systems were built during the cold war that followed the second world war to guarantee the economic and military supremacy of the "victors", especially the U.S. The crucial role of scientific and technological knowledge in warfare (radar, submarines, cryptography, computers), on one hand, and the impact on public opinion of the massacres perpetrated by the bombs dropped on Hiroshima and Nagasaki forced scientists and politicians to rethink critically the role and public image of science.

New debates on science and its ethical and social implications were stimulated by the creation of the National Science Foundation (NSF) in the U.S. in 1950, and by programs of education and mass popularization intended to win the respect and continuing support of public opinion for American science. In 1958, under President Dwight D. Eisenhower, the National Aeronautics & Space Administration (NASA) was created in response to the clamour of public opinion only months after the Soviet Union launched Sputnik 1, the first earth-orbiting artificial satellite, closely followed by Sputnik 2. In the same context, the NSF was impelled to support science education programs (on which US$1 billion was spent in the next two decades) and carry out public opinion surveys (Withey, 1959).

In Brazil, the National Council for Scientific & Technological Development (CNPq) was born in 1951 of the war effort in which the nation had been involved. CNPq was to conduct Brazil's first nationwide PUS survey in 1987. Meanwhile, anthropology made its contribution through Margaret Mead,[3] with studies of drawings of the bomb and Sputnik by children in several countries and a study of the image of science and scientists among high-school students (Mead & Metraux, 1957). A few years later the impact of student, women's and environmentalist movements, and public concern and opposition aroused by the growing environmental and social problems caused by industrialization, led to a new wave of popularization and education efforts, with the aim of renewing and rebuilding public support and appreciation for S&T (Castelfranchi & Pitrelli, 2007; Gregory & Miller, 1998).

Thus in the U.S. the NSF was already proposing a stable national PUS survey in 1979, and this has been carried out every two years since then. In Europe, a movement for the public understanding of science (PUS) emerged in the mid-1980s after the publication of a U.K. report commissioned by the Royal Society (Bodmer, 1985). This movement triggered a wave of activities to foster science dissemination and education, as well as research on the relations between science and society (OECD, 1997a; Durant, Evans & Thomas, 1989; Bauer, Durant & Evans, 1993). In the 1990s the European Commission began regularly conducting PUS surveys (EC, 1993, 2001, 2003, 2005) as well as surveys on public understanding of specific areas of S&T, such as information technology (EC, 1997) and biotechnology (EC/INRA, 1991; EC, 1997, 2000).

In the same period many central and peripheral countries held PUS surveys of their own, including India (Raza et al., 1996; Raza & Singh, 2002; Raza, Singh & Dutt, 2002), South Korea (Kim, Carter & Stamm, 1996), China (Zhang & Zhang, 1993), Malaysia (Mastic, 2000), New Zealand (New Zealand Ministry of Research, 1997), Japan (Japanese Prime Minister's Secretariat, 1995) and Russia (Gokhberg & Shuvalova, 2004).

2.2 In search of a standard for Ibero-America

In Ibero-America the importance of developing indicators of S&T perception has begun to be strongly recognized in recent years. Some countries have conducted their own national PUS surveys more or less systematically, above all since the 1990s, including Portugal (OCES, 2000) and Spain (FECYT, 2003, 2005), while others do so sporadically, including Colombia (Colciencias, 1994), Panama (SENACYT, 2001), Mexico (CONACYT, 1999, 2003) and Argentina (SeCyT, 2003, 2007). Brazil also falls into the latter category, having conducted three significant nationwide surveys since the 1980s (1987, 1992, 2006), but without a defined frequency or common methodology.

The Brazilian government first showed interest in mapping public opinion of S&T in a pioneering survey conducted in 1987 (CNPq/Gallup, 1987),[4] but the preoccupation with PUS did not become significant until the next decade, when the military dictatorship had ended and democracy had returned. In 1992 MCT

3. Margaret Mead (1901-1978) was one of the best-known American cultural anthropologists of the twentieth century.

4. The survey was commissioned from Instituto Gallup by CNPq, via Museu de Astronomia e Ciências Afins (MAST), to analyze the image of S&T among citydwellers in Brazil.

and CNPq carried out a nationwide survey "to find out what Brazilians think about ecology" (MCT & CNPq/IBOPE, 1992). This was the year of the Rio Earth Summit[5] and opinion formers were increasingly prioritizing environmental concerns. The survey addressed perceptions and values relating to the environment, as well as public attitudes[6] to education, awareness raising and conservation actions.

In 2006 MCT's Department of S&T Popularization & Diffusion held another nationwide PUS survey, intended to be the first of a series with the collaboration of Academia Brasileira de Ciências and Museu da Vida/FIOCRUZ (MCT, 2007).[7]

The Ibero-American Project has significantly bolstered survey activity in the region. The Salamanca meeting and the results of the first comparative survey held in Spain, Argentina, Uruguay and Brazil (Vogt & Polino, 2003; FAPESP, 2005) catalyzed activity in the region and led to the organization of several more meetings, attended by experts from Ibero-America and countries elsewhere with consolidated methodologies. An International Advisory Committee was set up[8] and a Technical Group established[9] to prepare a regional PUS agenda and formulate operating agreements as a basis for the construction of common, internationally comparable indicators.

Technical meetings were then held in Tenerife (Canary Islands), Lima (Peru), São Paulo (Brazil) and Buenos Aires (Argentina) to analyze the conceptual and methodological foundations for an Ibero-American indicator standard. The 2007 survey was carried out using these foundations. The sample was extended to seven countries – Argentina, Brazil, Chile, Colombia, Panama, Spain and Venezuela – using a painstakingly prepared methodology that permits international comparisons.

2.3 Questionnaire construction methodology

The questionnaire used in the latest survey was constructed on the basis of a theoretical review and comparative mapping of all representative surveys on the same subject, undertaken by the Ibero-American Project's Technical Group. Surveys carried out in all countries of the Ibero-American region were analyzed and discussed, as well as the most representative surveys in other parts of the world, highlighting the advantages and disadvantages of each methodology, common aspects and differences in sample structure, interview techniques, question typologies, question formulation and language, and response typologies and scales.

Generally speaking, the comparative analysis of the surveys conducted in the region and worldwide evidenced a significant degree of theoretical and methodological heterogeneity, as well as temporal discontinuity. Even countries that conduct regular surveys make changes to methodology, questions, scales and indicator construction over time. On the other hand, there are a number of important common features to most surveys, and criticisms of the methodology formulated in the 1990s have been put forward.

An analysis of the classic questionnaires developed in the U.S. by the NSF and in Europe by Eurobarometer and the Wellcome Trust, for example, raises questions about the application of so-called "knowledge" or "scientific literacy" indicators,[10] represented by a "package" of mostly closed questions designed to gauge certain specific points whose relevance changes over time.[11] Some studies (see for example Godin & Gingras, 2000; Pardo & Calvo, 2002, 2004) have criticized questions of this type for apparently relating more to average expo-

5. The United Nations Conference on Environment & Development (UNCED), informally known as the Earth Summit, was held at Rio de Janeiro in June 1992. Over 170 countries participated, with 108 sending their heads of state or government. Some 2,400 representatives of NGOs also attended.

6. The term *attitude* is used here in the sociological sense, as defined in *The Blackwell Dictionary of Sociology*: "The second meaning of attitude goes beyond beliefs and values to identify a distinct aspect of how we orient ourselves to the world – emotion. In this sense of the word, [...] an attitude is a cultural orientation to something that predisposes us not only to think about it in particular ways but to have positive or negative feelings about it as well" (Johnson, 2000). Thus the term stresses the importance of factors other than merely what individuals do.

7. Executed by CDN Estudos & Pesquisa, the survey was designed with the collaboration of researchers at FAPESP and Labjor (Unicamp), as well as experts from institutions in other countries including RICYT and the London School of Economics. The questionnaire shared eight questions with the questionnaire used in São Paulo State in 2007, enabling comparisons of some findings.

8. Carlos Vogt, who coordinated this chapter, is a member of the International Advisory Committee. The others are Rodrigo Arocena (Universidad de la República, Uruguay), Arturo García Arroyo (CSIC, Spain), Javier Echeverría (UPV, Spain), Tatiana Lascaris Commeno (UNA, Costa Rica), Emilio Muñoz (CSIC-Ciemat, Spain), León Olivé (UNAM, Mexico), Miguel Ángel Quintanilla (USAL, Spain), Jesús Sebastián (CSIC, Spain), Inguelore Scheunemann de Souza (CYTED), Juan Carlos Toscano (OEI) and Hebe Vessuri (IVIC, Venezuela).

9. The Brazilian members of the Technical Group are researchers Yurij Castelfranchi (Labjor/Unicamp) and Luisa Massarani (Museu da Vida, Fiocruz-RJ). The other members are Tania Arboleda (Pontificia Universidad Javeriana, Colombia), Tamara Arnold (CONICYT, Chile), Montaña Cámara Hurtado (Universidad Complutense, Spain), María de los Ángeles Erazo (Universidad Central, Ecuador), María Eugenia Fazio (Centro Redes, Argentina), Antonio Firminio da Costa (CIES, Portugal), José Luis Luján (Universidad de las Islas Baleares, Spain) and Carolina Moreno (Universidad de Valencia, Spain).

10. For a detailed analysis of the debate on the (controversial) definitions of scientific literacy and science culture, see Miller (1983, 1998), Albornoz et al. (2003) and Roth & Lee (2002).

11. During the cold war one of the questions used to find out if a person was scientifically literate was: "Can radioactive milk be made safe by boiling it?" Nowadays the typical questions are whether antibiotics kill bacteria or viruses and whether the oxygen we breathe "comes from plants".

sure to information and level of schooling than to factual knowledge and understanding of scientific processes. Moreover, the results of surveys using these questionnaires often appeared statistically inconsistent. In some items the number of responses considered "correct" increased according to the interviewee's level of schooling (as expected). In others, the distribution of "right" and "wrong" answers did not change according to schooling and access to information. Some questions also caused such a high frequency of "don't know/no answer" responses that interpretation became very complex, while others appeared to relate more to political or religious values than "scientific knowledge".[12]

Based on a critical analysis of scientific literacy surveys, the Technical Group concluded that questions on factual knowledge are important and relevant, but their utility is valid more for an appraisal of the level of exposure to a specific topic on the current social debate agenda in each country than for the purposes of constructing reliable indicators of "levels" of scientific literacy. The suggestion therefore was that such questions should be provided, with methodological guidelines on how they should be formulated in each country, while Ibero-American common indicators would be based mainly on the following dimensions: level of schooling, level of exposure to and consumption of S&T information, and level of declared interest in S&T.[13]

Having analyzed existing surveys and new theoretical and methodological considerations in the field of public understanding of science, and based on the objectives of the Ibero-American Project, the Technical Group produced the questionnaire, which can be perused in its entirety in the Methodological Annex to this chapter. It focuses mainly on interest in and information about S&T, value placed on and attitudes towards S&T, individual and social appropriation of S&T (knowledge indicators are part of this thread), citizenship and S&T public policy.

2.4 Questionnaire application methodology

Following the conceptual review, discussion of internationally tested indicators and a critique of the types of scales used to rank or score responses to valorative or attitudinal questions, a standard questionnaire application methodology was developed on the basis of rules for sample selection, stratification by gender and age, and geographical routes, among other criteria (all this information is detailed in the Methodological Annex).

The standard questionnaire consisted of a core of 39 closed, semi-open or open questions. According to the methodology established, each region could develop its own questions to supplement the standard questionnaire. Five extra questions were included in the questionnaire applied in São Paulo State, which therefore contained a total of 44 questions.

Some questions offer the interviewee a choice of responses to a range of topics, such as: food & consuming; science & technology; cinema, art & culture; sport; economy & business; medicine & health; environment & ecology; astrology & the occult; politics; and curiosities about the lives of famous people.[14] Food & consuming, environment & ecology, and medicine & health are considered subject areas that overlap with or are strongly linked to S&T, but this is not an epistemological division. Its function is not to establish orthogonal, mutually exclusive categories, but to compare the strength and relative weight of cultural elements with differing semantic and symbolic connotations. Both the way the questions are posed and the interviewee's preconceptions of the meaning of "science & technology" provide a framework for analyzing the responses. Interviewees may be interested in S&T in practice, in their daily lives, but their responses are elicited with reference to a category label or alternative offered in the context of others.[15] This is how responses should be interpreted: as statements formulated in the framework of a mental universe of ideas or preconceptions.

3. Data analysis and discussion

3.1 Interest in S&T

Gauging levels of interest in and information about S&T is especially interesting as an important

12 For example, in the U.S. interviewees who rate "true" a statement that the earliest humans lived at the same time as the dinosaurs may well be believers in creationism or followers of certain political movements, and their responses may not be accurately classifiable in sociocultural terms.

13. Level of exposure to and consumption of information are common-sense terms. Consumption of information refers to the use of newspapers, magazines, the internet, television, books etc. as sources of information on any subject.

14. Example: "Q8: Please choose one of the following in response to each topic – *Very interested, Interested, Fairly interested, Not interested*." The letter "Q" is used from now on to identify items in the questionnaire, followed by the question number. Thus question number eight is identified as Q8, and so on.

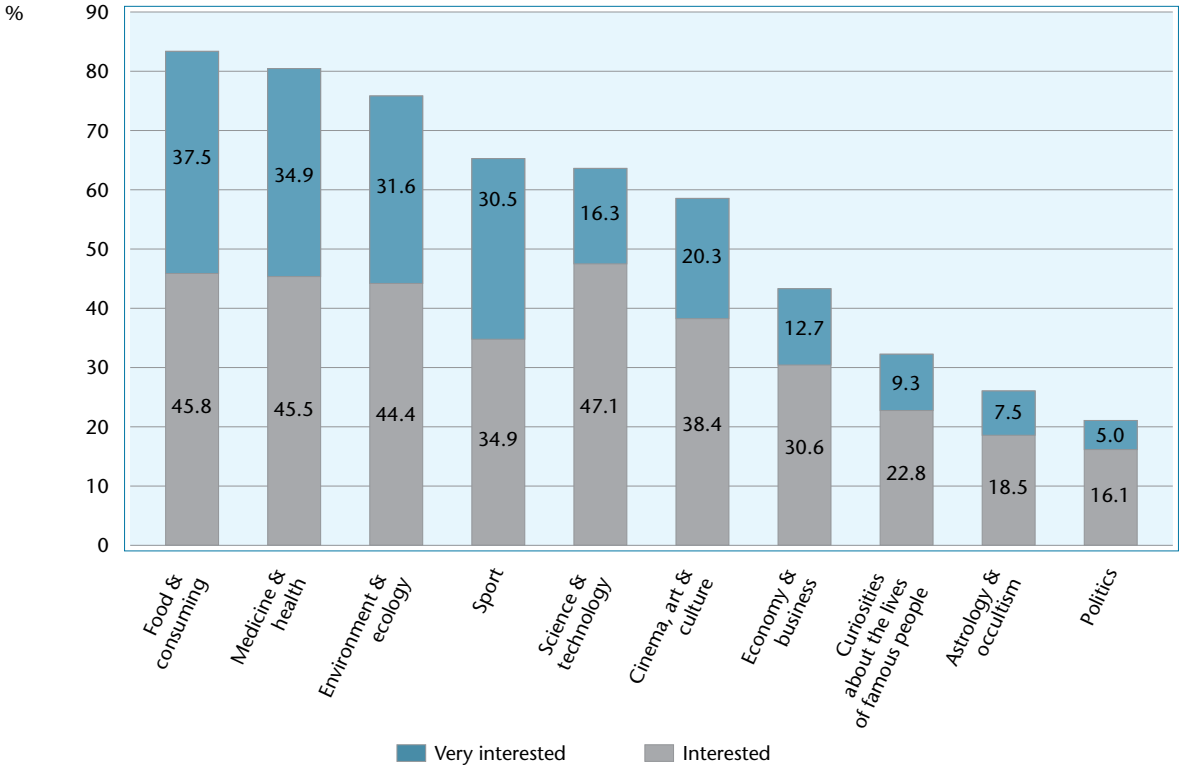
15. For this reason it makes sense to ask separate questions about interests in overlapping subjects such as environment, science or medicine. NSF and Eurobarometer surveys, like the survey described in this chapter, opted for this approach, considering that restricting questions to general interest in S&T would miss information relating to variations, modulations or fluctuations in interviewees' interest in the scientific and technological areas that most affect their lives.

motivator of actions linked to public policy for S&T, education and communication, with an emphasis on science journalism. A good example is the question on the interviewee's interest in various topics or issues. Q8 states as follows: "Say whether you are *Very interested*, *Interested*, *Fairly interested* or *Not interested* in each of these areas". The interviewee is then read a list of subjects (such as food & consuming, science & technology, cinema, art & culture etc.) that establish limits or divisions between areas.

As in almost any part of the world,[16] people in São Paulo State express a high degree of interest in S&T-related issues, but this interest is unevenly distributed across different knowledge areas. Among the options in which interviewees most expressed interest are food & consuming, medicine & health, and environment & ecology. Public interest in these areas is largely linked to, or at least touches on, S&T-related issues, leading many people to seek information on them in order to increase their knowledge or attempt to solve concrete problems they face in their day-to-day lives.

The number of respondents who say they are interested specifically in S&T is predictably small, but not negligible: 297 out of 1,825 interviewees are *Very interested*[17] in S&T, while 860, or 47.1%, are *Interested*. Thus the proportion opting for *Very interested* or *Interested* in S&T is 63.4% when those choosing both options are added together (Figure 12.1), ranking fifth in terms of stated interest among the ten areas or subjects listed in the question.

Figure 12.1
Interest in S&T and other knowledge areas – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Notes: 1. Single-frequency chart. A complete breakdown of the responses (adding up to 100%) is presented in Detailed Table 12.13.
2. See Detailed Table 12.1.

16. An exception is Japan, where stated interest is very low and a significant proportion of the population express strongly negative attitudes to S&T. See for example Miller, Pardo & Nuwa (1998).

17. The options available to respondents when asked this type of question are italicized in this report and begin with a capital letter to facilitate comprehension by the reader.

However, the level of stated interest in S&T in the city of São Paulo is significantly lower than in most other cities covered by the survey (see the Methodological Annex for the administrative regions of São Paulo State covered by the survey). This is an intriguing finding and worth analyzing in a separate study, especially bearing in mind that, among the cities covered by the survey, São Paulo has a high density of outstanding research centers and institutions dedicated to the diffusion and democratization of scientific knowledge.

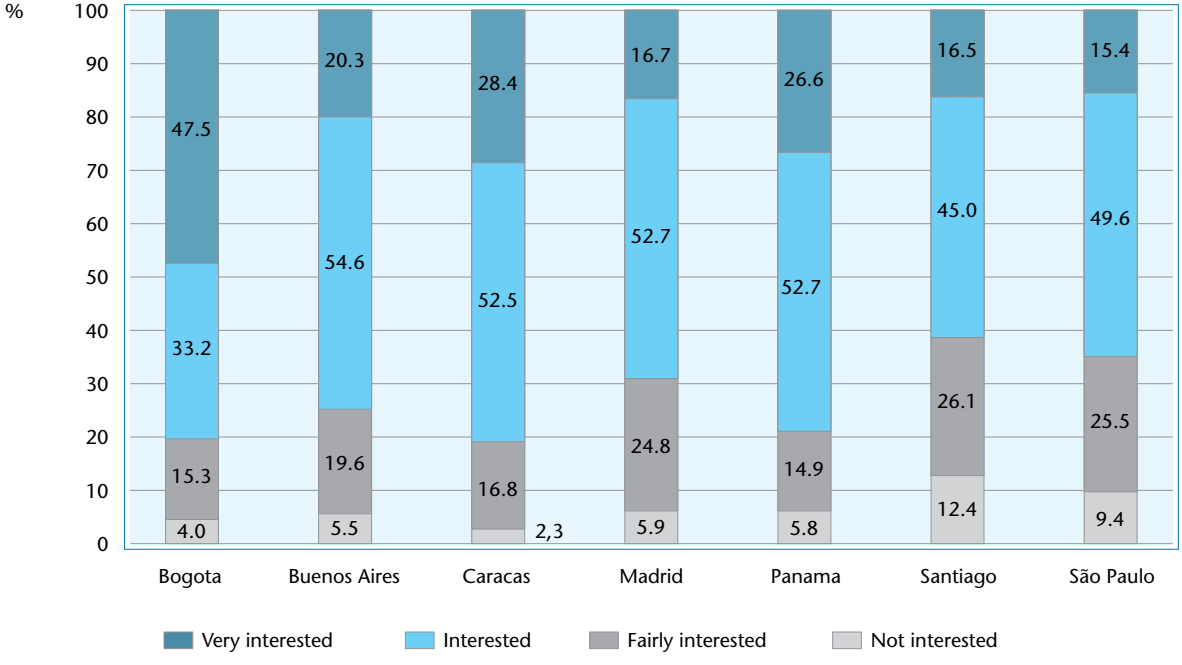
A comparison of responses to the question on respondents' interest in a range of areas (Q8) for the city of São Paulo and the other cities covered by the Ibero-American Project shows São Paulo ranking sixth in terms of the level of interest in S&T and related areas, with 65% selecting *Very interested* or *Interested*. This is similar to Madrid (Spain), where the proportion is 69.4%. The highest is 80.9% in Caracas (Venezuela). Bogota (Colombia) has the highest proportion who say they are *Very interested* in C&T: 47.5% of respondents there choose this option (Figure 12.2).

In the 2006 survey by MCT, where respondents were asked to say whether they were *Very interested*, *Fairly interested* or *Not interested* in nine different areas, 41% said they were *Very interested* in S&T. This can be considered a large proportion for Brazil, since given the margin of error it resembles the proportion who said they were *Very interested* in sport, which was 47% (MCT, 2007). Thus the statistics show S&T to rank alongside what is commonly known to be one of the subjects in which Brazilians are most interested.

As for the other areas listed in this question, it is worth noting the high frequency of rejection in some cases, such as politics, astrology & occultism and celebrities, all of which feature constantly in the media and in Brazil are a focus both for major dailies and TV networks, and for segmented magazines (Figure 12.1). Astrology and occultism, for example, are present in people's lives in various ways. The major newspapers all have daily horoscopes bylined by astrologers, there are several magazines dedicated to the area, and the books of Paulo Coelho, one of Brazil's best-selling writers, almost invariably touch on occultism.

Thus, with the exception of politics, which characteristically tends to be rejected outright, the other two areas in which a large proportion of the sample state a lack of interest are considered "frivolous" in our society, and few people would acknowledge appreciation

Figure 12.2
Interest in S&T by city surveyed – São Paulo & other cities covered by Ibero-American Project, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.2.

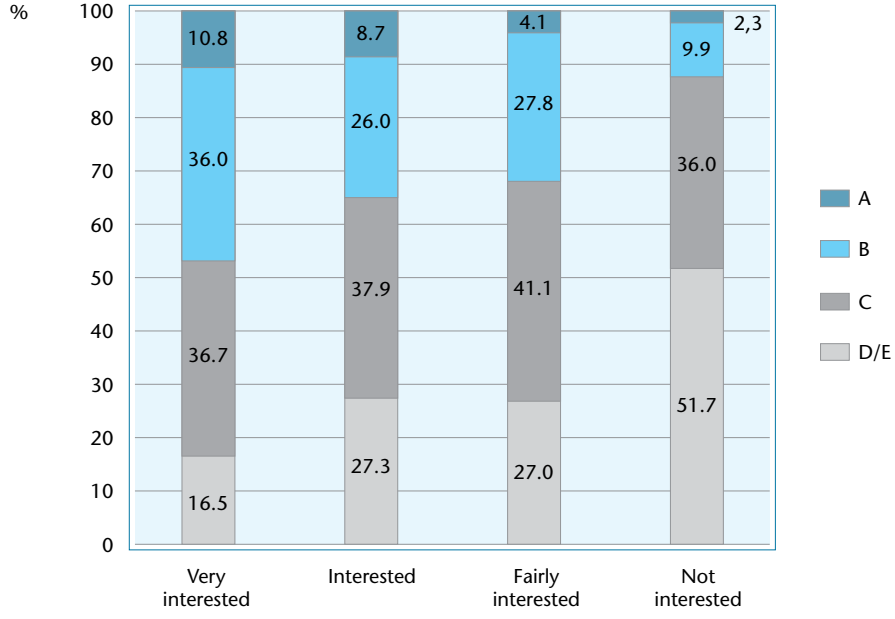
for or interest in these areas in a survey that also lists medicine & health, or environment & ecology.

Nevertheless, these declarations of interest in the various subjects do not appear to have been influenced merely by their "aura" of social respectability. On the contrary, at least in the case of S&T they appear to suggest a partial match with real behavior, in that the interest in S&T and high levels of consumption of information on S&T are statistically associated with respondents' actual knowledge of S&T, as measured by Q25, for example.[18]

3.1.1 Who is "interested" in S&T?

The responses to questions on interest in S&T, medicine & health, environment & ecology and food & consuming (series Q8) can be used to construct an interesting portrait of social groups in São Paulo State. Although the proportions of both those who say they are *Not interested* in subjects relating to science culture and those who say they are *Very interested* are far from negligible and found in all social groups, it is possible to point to certain patterns, as evidenced by Figure 12.3.[19]

Figure 12.3
Breakdown of survey respondents by level of interest in S&T and socioeconomic class – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.3.

18. Outside surveys it is difficult to measure people's interest in S&T-related subjects. Labjor/Unicamp is developing a methodology for precisely this purpose. Known as Scientific Automatic Press Observer (SAPO), the methodology gauges exposure to S&T and related topics in the print and digital media (see Vogt et al., 2007). SAPO focuses on media exposure because it is costly to measure consumption of news about S&T specifically. In connection with print media generally, and daily newspapers in particular, it is impossible to know whether a person who buys or has access to a newspaper really reads the science articles published in the newspaper. In the case of digital media, pageview statistics and data on the time spent visiting pages indicate reading, but companies consider such data strategic and therefore do not disclose them.

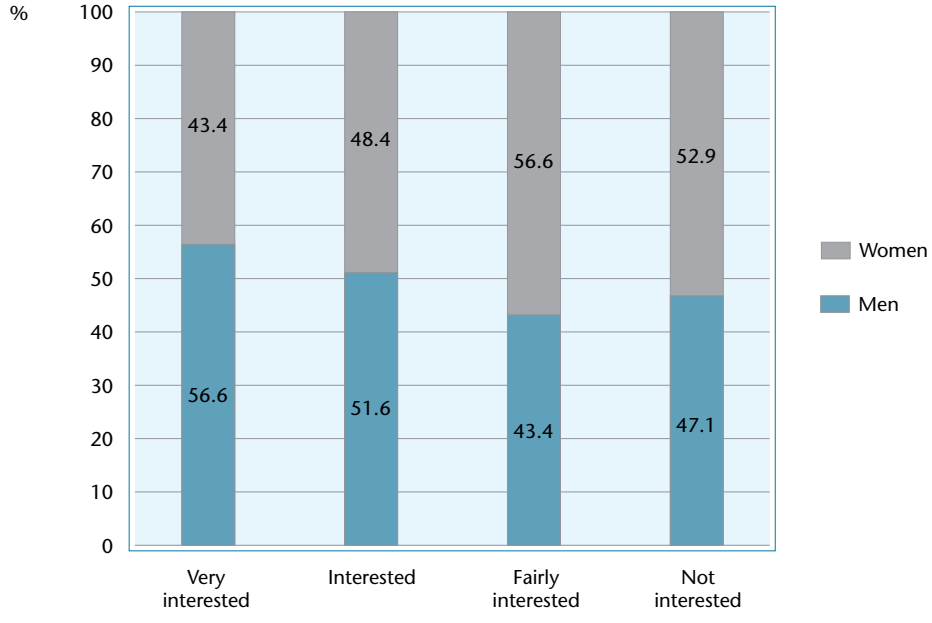
19. Respondents are grouped into socioeconomic classes according to the "Brazil Economic Classification Criterion" (CCEB), based on average monthly family income in reais (R$), as follows: A1 – R$7,793; A2 – R$4,648; B1 – R$2,804; B2 – R$1,669; C – R$927; D – R$424; E – R$207. Response categories A1 and A2, B1 and B2, and D and E are grouped together for the purposes of validating association tests. Thus classes A1 and A2 form class A, B1 and B2 form class B, and D and E constitute a single class, D/E.

From the standpoint of income or economic condition, respondents who declare themselves *Not interested* in S&T tend to belong predominantly to classes C and D/E (87.7% of *Not interested*), while a significant proportion of those who say they are *Very interested* belong to classes A and B (46.8% of *Very interested* – 10.8% A, 36% B – compared with 53.2% who belong to classes C, D and E). The responses to the question on interest in S&T were recoded, like all the others, to a Likert scale ranging from 0 = no interest to 3 = very interested. The average for A1 is 2.0. The average for E is 1.3.

A key finding arising from the breakdown by gender is that when asked about their interest in S&T men appear to be slightly more interested (Figure 12.4a). When asked specifically about S&T-related topics with greater appeal, such as medicine & health, or food & consuming, the difference is reversed, with women declaring significantly more interest than men (Figures 12.4b and 12.4c). No significant differences are observed between men and women as regards their declared interest in environment & ecology (Figure 12.4d).

Educational attainment is also associated with interest in S&T: 75.8% of respondents who say they are *Very interested* have a complete secondary education or a university degree. Only 1.2% of those who say they are *Not interested* in S&T have a tertiary education, while 72.6% of those who say they are *Not interested* have completed only primary or pre-primary school, or have no formal schooling at all (Figure 12.5).

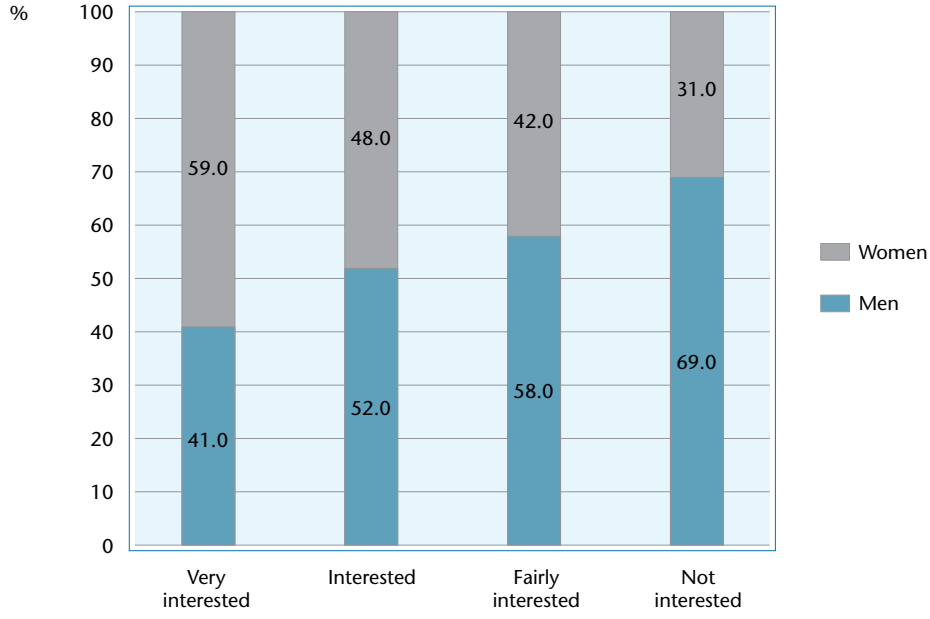
Figure 12.4a
Breakdown of survey respondents by level of interest in S&T and gender – São Paulo State, 2007



Source: LabjorUnicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.4a.

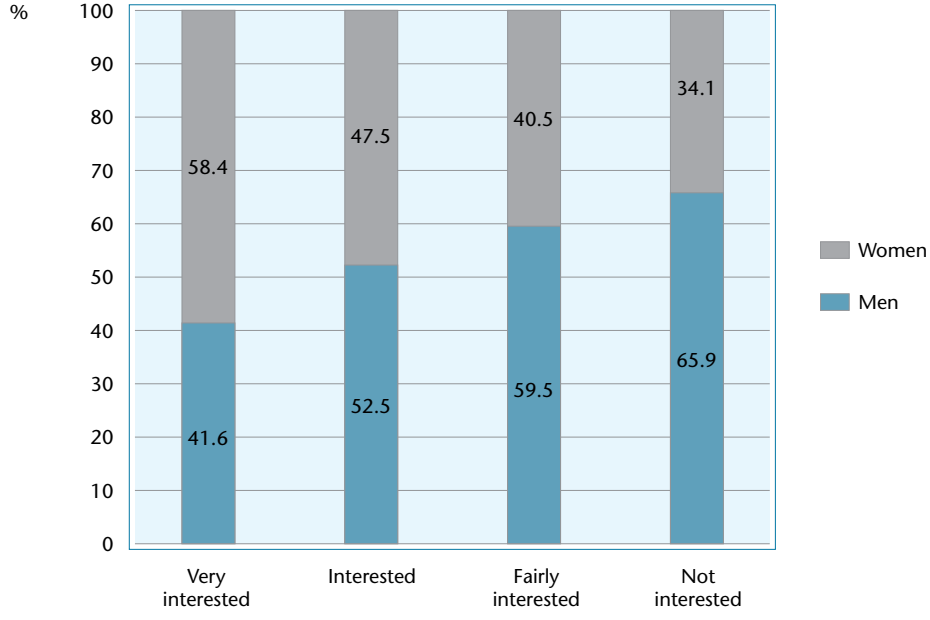
Figure 12.4b
Breakdown of survey respondents by level of interest in medicine & health and gender – São Paulo State, 2007



Source: LabjorUnicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.4b.

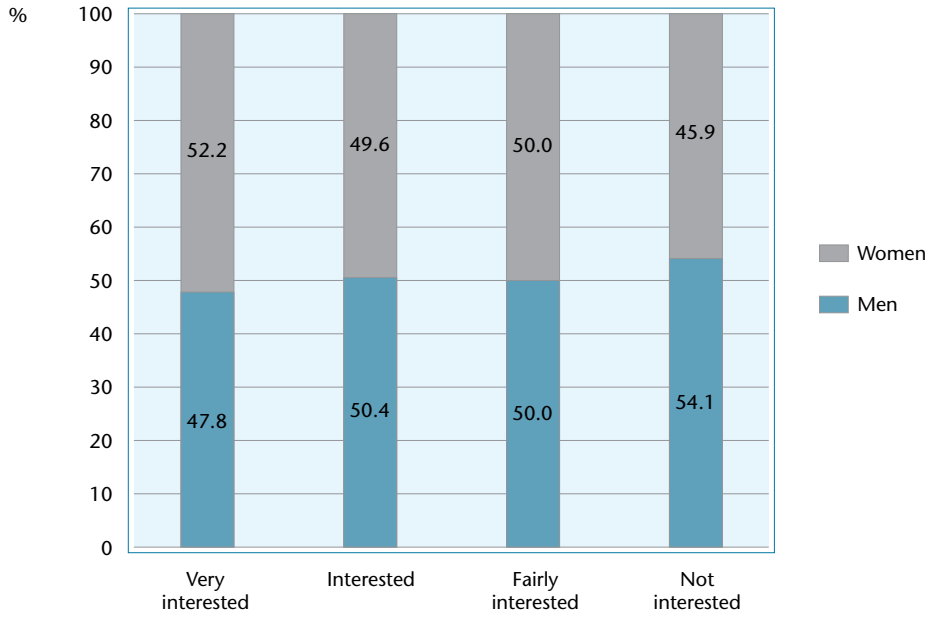
Figure 12.4c
Breakdown of survey respondents by level of interest in food & consuming and gender – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.4c.

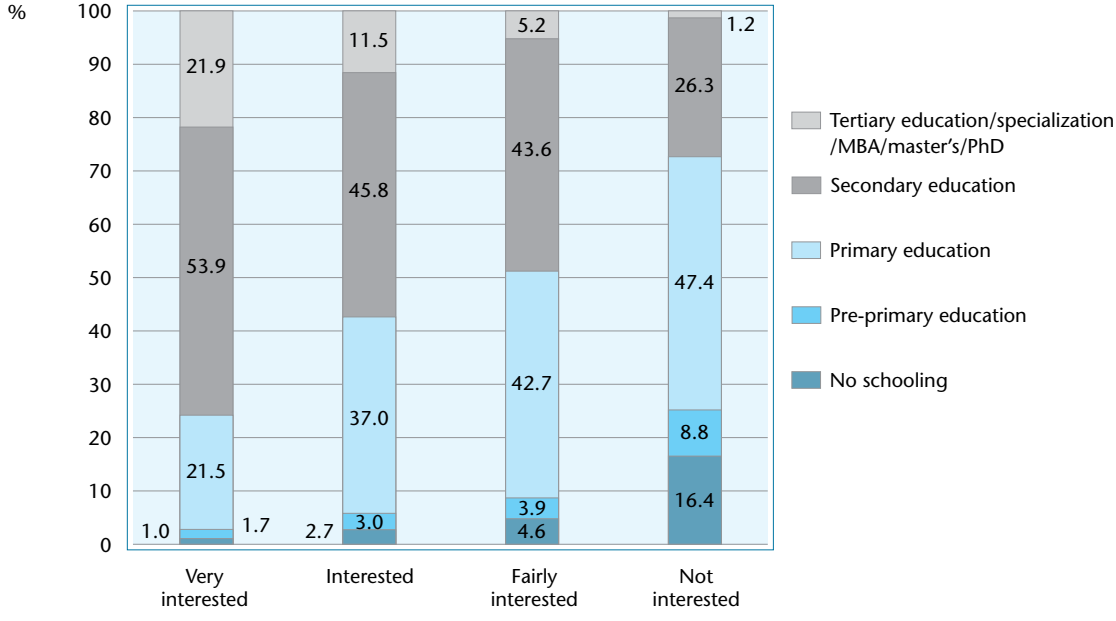
Figure 12.4d
Breakdown of survey respondents by level of interest in environment & ecology and gender – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.4d

Figure 12.5
Breakdown of survey respondents by level of interest in S&T and educational attainment – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

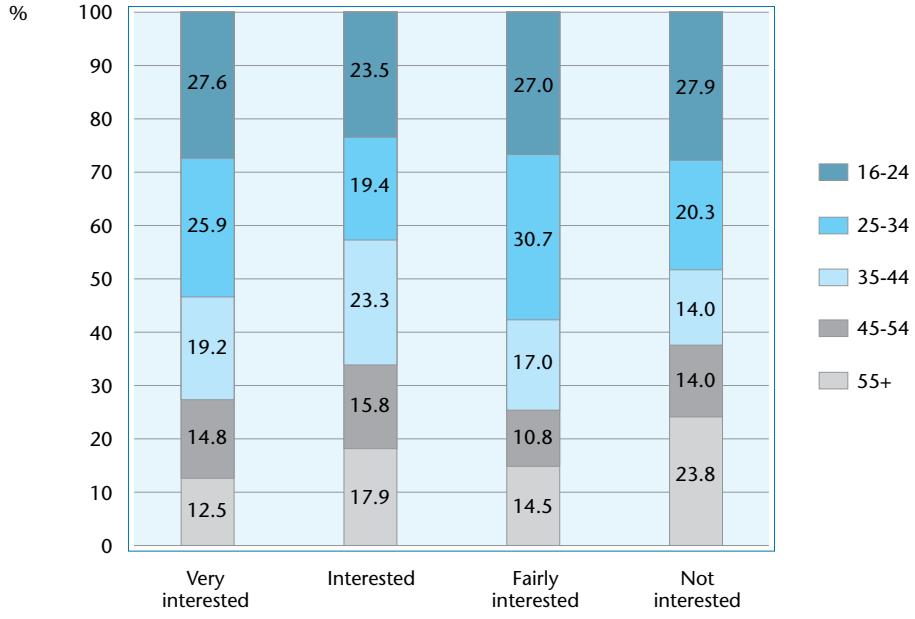
Note: See Detailed Table 12.5.

Logistic regression shows that people with a tertiary education are 18.1 times more likely to be interested in S&T than people with no formal schooling at all.[20]

Young people (age group 16-24) and adults (age group 25-34) do not express more interest in S&T, medicine & health, and food & consuming than respondents in other age groups: the average level of interest in S&T is 1.69 for the 16-24 age group and 1.67 for the 25-34 age group, compared with an overall average of 1.71 and an average of 1.80 for the 35-44 age group (Figures 12.6a-12.6d).

However, a comparison of age groups using logistic regression shows that respondents over 35 are about twice as likely to be interested in S&T as those in the 16-24 age group and 2.4 times as likely as those aged 25-34 (Detailed Table 12.6).[21]

Figure 12.6a
Breakdown of survey respondents by level of interest in S&T and age – São Paulo State, 2007



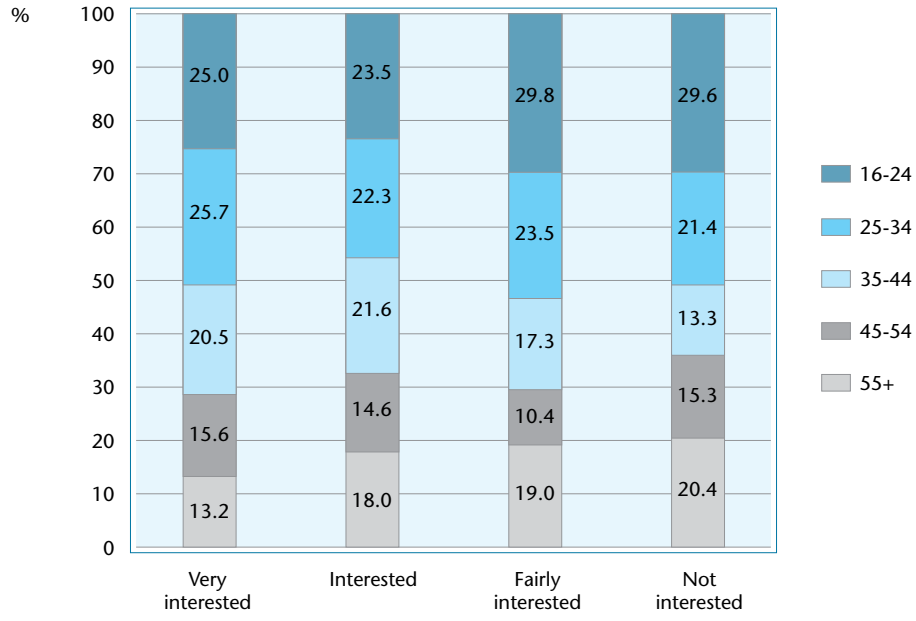
Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.7a.

20. As can be seen from Detailed Table 12.6, the number 18.1 is the quotient of 1 divided by 0.055. The Methodological Annex to this chapter explains how the data were modeled, with the level of interest in S&T as response variable, and with gender, educational attainment and age group as independent variables.

21. As can be seen from Detailed Table 12.6, the finding that respondents over 35 are twice as likely to be interested in S&T than those aged 16-24 derives from dividing 1 by 0.496 and that they are 2.4 as likely as those aged 25-34 from dividing 1 by 0.425. Because the odds ratio confidence interval for age group 4 versus age group 5 includes 1, it can be said the age group 4 (45-54) is equal to age group 5 (over 55). These two variables are therefore amalgamated into a single age group, age group 4, comprising respondents aged more than 45. The model is again adjusted and the odds ratio confidence interval now shows age group 3 (35-44) equal to age group 4 (45-54), giving a new age group 3 for those aged more than 35.

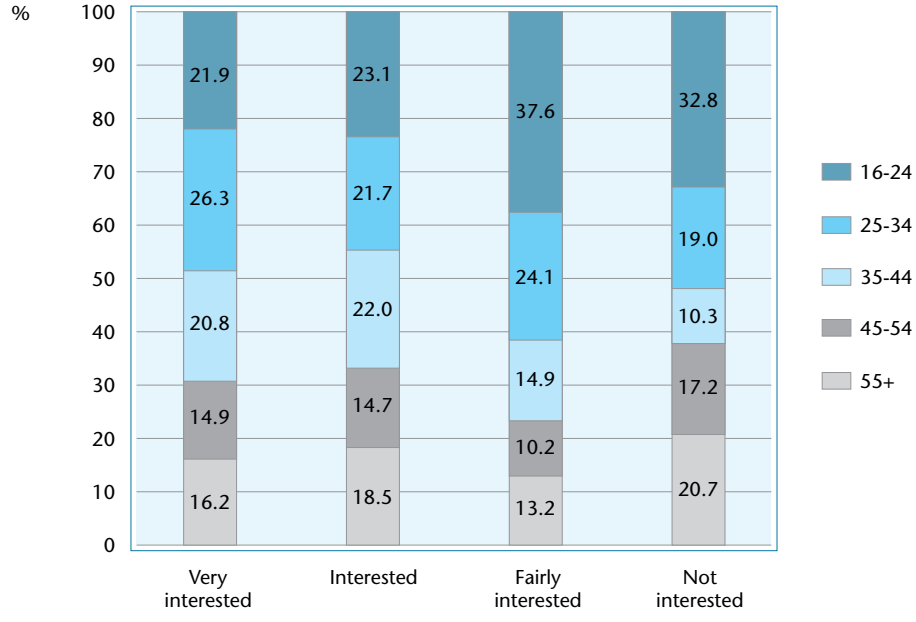
Figure 12.6b
Breakdown of survey respondents by level of interest in environment & ecology and age – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.7b.

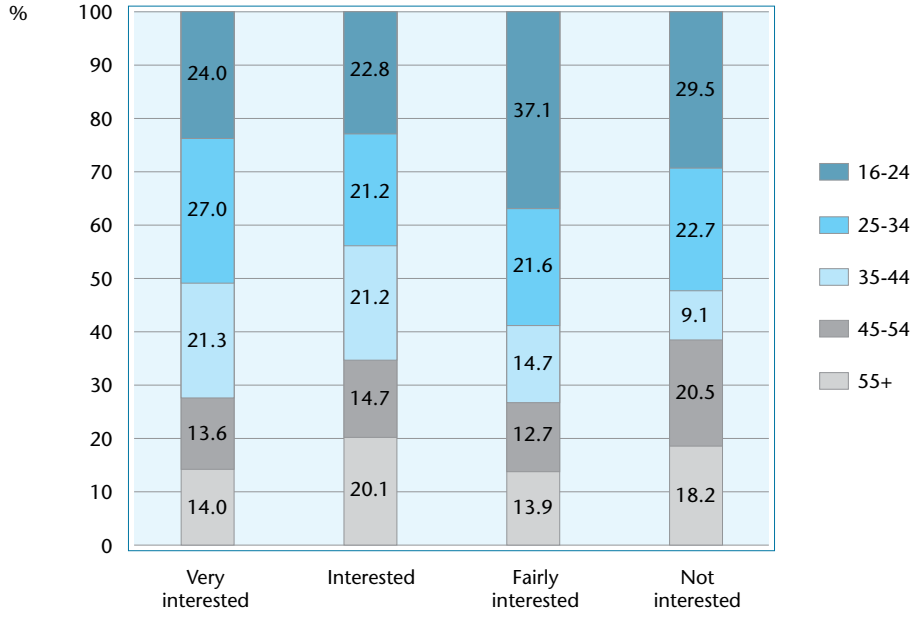
Figure 12.6c
Breakdown of survey respondents by level of interest in medicine & health and age – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.7c.

Figure 12.6d
Breakdown of survey respondents by level of interest in food & consuming and age – São Paulo State, 2007



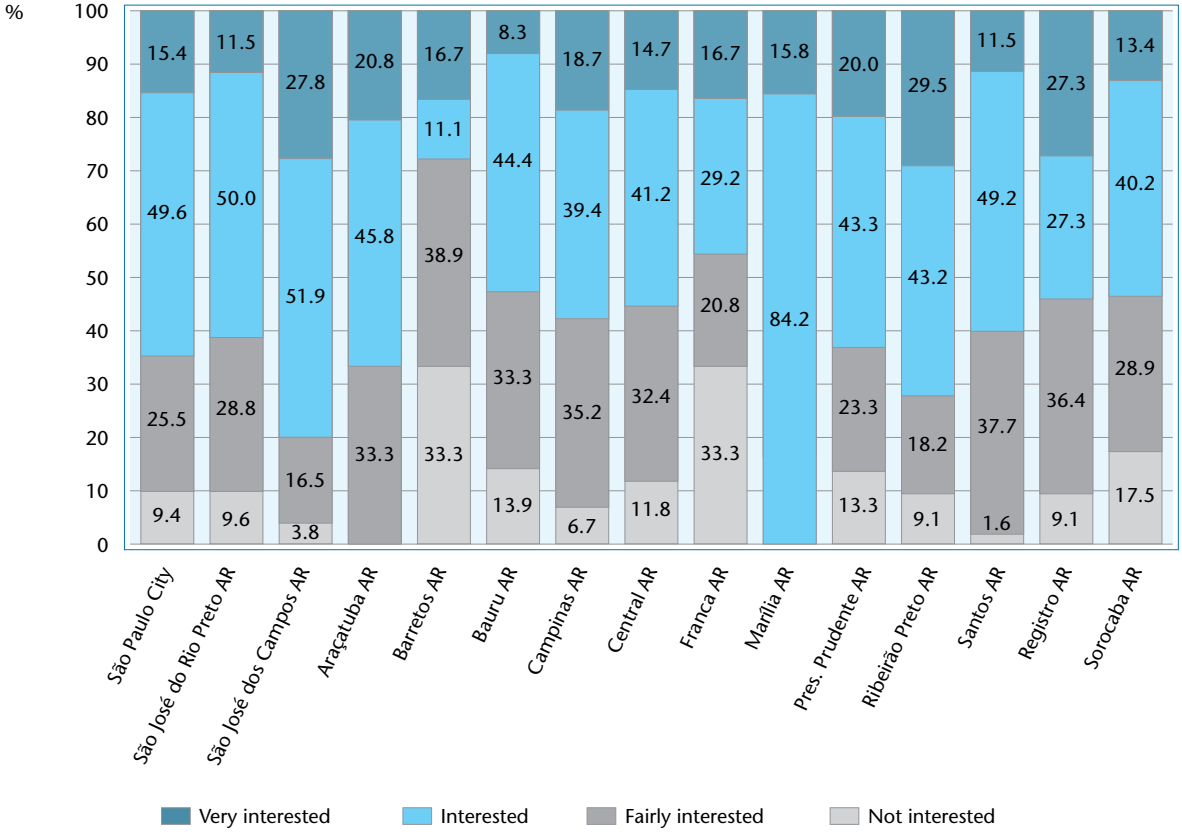
Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Nota: See Detailed Table 12.7d.

Based on a geographical distribution analysis, it is not easy to argue for or against the existence of concrete differences among the administrative regions of São Paulo State as far as interest in or attitudes to S&T is concerned, owing to the insufficient sample size for this type of cross-tabulation.

However, it is worth noting that the level of declared interest in S&T is higher in some cities than others and that these are not necessarily cities with more research institutions or venues for science culture diffusion. For instance, interest in S&T is relatively low in Barretos and Franca, high in São José dos Campos and Marília, and medium in São Paulo and Campinas. These findings accord with those of the previous survey, covering the cities of Ribeirão Preto, Campinas and São Paulo with representative samples in each city yet without significant differences in attitudes and declared behavior that can be explained in terms of different economic or structural contexts (Figure 12.7).

Figure 12.7
Interest in S&T by administrative region – Administrative regions of São Paulo State & São Paulo City – 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.8. AR = Administrative region.

3.2 Information about S&T

Another significant part of the questionnaire is the level of information about S&T declared by respondents in terms of self-perception (in Q10), with regard to the same list of ten areas as in Q8, which asks respondents to say how interested they are in the areas. In the case of sport, in which 65.4% say they are *Very interested* or *Interested*, the level of information is similar, with 64.0% considering themselves *Highly informed* or *Informed*. Thus sport ranks second in the list on this criterion (Figure 12.8).

Similarly high levels of information are found for S&T-related areas: food & consuming 72.1%, medicine & health 63.6%, environment & ecology (61,4%). One possible conclusion is that these subjects not only arouse interest but lead people to consume information about them in pursuit of more knowledge and answers to related problems.

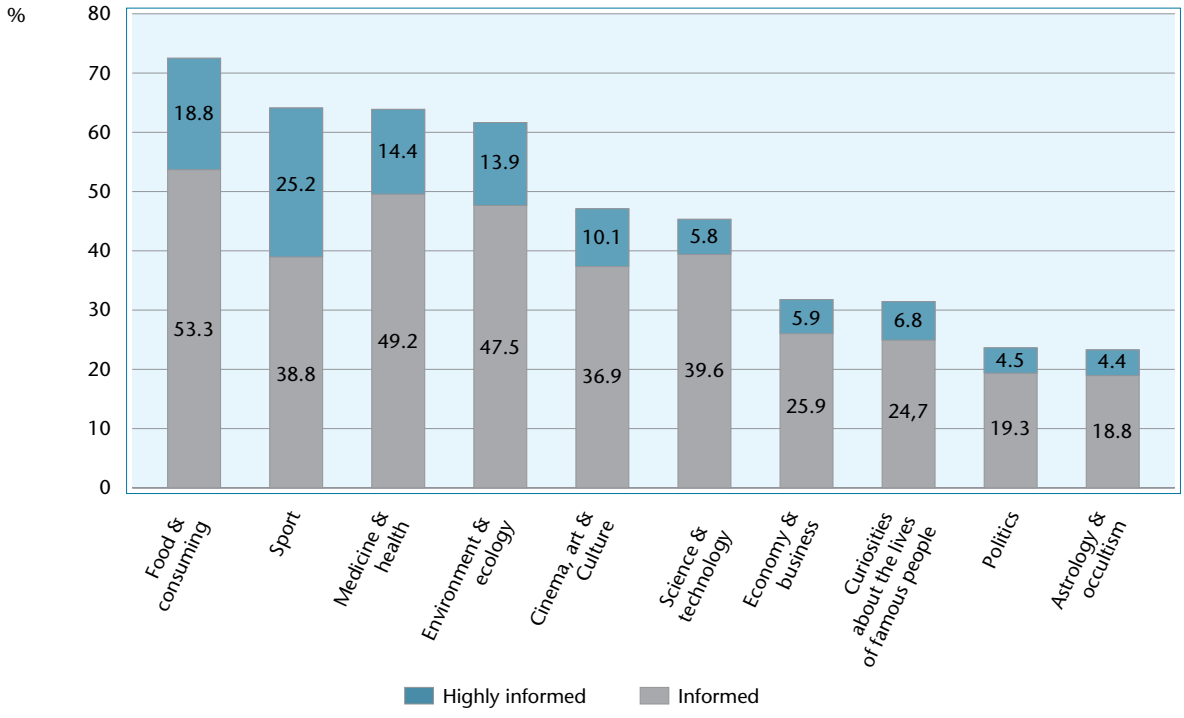
However, with regard to S&T exclusively only 105 respondents, or 5.8% of the sample, declare themselves *Highly informed*, although the number declaring themselves *Informed* is larger: 722 respondents, or 39.6% of the sample.

Lack of both interest and information are significant with regard to politics, astrology & occultism, and curiosities about the lives of famous people. The responses *Not informed* and *Moderately informed* account for a significant proportion of the total in these areas.

Compared with respondents in cities of the interior of the state, interviewees in the city of São Paulo who say they are *Highly informed* about S&T are the smallest group (4.8%). The responses *Highly informed* and *Informed* about S&T obtained in the city account in aggregate for 45%, similar to the proportion in Madrid (Spain), which is 46.4%.

When asked why they do not consider themselves informed about S&T, 35.9% of respondents in São

Figure 12.8
Level of information about S&T and other subjects – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Notes: 1. Single-frequency chart. A complete breakdown of the responses (adding up to 100%) is presented in Detailed Table 12.13.
2. See Detailed Table 12.9.

Paulo say they "do not understand" the subject. This finding appears to be of fundamental importance as an input for policymaking in the field of science diffusion and public understanding of S&T.

The results of the Ibero-American Project show a similar difference between levels of interest and information self-assessed by interviewees in the city of São Paulo (19.6%) and Madrid (21.8%). In Santiago the difference is greater (28.6%). Caracas displays the widest gap between levels of interest and information, with 38.6% (López Cerezo & Polino, 2008).

3.2.1 Scientific Information Consumption Indicator

Research on public understanding of S&T has always involved a heated debate regarding the construction of viable indicators in longitudinal surveys[22] or for international comparisons. The disagreements are considerable and a community consensus is still a long away off. Indicators of knowledge of scientific notions or the processes and methodology of science are a notorious case in point. Examples include the *Knowledge Index*, the *Index of Scientific Construct Understanding* and the *Index of Scientific Inquiry* (Miller, 1983, 1998; Durant, Evans & Thomas, 1989), some of which have been used, not always consistently or continuously, in some NSF surveys in the U.S. (NSF, 1996, 2000, 2002) or by Eurobarometer. The construction of indicators to measure attitudes to S&T is an even more controversial field. Well-known examples include the *Attitude Toward Organized Science Scale* (ATOSS), tested by the NSF (1993), and the *Index of Scientific Promise* and *Index of Scientific Reservation* (NSF, 2000). Indicators that appear statistically consistent and ro-

22. Longitudinal surveys involve repeated observations of the same variables over a long period of time, typically several decades.

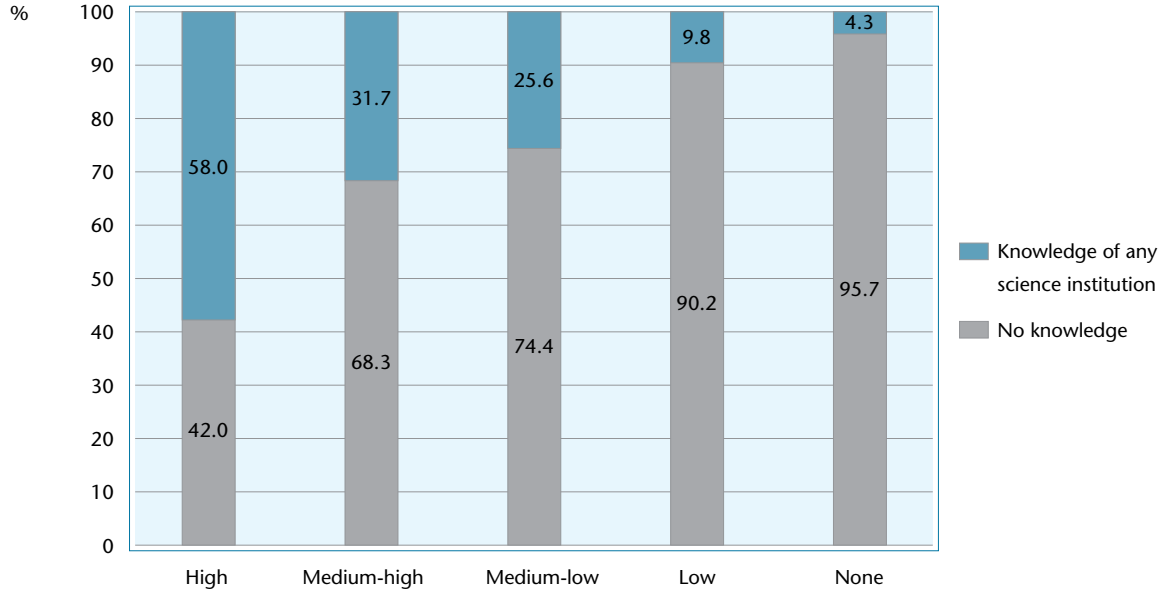
bust in one country may produce insignificant data in others; factorial analysis of an indicator may lead to different results over time and even within a single country; and so on.

Despite these difficulties, the Ibero-American Project team are working on the development of common indicators that can be shown to be valid and consistent, based on the data for each country. Factor analysis and cluster analysis are being applied to the complete database to test groups, predictors, and possible indicators with consistency and significance in the region.

One particular indicator proposed in SeCyT (2003a) and tested in depth in SeCyT (2007) appears to be promising. This is ICIC, an acronym for Scientific Information Consumption Indicator,[23] which is described in detail in the Methodological Annex. ICIC has proved capable of discriminating between groups of respondents. As noted later, respondents' attitudes and perceptions do in fact change as their self-declared consumption of scientific information in the media increases.

In the present survey, this is evidenced initially by the finding that self-declared consumption of scientific information correlates with knowledge of S&T: whereas fewer than 2 out of 10 respondents in general say they know the name of any Brazilian science institution, the proportion of those with high ICIC scores, i.e. respondents who consume scientific information from print media or TV, is far greater (Figure 12.9). Among

Figure 12.9
Breakdown of survey respondents by Scientific Information Consumption Indicator (ICIC) and declared knowledge of any Brazilian science institution – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.10.

23. ICIC was developed on the basis of two questions relating to the consumption of scientific information. The first asked respondents about TV programs with S&T content that they watched; the second asked about science news they read in the newspapers. An information consumption score was attributed to each response. The sum of these values is ICIC, which ranges from 0 to 2. Despite its simplicity, ICIC has proved highly useful as an indicator of science information consumption by survey respondents. For more details of ICIC, see the Methodological Annex to this chapter.

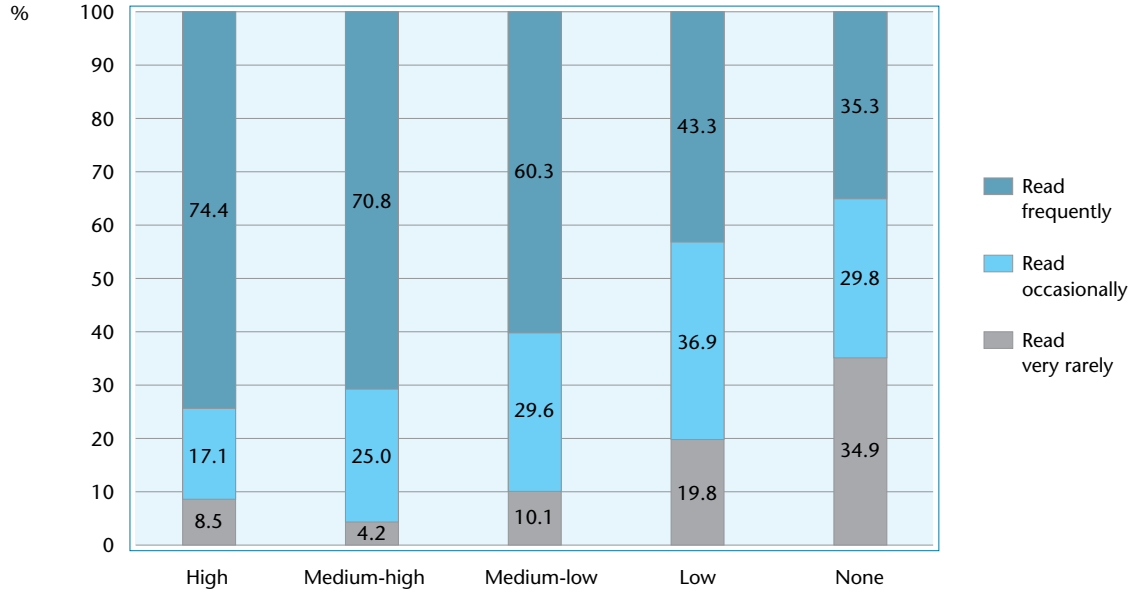
those with high ICIC scores, 58% say they know the name of a science institution. The proportion with an ICIC score of zero is negligible (4.3%).

ICIC also correlates with certain habits linked to appropriation of and participation in S&T. For example, the proportion of respondents who say they frequently read food labels more than doubles as ICIC scores rise from zero to high (Figure 12.10).

Attitudes towards science and images of the roles of science and scientists also vary significantly in accordance with the level of this indicator. For example, by numerically quantifying the Likert scale used to score admiration for the work done by scientists (see next subsection) it is possible to see how this appreciation rises rapidly as self-declared consumption of scientific information increases. ICIC correlates closely with interest in S&T, educational attainment and socioeconomic status.

An important point to note is that a high ICIC score does not simplistically mean general enthusiasm for S&T, but rather appears to reflect a concrete and critical understanding of science culture. This is evidenced when the responses to two questions on the risks and benefits of S&T are cross-tabulated (see Q14 and Q15 in the questionnaire, reproduced in the Methodological Annex). If responses are grouped into four attitudinal quadrants (believing that S&T can offer *Many risks & many benefits*, *Many risks & few benefits*, *Many benefits & few risks* or *No risks & no benefits*), it can easily be seen that increasing consumption of scientific information does not automatically entail an increase in the number of "enthusiasts" who believe S&T has *Many benefits* with *Little or no risk*, but does conspicuously correlate with a growing belief that scientific and technological development brings benefits together with risks. It also tends to correlate with a smaller proportion of "pessimists" who see many risks and little or no benefit (Figure 12.11 – see also the detailed analysis of perceived risks and benefits in 3.3.2 below).

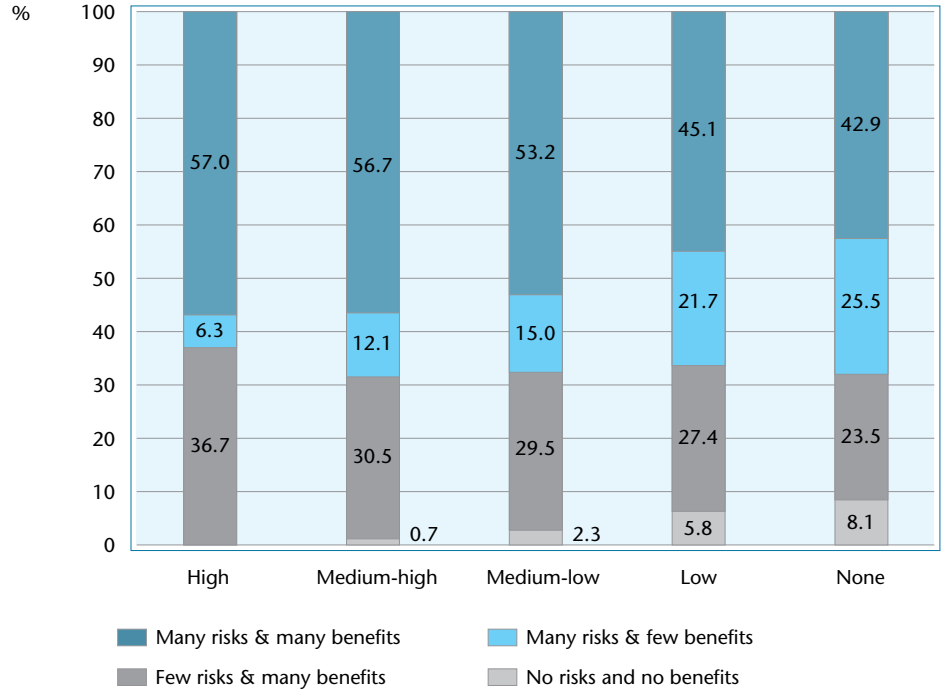
Figure 12.10
Breakdown of survey respondents by Scientific Information Consumption Indicator (ICIC) and declared reading of food labels – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.11.

Figure 12.11
Breakdown of survey respondents who declared consumption of information about S&T by Scientific Information Consumption Indicator (ICIC) and attitude to risks and benefits – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.12.

3.3 Perceptions, values and attitudes relating to S&T

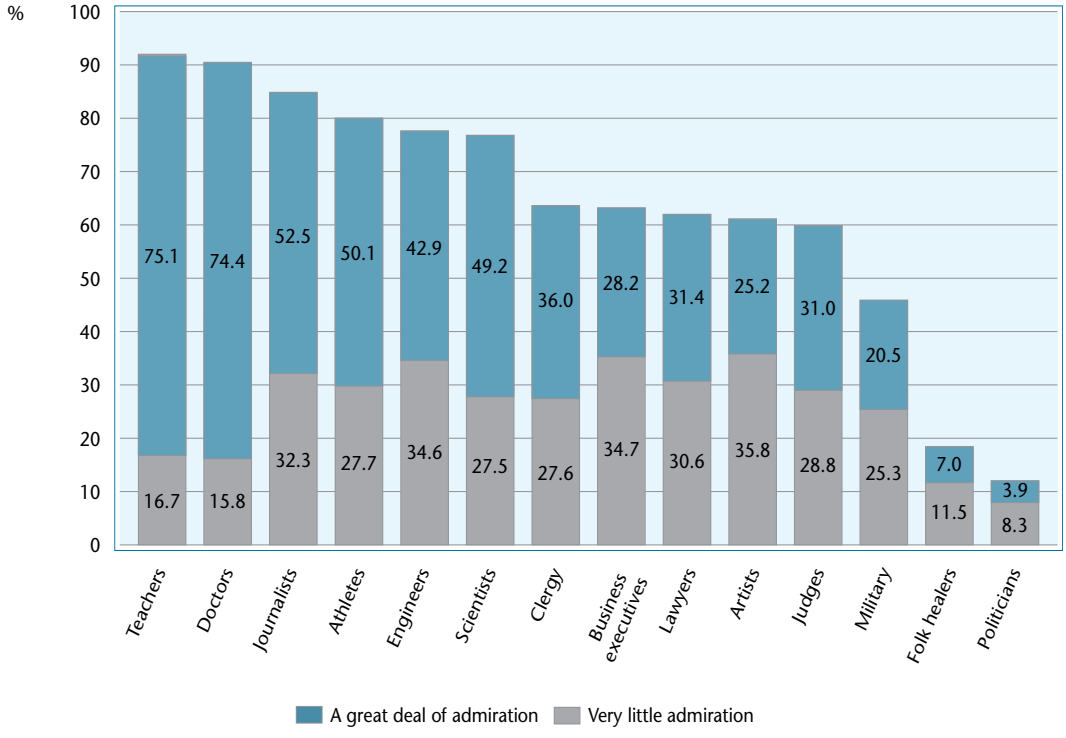
Some of the survey questions address values and attitudes relating to S&T. They are designed to capture public perceptions, not directly of S&T properly speaking, but of the universe that surrounds S&T. One of the questions asks respondents to say how much they admire each of 14 professions in order to find out where scientists stand in the public's perceptions (Q5: "For each of the professions listed, choose *A great deal of admiration*, *Some admiration*, *Very little admiration* or *No admiration*").

The survey findings show a very high proportion of positive responses to this question for scientists, with *Great admiration* or *Some admiration* accounting for 76.7% (Detailed Table 12.13, Q5). The results are more positive still for other professions: 91.8% say they admire teachers, for example, as the sum of *Great admiration* and *Some admiration*, with 75.1% opting for the former (Figure 12.12).[24] This finding is all the more noteworthy since Brazilian teachers are very poorly paid.

In addition, responses to this question about admiration for professions (Q5) were cross-tabulated with responses to the question discussed earlier about interest in ten subjects including S&T (Q8) in order to see whether those who admire scientists are also those who declare the most interest in S&T. A strong

24. There is a degree of overlap here, as teachers may also be scientists, doctors or engineers. However, this approach was preferred to enable social representations of the professions concerned to be analyzed more effectively.

Figure 12.12
Level of admiration for scientists and other professions – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.14.

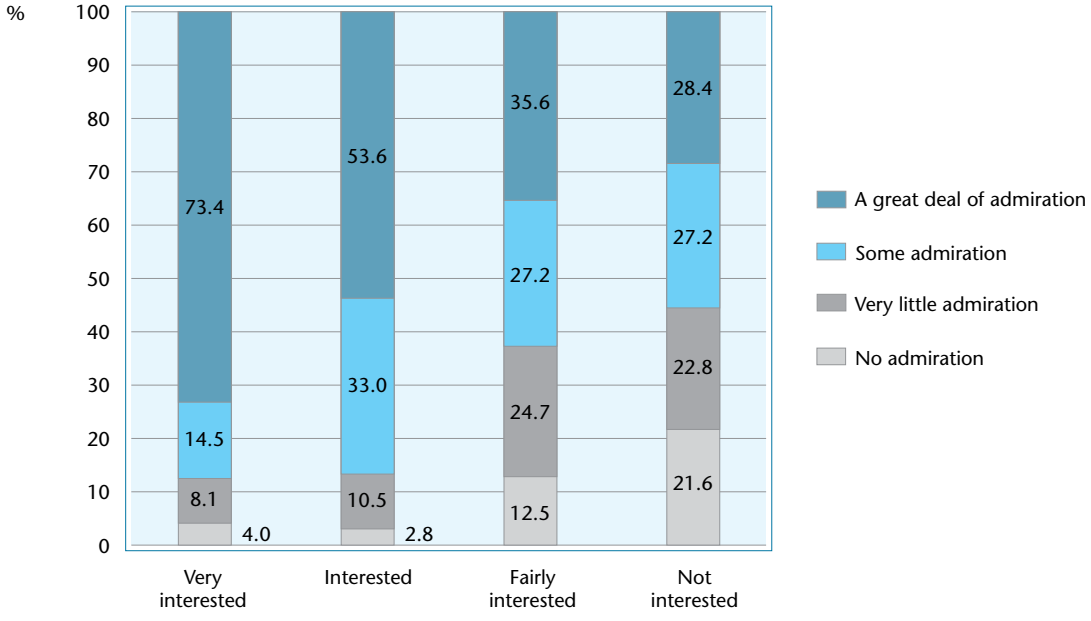
correlation was indeed found: 73.4% of respondents who say they are *Very interested* in S&T declare admiration for scientists, as do 53.6% of those who say they are *Interested* (rather than *Very interested*) (Figure 12.13).

Journalists are also an admired profession, with 52.5% of respondents choosing *Great admiration* and 32.3% opting for *Some admiration*, making a total of 84.8%. At the opposite extreme, politicians rank bottom with 61% of respondents selecting *No admiration* and 26.4% *Very little admiration*, for a total of almost 88% (Detailed Table 12.13, Q5).

The responses to a question asking interviewees to choose three trusted types of entity or group out of a list of 12 (Q17: "Sometimes the results of science and technology are controversial for society. In these cases whom do you trust most when forming your opinion?") show a high level of trust in universities and research centers, with 66.2% of responses (as the sum of all three options). Next comes the media with 58.2%, followed at a distance by government with 36.9%. The latter almost tie with 35.3% for friends and family (Detailed Table 12.13).

This trust in scientists at universities and research centers correlates strongly with responses to questions on values and attitudes, such as those that ask interviewees for their opinions on professional careers. In response to Q29, for example, 44.8% find the prospect of becoming a scientist *Highly attractive* to young people, 63.7% rate the profession *Highly rewarding* from a personal standpoint, 63.4% agree with the statement that it is a well-paid profession, and 62.6% agree with the statement that it enjoys high prestige (Detailed Table 12.13).

Figure 12.13
Breakdown of survey respondents by level of interest in S&T and admiration for scientists – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.15.

3.3.1 Perceptions of Brazil's performance

Continuing with the analysis of public perceptions of science and scientists, in response to a question in the survey (Detailed Table 12.13) that asks interviewees to rate how well Brazil performs in a number of areas including scientific research and development of technologies (Q6: "I'm going to read out a list of areas and I'd like you to say how well you think Brazil performs in each one, choosing *Outstanding performance, Above-standard performance*, *Standard performance* or *Insignificant*"), a large proportion rate the following positively: sport, tourism, agriculture, and industry. Development of technologies and scientific research rank sixth and seventh, with the sum of *Outstanding performance* and *Above-standard performance* accounting for 57.5% and 49.1% respectively, more than 30 percentage points behind the top-ranking area, which is sport.

Sport, tourism and agriculture, ranked highest in terms of performance, may reflect the general perceptions of Brazil by its own citizens and are associated with important aspects of the nation's self-image, such as success in soccer and the ideas that Brazilians are friendly and hospitable as a people, and that nature is bountiful in Brazil. Scientific research and development of technologies, however, are typically perceived as areas in which other (developed) countries perform outstandingly. As for education and health, their negative ratings in this survey reflect widely debated problems in Brazil's education and health systems, which are constantly covered by the media, in election campaigns and in reports by international organizations.

3.3.2 Risks and benefits

Among other survey questions that deal with values and general attitudes towards S&T (Detailed Table 12.13), one of the most significant is Q22: "New applications of science and new technological developments frequently arouse controversy because they involve both risks as well as benefits. Tell me whether you agree or disagree with the following statements as they apply to such cases". This question was read to the interviewee,

followed by six statements and the options *Strongly agree*, *Agree*, *Neither agree* or *disagree*, *Disagree* and *Strongly disagree* (see the Methodological Annex for the complete six statements). *Strongly agree* and *Agree* were grouped together as positive; *Strongly disagree* and *Disagree* as negative; *Neither agree nor disagree* constituted a middle column.

Responses to the first statement (Q22.1: "The citizens should be heard and their opinions taken into consideration") are 89.5% positive, with *Agree* accounting for the larger proportion (55.1%). Responses to the second statement (Q22.2: "Only the views of experts should be heard") are 56.4% negative, matching the proportion who agreed with the first statement. This is consistent with the idea that ordinary citizens should participate or at least be consulted on new applications of science and new technological developments.

In the case of the third statement (Q22.3: "A new application of science or technology should be banned if there is the least possibility of a grave risk"), 76.2% choose *Agree* or *Strongly agree*, while 8% *Disagree* and 14.7% choose the option *Neither agree nor disagree*.

Responses to the fifth statement (Q22.5: "I would not be concerned as long as I was not directly affected") are 63.6% negative, evidencing a certain degree of consideration for the public interest. This is confirmed by the responses to the sixth statement (Q 22.6: "I would accept [such cases] as long as there was a benefit for the community"), which are 75.6% positive. The fact that 11.7% disagree can be interpreted as espousal of the precautionary principle, in that at least a tenth of the respondents reject the idea of benefits for the community if there are risks, however small.

An analysis of the correlations between responses to questions that address perceptions of the risks and benefits of future S&T developments and the respondents' socioeconomic status produces interesting findings. Socioeconomic status is clearly a strong explanatory variable, especially for perceptions of the possible benefits of S&T. The evidence suggests that this can be understood as resulting from better access to technological products and services for higher income groups, whereas the material benefits take longer to reach the lower classes or appear inaccessible to them.

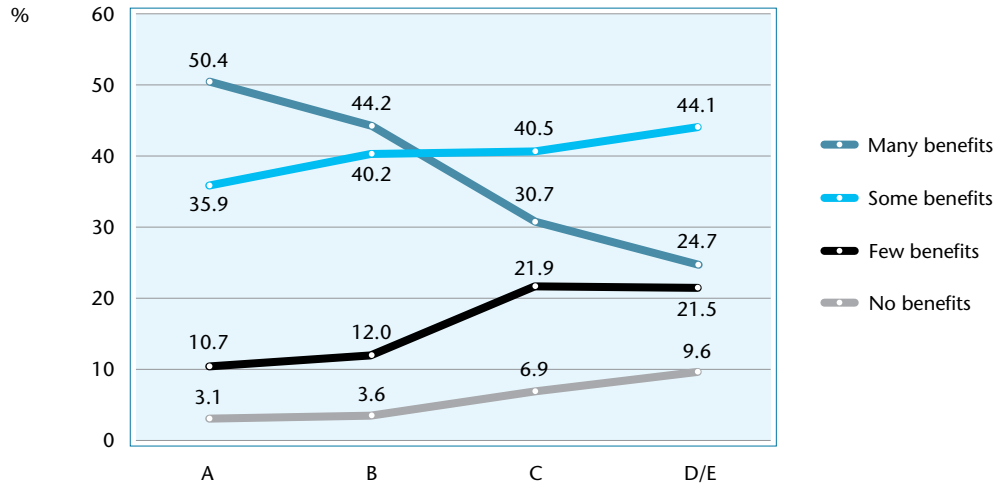
Figure 12.14 presents a breakdown by socioeconomic group of responses to Q15: "Generally speaking, do you believe the development of science and technology in the next 20 years will offer *Many benefits*, *Some benefits*, *Few benefits* or *No benefits* to the world?" The findings show that the higher up the socioeconomic scale, the more respondents tend to expect benefits from S&T. Conversely, the frequency of the responses *Few benefits* and *No benefits* increases as one descends the socioeconomic scale. In particular, the option *Many benefits* becomes consistently less frequent as income falls. These correlations can clearly be seen in Figures 12.14 and 12.15, which present a percentage breakdown of the responses to this question by socioeconomic class (see note 19 above). An analysis of each option regarding perceived benefits as it is distributed across the four socioeconomic groupings (Figure 12.15) shows class A, which corresponds to 7.2% of the sample,[25] accounting for 11% of *Many benefits*. The proportion of respondents in class A who chose *Many benefits* was fairly high (50.4%), as can be seen from Figure 12.14. Class B, which corresponds to 26.4% of the sample, accounts for 35% of respondents who choose the option *Many benefits* and the proportion of respondents in class B who choose this option is 44.2%. The option *Some benefits* ranks second for classes A and B. Class A contributes 6.5% of these responses while class B accounts for 26.5%, similar to its percentage share of the sample. The option *Some benefits* is chosen by 35.9% of class A and 40.2% of class B.

An analysis of responses by classes C and D/E shows a complete inversion of preferences. Class C respondents, who correspond to 38.3% of the total sample, account for 45.8% of the option *Few benefits* and 40.7% of *No benefits*. In class C, 21.9% choose the option *Few benefits* while 6.9% prefer *No benefits* (Figure 12.15). In the case of class D/E, in contrast, the preferences are inverted, with the option *No benefit* ranking first. Class D/E contribute 40.7% of this option, while interviewees in this class account for only 28.1% of the total sample. Class D/E contribute 21.5% of the option *Few benefits* (see Detailed Table 12.13).

This distribution shows that classes C and D/E perceive fewer future benefits of S&T, while classes A and B expect S&T to offer more benefits. The question put to the interviewees refers to non-individual benefits ("benefits to the world"), but the responses appear to be directly linked to access to technology-based goods and services.

25. For the overall distribution of socioeconomic classes in the sample, see Detailed Table 12.14 (Q44).

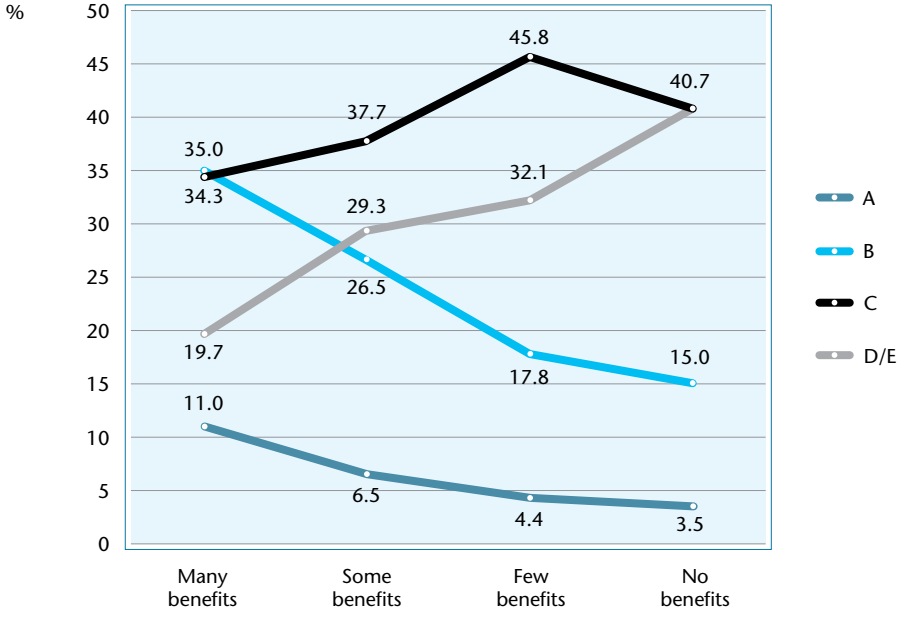
Figure 12.14
Breakdown of survey respondents by socioeconomic class and perception of future benefits of S&T – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.16.

Figure 12.15
Breakdown of survey respondents by perception of future benefits of S&T and socioeconomic class – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.17.

Another question, Q14, addresses perceptions of possible risks**:** "Generally speaking, do you believe the development of science and technology in the next 20 years will offer *Many risks*, *Some risks*, *Few risks* or *No risks* to the world?" A breakdown of the responses by socioeconomic class is presented in Figure 12.16.

The option *Many risks* is most frequent among classes C (30.9%) and D/E (32.8%). The option *Some risks* is preferred mainly by class A (43.8%), with class B close behind (40.2%). This profile changes moderately for the option *Few risks* and much more starkly in the case of *No risk*. Indeed, the perception of grave risks is strongest among respondents of lower socioeconomic status while the perception of moderate risks is predominant among those of higher status.

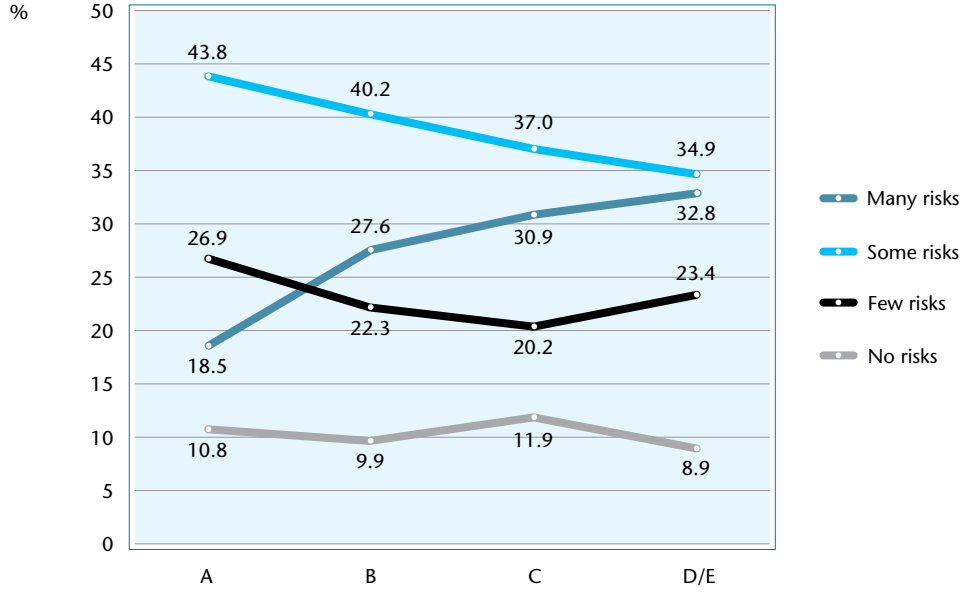
Nevertheless, it is important to note the steady growth of the proportion perceiving high future risks of S&T (*Many risks*) as one descends the socioeconomic scale, while the perception of more moderate risks (*Some risks*) decreases. Only class A respondents prefer the moderate options *Some risks* and *Few risks* over the extremes *Many risks* and *No risks*. In the case of class B, the proportion opting for *Many risks* exceeds the proportion opting for *Few risks*, a trend that becomes more pronounced all the way down to class E.

3.3.3 Consumption of information

Although less access to technological goods and services appears to play an important role as an explanatory variable in perceptions of the risks and benefits of S&T, it certainly is not the only explanation. In São Paulo State, as in the rest of Brazil, belonging to a low income group typically means having less access to cultural and informational goods.

An analysis of the responses regarding future benefits of S&T from those who say they do not read about science in newspapers or magazines (in a question with the options *Often, Sometimes* and *Never*) results in a distribution very similar to that observed for classes C and D/E. As can be seen from Figure 12.17, only 27.9% of non-readers about S&T choose *Many benefits* when asked if they expect S&T to offer benefits in the next 20 years (30.7% of respondents who choose this option are class C and 24.7% are D/E, as shown by Figure 12.14). It is also worth noting that 41% of non-readers opt for *Some benefits* (40.5% of respondents who choose this option are class C and 44.1% are D/E), 22.1% for *Few benefits* (21.9% of respondents who choose this option are class C and 21.5% are D/E), and 9% for *No benefits* (6.9% of

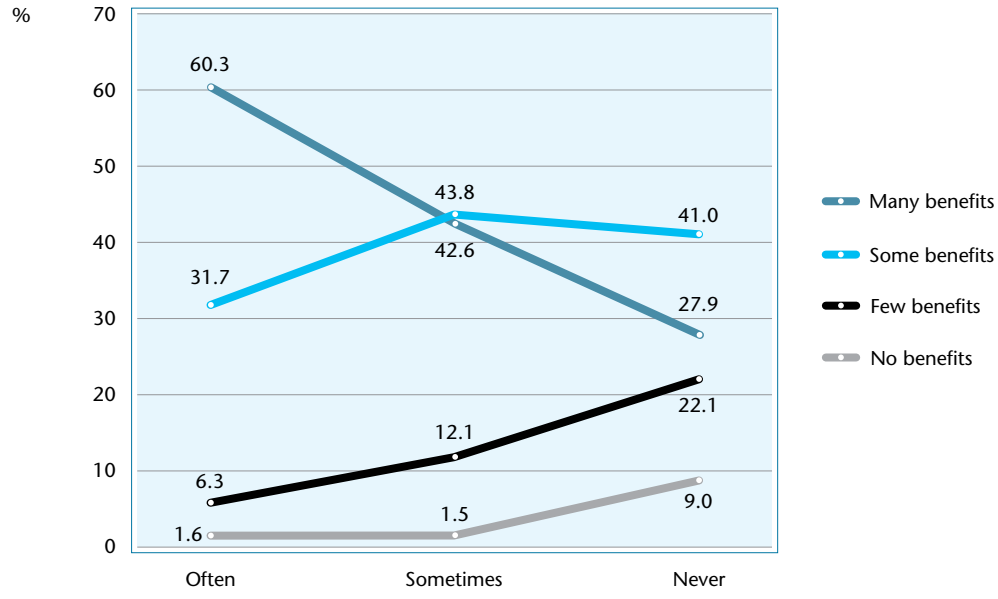
Figure 12.16
Breakdown of survey respondents by socioeconomic class and perception of future risks of S&T – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.18.

Figure 12.17
Breakdown of survey respondents by frequency of reading about science in newspapers and perception of future benefits of S&T – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.19.

respondents who choose this option are class C and 9.6% are D/E).

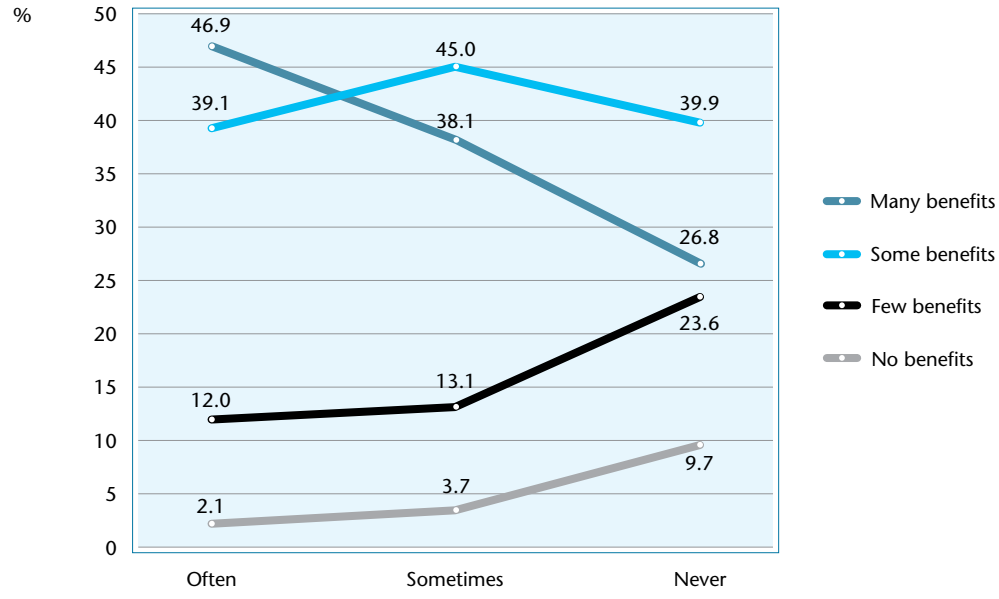
As for those who say they often read about science in newspapers or magazines, the proportion perceiving benefits is high: 60.3% opt for *Many benefits* and 31.7% for *Some benefits*. Among those who say they sometimes read about science, it is also fairly high: 42.6% of these respondents choose *Many benefits* and 43.8% opt for *Some benefits*.

If instead of focusing only on respondents who say they read the science section of newspapers or magazines the analysis is extended to all those who read print media (frequently or sometimes), the resulting distribution is as shown in Figures 12.18a and 12.18b (respectively plotting perceived benefits and risks against frequency of reading newspapers or magazines). The proportion perceiving benefits falls consistently in accordance with the frequency of reading; conversely, the proportion perceiving *No benefits* rises from 2.1% among those who say they read print media frequently to 9.7% among those who say they never do so.

Risk perceptions vary little according to the frequency of reading specifically about science (Figure 12.19). Among respondents who see *Many risks* in the next 20 years, 7.9% are frequent readers of science news, 22.9% are occasional readers, and 69.2% are non-readers. At the opposite extreme, among those who see *No risks*, 10% are frequent readers of science news, 26.7% are occasional readers, and 63.3% are non-readers. Thus reading science news apparently does not correlate with risk perceptions.

Again, it is difficult to say with precision whether these variations in opinions regarding risks and benefits are due to information consumption habits or to real living conditions. The most plausible conclusion is that they are due to a blend of these two factors, among others. However, as already noted there appear to be situations in which one of the factors predominates. The idea of benefits appears to be associated with both the habit of reading (i.e. with a higher proportion of frequent readers opting for *Many benefits*) and socioeconomic status (i.e. fewer opting for *Many benefits* lower down the socioeconomic scale). Conversely, the perception that science is associated with *Many risks* increases in inverse proportion to the habit of reading newspapers and magazines (which decreases in line with socioeconomic status) but is balanced for readers of science news and readers of newspapers or magazines who shun the science section. However, the idea of risk increases as socioeconomic status diminishes.

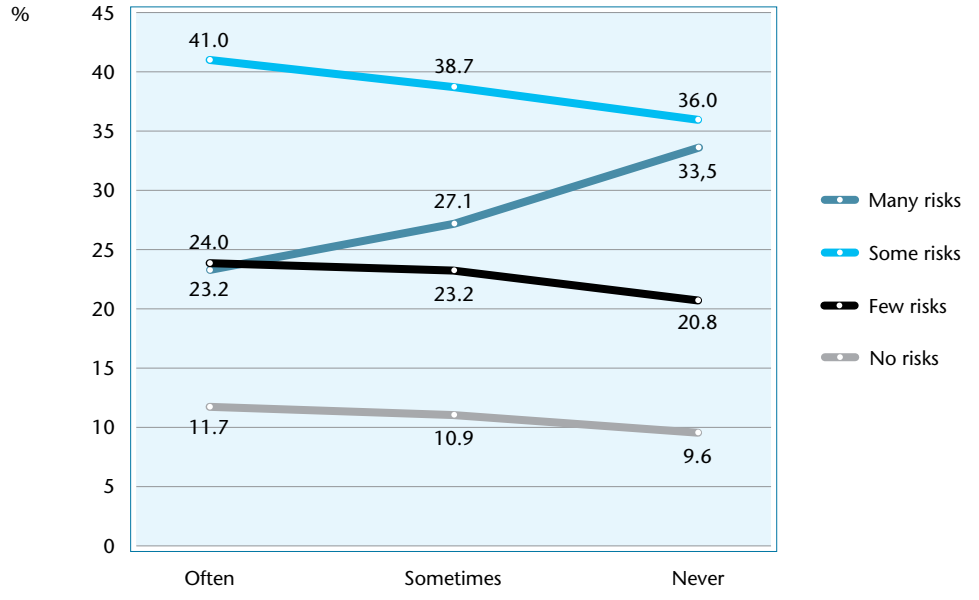
Figure 12.18a
Breakdown of survey respondents by frequency of reading newspapers or magazines and perception of future benefits of S&T – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.20a

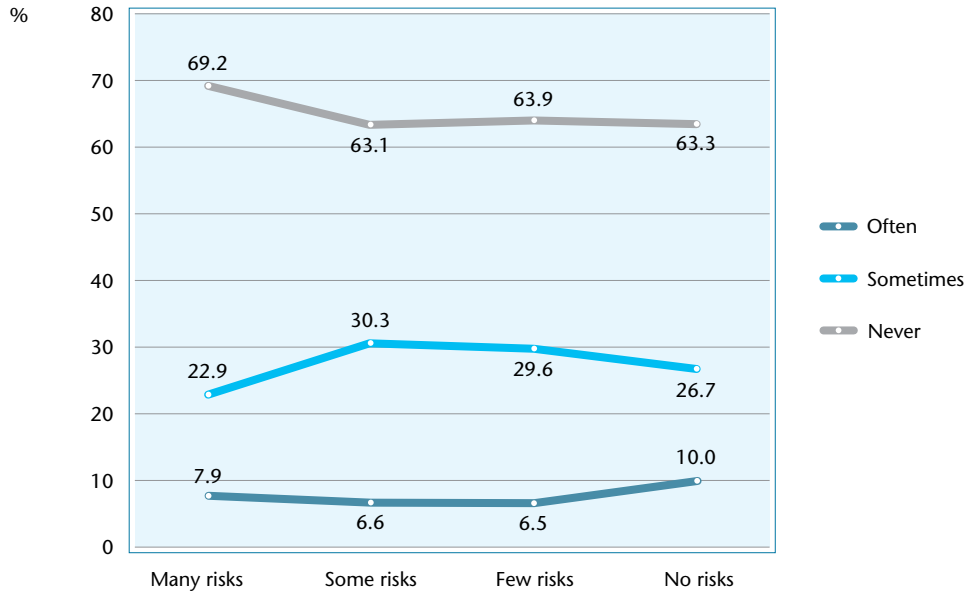
Figure 12.18b
Breakdown of survey respondents by frequency of reading newspapers or magazines and perception of future risks of S&T – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.20b.

Figure 12.19
Breakdown of survey respondents by perception of future risks of S&T and frequency of reading science news – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.21.

3.4 Individual and social appropriation of S&T

Social and individual appropriation of S&T, whereby scientific affairs become part of people's everyday lives, involves questions that are answered in different ways depending on the specific cultural context. For example, food security concerns are not the same in every country and the degree of interest in information on this subject, not just in the media and science journals but also on food labels, varies from place to place. It is also possible to observe the influence of interviewee gender on variations in behavior relating to individual appropriation of S&T.

The responses to some survey questions can be used to illustrate how ordinary people incorporate science into their daily lives. For example, Q21 runs as follows: "I'm going to read out descriptions of things that some people do on a routine basis. Please tell me in each case if this is something you do Often, Occasionally or Very rarely". The six types of behavior refer to: reading the patient information leaflet (PIL) before taking medicine, reading food labels or taking an interest in the nutritional value of food, checking the technical specifications or manuals of home appliances, taking medical advice before following a diet, attending to public health campaigns, and consulting a dictionary to find out more about unfamiliar words or terms.

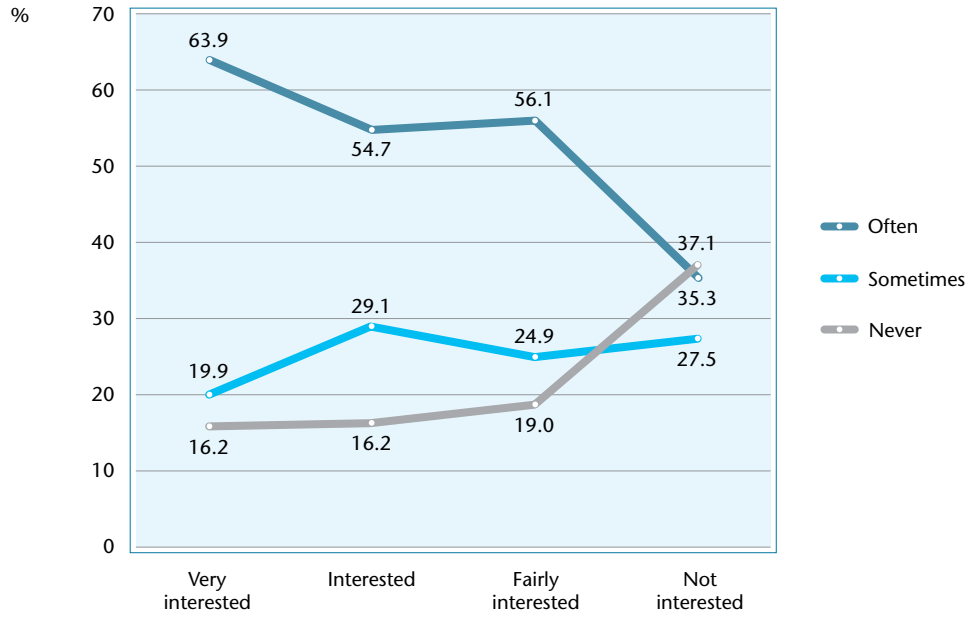
People who read patient information leaflets or food labels, for example, display a concern with the effects that products created on the basis of scientific and technological knowledge may have on their organisms or those of their families. Respondents who read manuals or look up words in dictionaries express both their interest in using appliances and words correctly and their knowledge of where to find information on such use.

The analysis was deepened by examining the correlations between responses on S&T appropriation and others on interest in and information about S&T, as well as educational attainment. The findings of this investigation are described below.

3.4.1 Appropriation x interest in S&T

The first hypothesis was that people who read PILs and food labels, for example, are also those with the most interest in S&T. To verify this, the correlation between responses to a question on routine behavior (Q21) and one of the questions on interest on S&T (Q8) was investigated (Figures 12.20a and 12.20b).

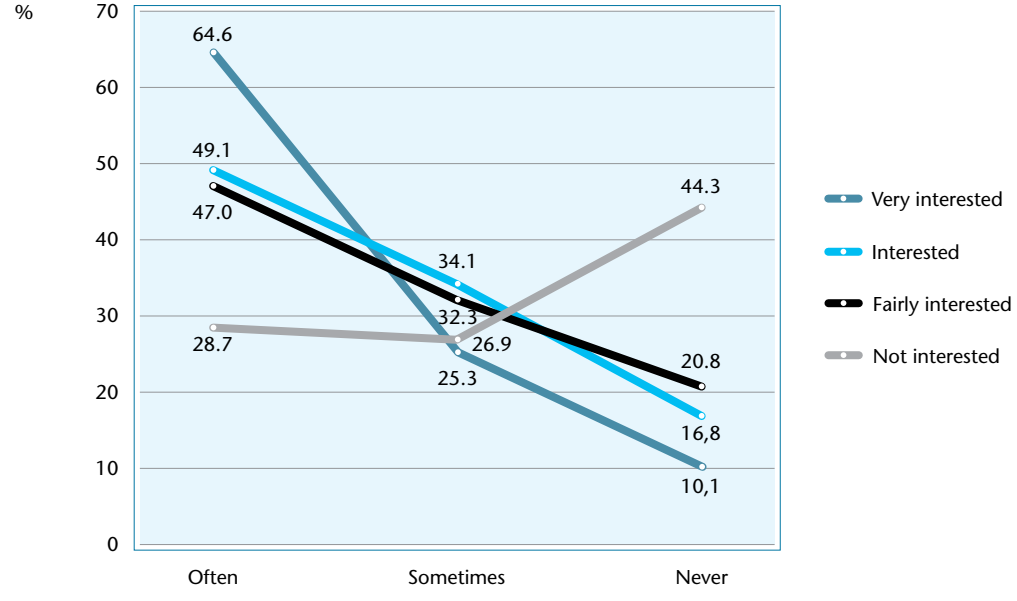
Figure 12.20a
Breakdown of survey respondents by level of interest in S&T and frequency of reading patient information leaflets – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.22a.

Figure 12.20b
Breakdown of survey respondents by frequency of reading food labels and level of interest in S&T – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.22b.

Among respondents who declare themselves *Very interested* in S&T, 63.9% say they often read PILs before taking medicine and 64.6% say they read food labels. Reading PILs and food labels becomes less routine (options *Yes, occasionally* and *No, very rarely*) as the level of declared interest in S&T diminishes. This example suggests that people who take more interest in S&T also take more interest in informing themselves about procedures that can affect their lives or those of their loved ones. This in turn may mean they consider themselves sufficiently well-informed about S&T to believe they will understand, even minimally, what they read in PILs, food labels and appliance manuals.

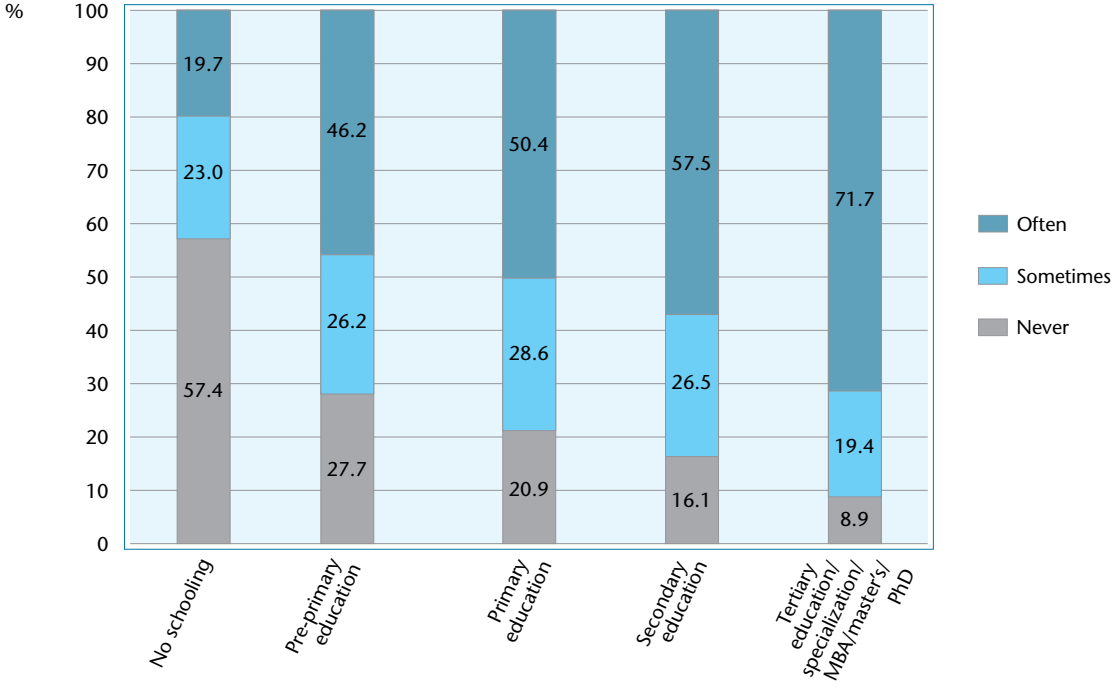
Figure 12.20a also shows that 35.3% of respondents who say they are *Not interested* in S&T read PILs, while 28.7% often read food labels and 44.3% do so only very rarely. Those who rarely read PILs and food labels also have less schooling (Figures 12.21a and 12.21b).

To see whether being well-informed about medicine or food correlates with educational attainment, responses to the question on routine types of behavior (Q21) were cross-tabulated with responses to the question on schooling (Q34). Among interviewees with a tertiary education (undergraduate, specialization, MBA, master's or PhD courses), 71.7% say they often read PILs and 69.1% say they often read food labels.

Finally, to see whether there was a significant gender difference in the level of interest in information involving S&T, responses to questions Q21 on routine types of behavior and Q33 on gender were cross-tabulated, showing that proportionally more women than men read PILs and food labels. Among interviewees who say they often read PILs, 60.3% are women and 39.7% are men. Among those who say they occasionally read PILs, 58.8% are men and 41.2% are women (Figure 12.22).

As for food labels, 60.1% of those who often read them are women and 39.9% are men, while 56.7% of those who read them occasionally are men and 43.3% are women. Among those who only rarely read food labels, 63.1% are men and 36,9% are women (Figure 12.23).

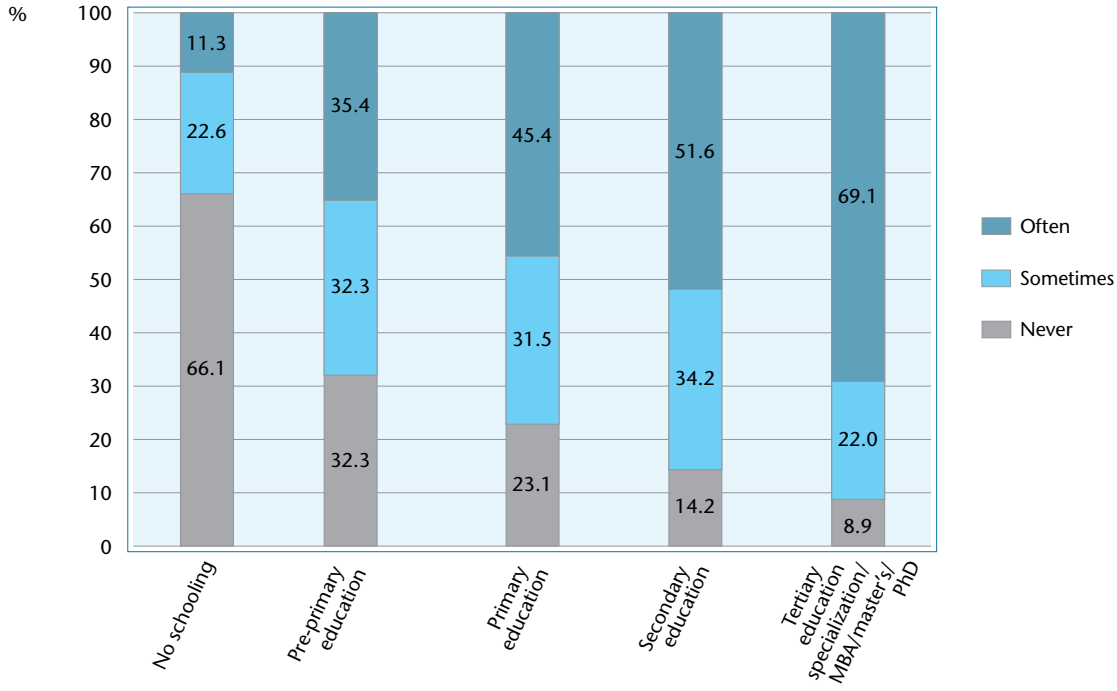
Figure 12.21a
Breakdown of survey respondents by educational attainment and frequency of reading patient information leaflets – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.23a.

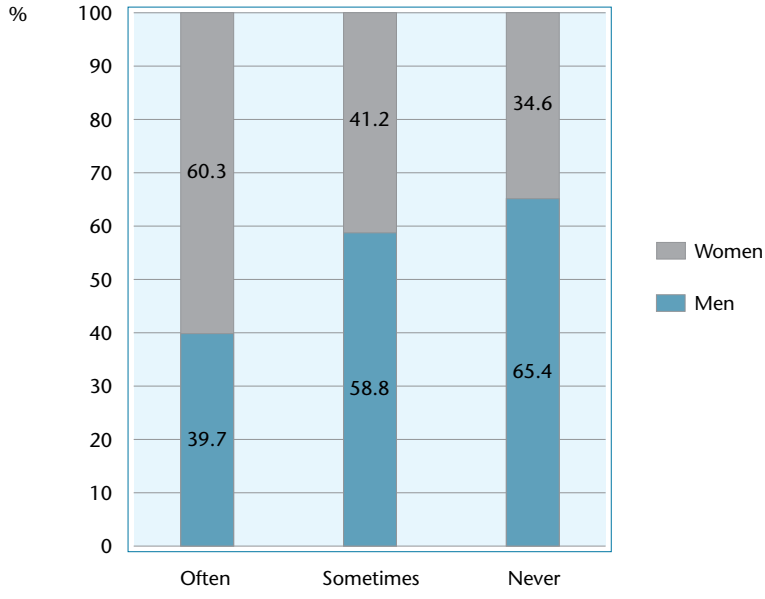
Figure 12.21b
Breakdown of survey respondents by educational attainment and frequency of reading food labels – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.23a.

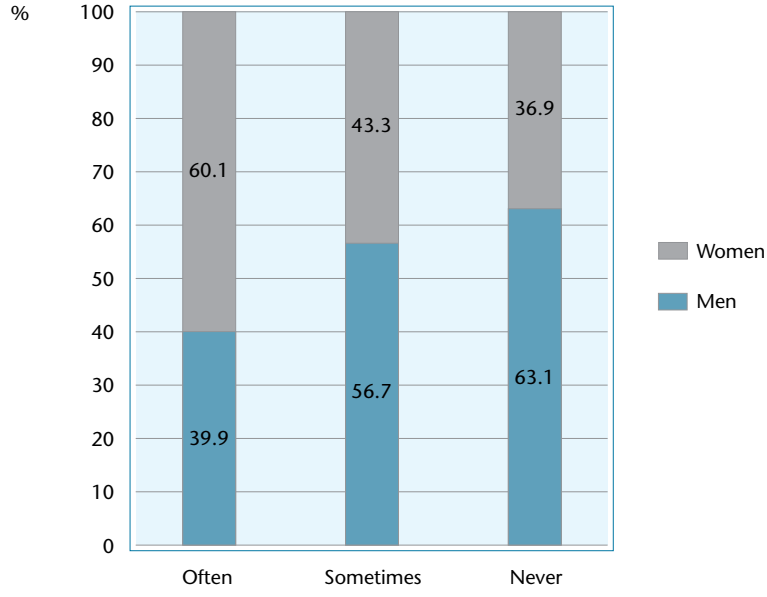
Figure 12.22
Breakdown of survey respondents by frequency of reading patient information leaflets and gender – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.24.

Figure 12.23
Breakdown of survey respondents by frequency of reading food labels and gender – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

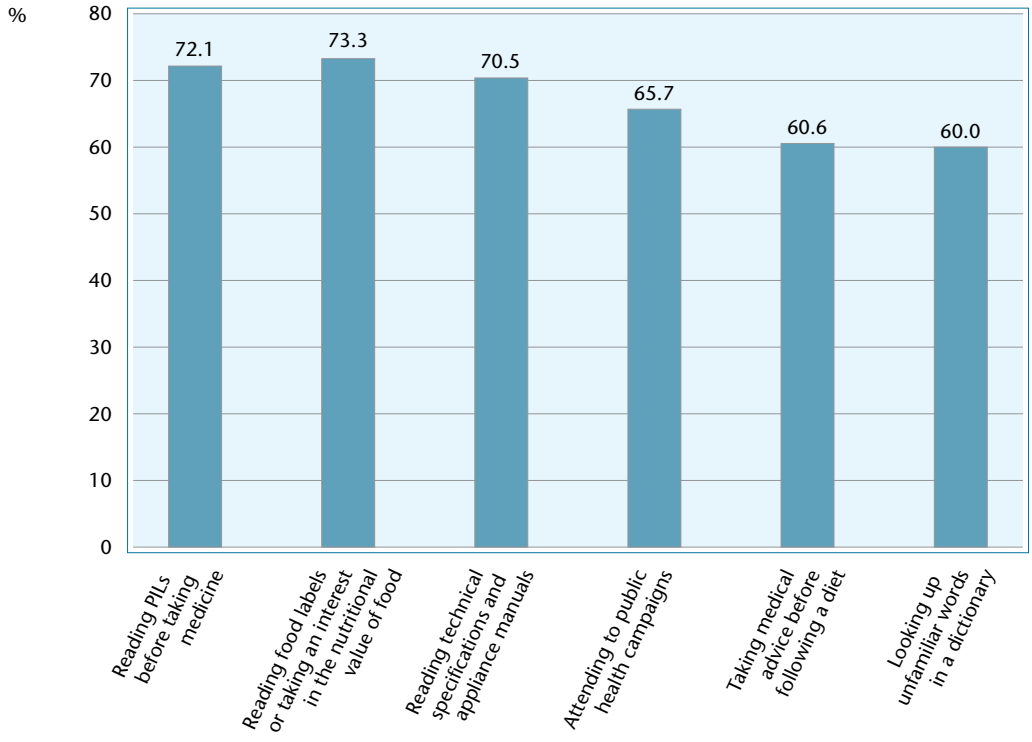
Note: See Detailed Table 12.25.

3.4.2 Appropriation x information about S&T

Responses to Q21, the question on types of routine behavior, were also cross-tabulated with responses to a question on the self-assessed level of information about S&T, Q10: "How well-informed do you consider yourself on each of these same subjects? Would you say you are *Highly informed*, *Informed*, *Moderately informed* or *Not informed*?"

Among respondents who consider themselves *Well informed* about S&T, 72.1% read PILs before taking medicine, 73.3% read food labels, 70.5% say they read technical specifications and appliance manuals, 65.7% attend to public health campaigns, 60.6% take medical advice before following a diet, and 60% look up unfamiliar words in the dictionary (Figure 12.24).

Figure 12.24
Breakdown of survey respondents who consider themselves well-informed about S&T by routine behavior – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.26.

3.4.3 Faith and science, faith in science

Although the survey was conducted in several other countries as well as Brazil and the responses to certain questions are compared in this discussion, some analyzes were performed with exclusivity, depending on the specific interest of each Ibero-American team. The common questionnaire applied in all countries that participated in the Ibero-American Project did not include Q37.1 and Q37.2, asking respondents whether they agreed with the statements "We value science too highly and disregard religious faith" and "Science and technology can solve any problem", but they were included in the São Paulo survey because they had been used in several previous rounds both by Eurobarometer and by NSF in its public understanding of science (PUS) surveys in the U.S. Some researchers consider these statements to be part of a "scientific ideology" indicator, with the first, at least in Europe, suggesting a degree of polarization or disjuncture between the valorization of science and faith, and the second tending to indicate a euphoric, uncritical "belief" in the power of science.

In Brazil the findings were very different, showing that admiration for science and religious faith are not necessarily mutually exclusive, and that conflicts between science and religion do not take the same forms as in Europe or the U.S. Moreover, "belief" in the capacity of science to solve any problem is characteristic of a small proportion of the population, although it is found among all socioeconomic groups. The findings also suggest that a low level of scientific literacy (as measured by Miller, 1998, for example)[26] is not a symptom of "fear" of science. Similarly, they

26. Based on a quiz-type survey asking interviewees to say whether certain statements are true or false, such as "Radioactive milk can be made safe by boiling it", "Antibiotics kill bacteria or viruses", and "The oxygen we breathe comes from plants".

suggest that the ability to think critically is not proportional to educational attainment. These findings and the type of respondent profile they identify are briefly discussed below.

3.4.4 Can science solve any problem?

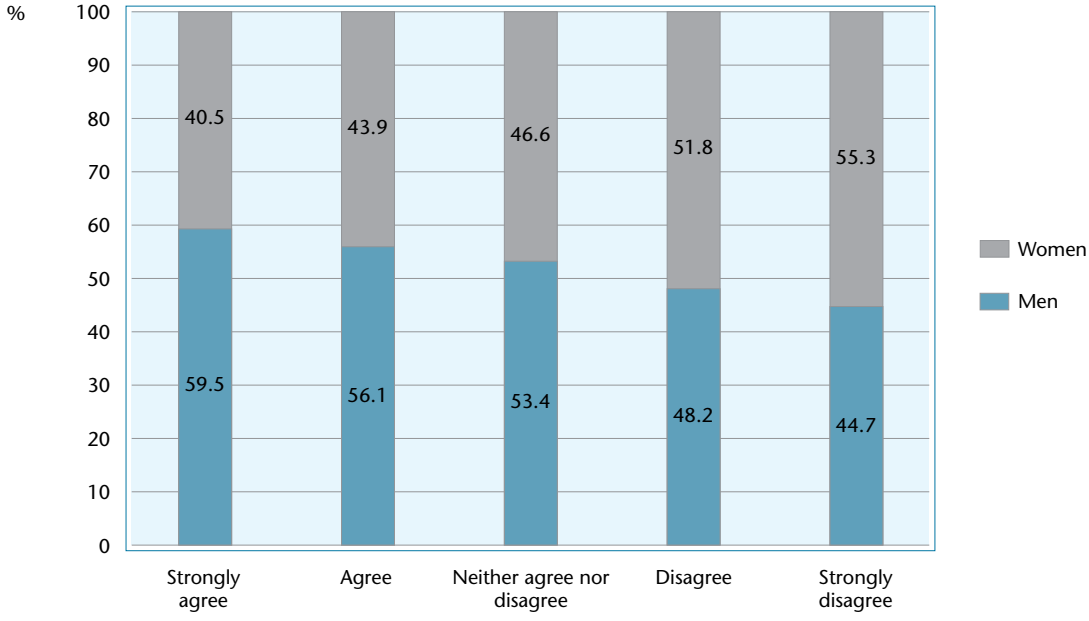
The first important point is that "believers in science" (those who agree with the statement that "science can solve any problem") are a minority of interviewees in the survey conducted in São Paulo State, accounting for 14.5% (Detailed Table 12.13, Q37) and do not coincide with the group of respondents who say they are interested in S&T, with those who say they consume a large amount of information about S&T, or with information-oriented respondents who routinely read patient information leaflets and food labels. The findings show that declaring an interest in science or a high level of information consumption and agreeing with the statement that science can solve any problem are not necessarily associated attitudes. Those who say they consume little or no scientific information (with ICIC scores between 0 and 0.5) include 37.8% of "strong believers" and 59.2%[27] of "believers" in science (Detailed Table 12.27). For 32.4% of the strong believers in science and 23.5%[28] of the believers, S&T arouse little or no interest (Detailed Table 12.28 – see the Methodological Annex for more about ICIC).

Analyzed in this way, the findings suggest points of contact with the quali-quantitative research carried out by the U.K. Office of Science & Technology (OST, 2000), which identified six attitudinal groups, including *"confident believers",* who are not outstandingly knowledgeable about or interested in S&T but express a higher-than-average belief in science and in the success and power *S*&T can offer. In the survey analyzed here, among those declaring a high level of S&T-related information consumption, 8.5% of the group with high ICIC scores can be considered "confident believers" in that they *Strongly agree* with the statement that science can solve any problem, while 19.5% can be considered "believers" in that they *Agree*. Moreover, only 2.8% of those with high ICIC scores are *strong believers* in science and 11.9% are *believers* (Detailed Table 12.29). It can be concluded that the subset of those who agree that science can solve any problem represent a part of the population comprising both people with a scant cultural background and a minority with high levels of educational attainment.

Belief in science predominates moderately among young respondents: 29.7% of those who *Strongly agree* with the statement that science can solve any problem are aged *16-24,* while only 16.2% are 55 or over. Belief in science is also higher among socioeconomic classes B, C and D/E, and among respondents at the high end of the educational attainment scale: 13.5% of those who *Strongly agree* that science can solve any problem have at least a university degree, whereas those with no formal schooling account for only 2.7% of respondents choosing this option.[29] The breakdown by gender points to a more significant difference (Figure 12.25): 59.5% of those who *Strongly agree* that science can solve any problem are men, while 40.5% are women.

27. The value 37.8% is obtained by adding 21.6% to 16.2% (zero ICIC + low ICIC) and 59.2% by adding 16.2% and 43.0% (zero ICIC + low ICIC).
28. The value 32.4% is obtained by adding 29.7% to 2.7% (*Fairly interested* + *Not interested*) and 23.5% by adding 18.6% to 4.9% (*Fairly interested* + *Not interested*).
29. See Detailed Tables 12.30, 12.31 and 12.32.

Figure 12.25
Breakdown of survey respondents by response to the statement that S&T can solve any problem and gender – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.33.

3.4.5 Faith and science: two valued spheres

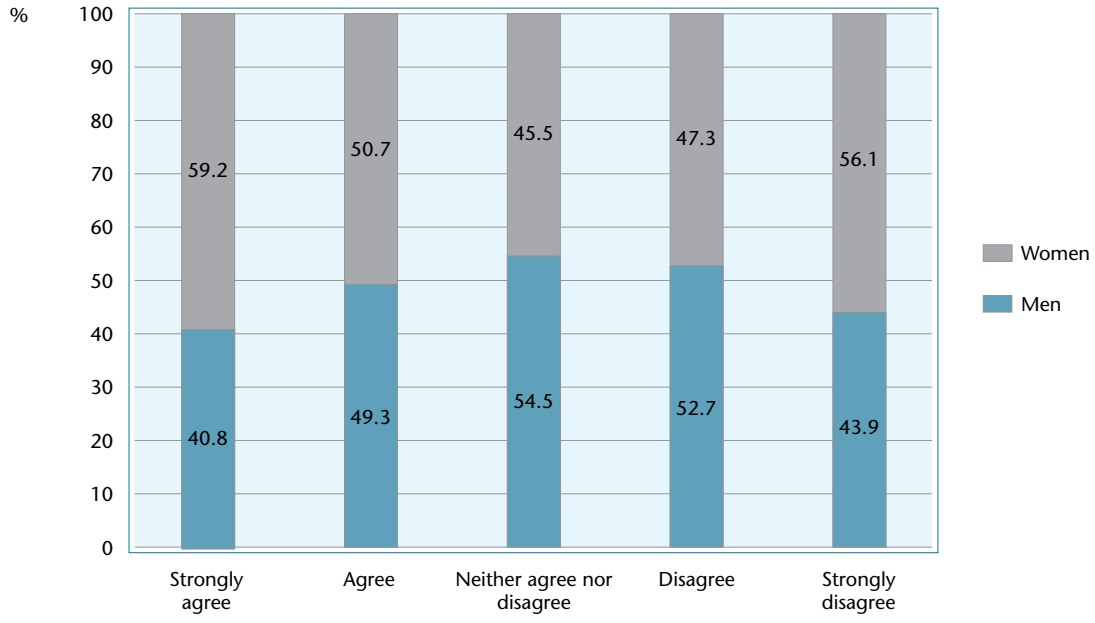
An analysis of the responses to the statement about the value of science and faith (Q37.2: "We value science too highly and religious faith too little") shows that women agree slightly more than men, as can be seen from Figure 12.26. It is also worth noting that 59.2% of respondents who *Agree* and *Strongly agree* belong to classes D/E, with only 14.4% belonging to class A.[30]

On the other hand, agreeing with this statement in São Paulo State, in contrast with Europe, does not at all entail being less interested or believing less in science. For example, cross-tabulating the responses to this question (Q37.1) with ICIC scores shows that among respondents who declare high consumption of scientific information (ICIC>1, i.e. medium-low and above) a far from negligible proportion strongly disagree with the statement that we value science too highly and religious faith too little, while a similar percentage strongly agree, suggesting that interest in and consumption of information about S&T do not necessarily entail a "preference" or a polarization between valuing science and valuing spirituality (Figure 12.27).

Analogously, cross-tabulating the declared level of admiration for scientists (where 0 = *No admiration* and 3 = *A great deal of admiration*) with opinions on the statement that science is overvalued and religious faith undervalued shows that among those who declare *No admiration* for scientists there is a large proportion of respondents who disagree with the statement (33.1% in aggregate, as the sum of *Disagree* and *Strongly disagree*) whereas a majority of those who say they greatly admire scientists agree with it (51.9% = 12.8% *Strongly agree* + 39.1% *Agree*). Statistical analysis evidences a lack of significant correlation between agreeing with the statement that science is overvalued and religious faith undervalued and admiring scientists as a profession. Thus a combination of views that is felt to be a polarization in Europe is seen differently and in a more nuanced fashion in Brazil (Figure 12.28).

30. See Detailed Table 12.35.

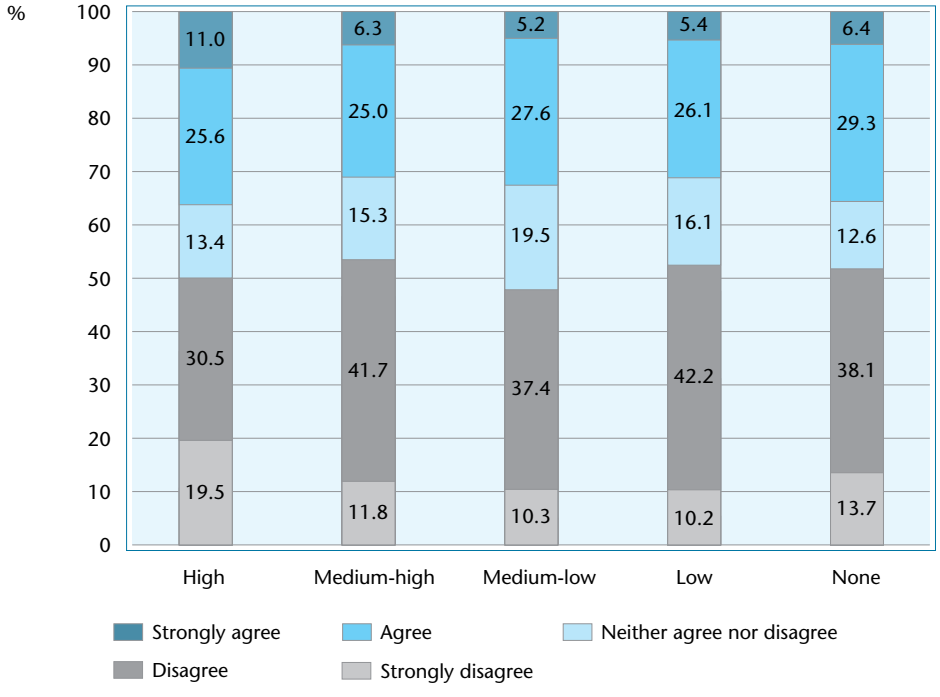
Figure 12.26
Breakdown of survey respondents by response to the statement that science is overvalued and religious faith undervalued and gender – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.34.

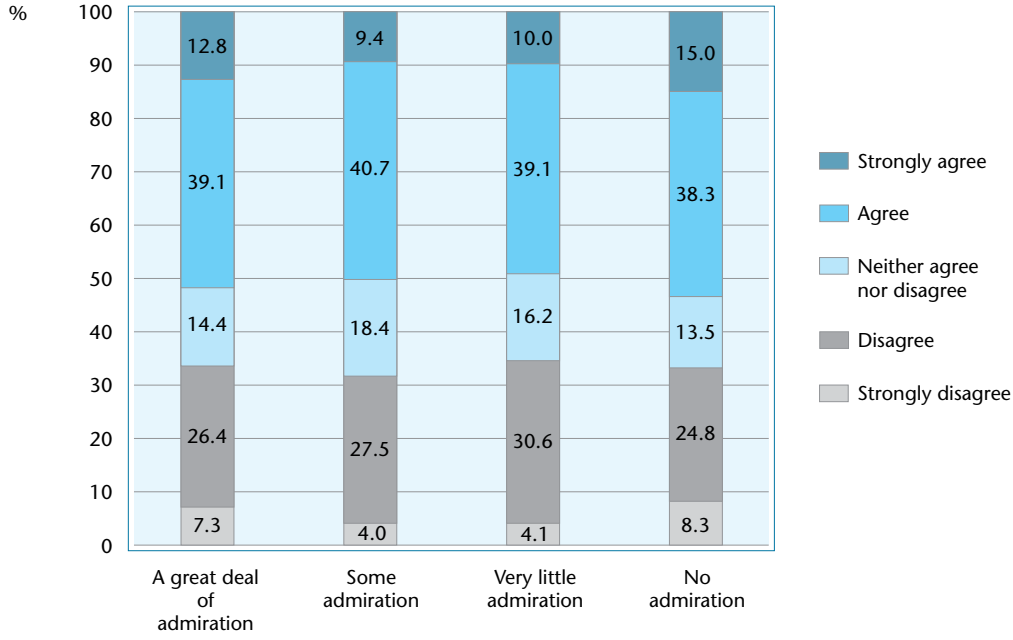
Figure 12.27
Breakdown of survey respondents by Scientific Information Consumption Indicator (ICIC) score and response to the statement that science is overvalued and religious faith undervalued – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.36

Figure 12.28
Breakdown of survey respondents by response to the statement that science is overvalued and religious faith undervalued and admiration for scientists – São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State.

Note: See Detailed Table 12.37.

3.5 Comparisons within the Ibero-American Project and other international comparisons

The data collected by the survey were also analyzed on the basis of discussions with other Ibero-American teams. In 2008, following completion of the fieldwork for the survey in all participating countries, some of the specialists, including part of the team from Labjor (Unicamp), met in Madrid during the Conference on Citizenship & Public Policy for S&T held by FECYT and OEI, and then in Campinas (São Paulo) for an international workshop on "Science culture: the challenge of indicators" hosted by Labjor (Unicamp) and also attended by scholars from outside the Ibero-American region such as Martin Bauer from the London School of Economics (LSE).

This survey conducted for FAPESP is associated with an international project whose goals include the construction of an instrument capable of reflecting the specificities of Brazil and other Latin American countries while incorporating developments and innovations in the field of social studies of S&T in the region. Another goal is to enable partial integration of the data collected with important databases in the U.S. and Europe, and to construct common indicators for the purposes of comparison and benchmarking as valuable inputs for policymaking.

International comparisons have indeed produced highly interesting findings. A preliminary exploration of these comparisons, which have proved exceptionally fertile, is set out below (see also Lopez Cerezo & Polino, 2008).

An initial set of findings that are impressive for their relevance relates to access to scientific information. The level of interest in S&T declared by respondents in both São Paulo State and throughout Brazil lacks nothing when compared to those observed in many European countries.[31] However, when respondents are asked

31. This question does not permit rigorous comparison of the data of interest because the scale used in the Ibero-American survey is different from that used by MCT in Brazil and Eurobarometer (4 points versus 3 points). However, both contain the element *No interest*, so that the proportion located at this end of the scale can be estimated. Respondents declaring themselves *Not interested* in S&T in São Paulo account for 9% of the sample, compared with 20% in the E.U. and 41% as an average for Brazil (European Commission, Eurobarometer, 2005; MCT, 2007).

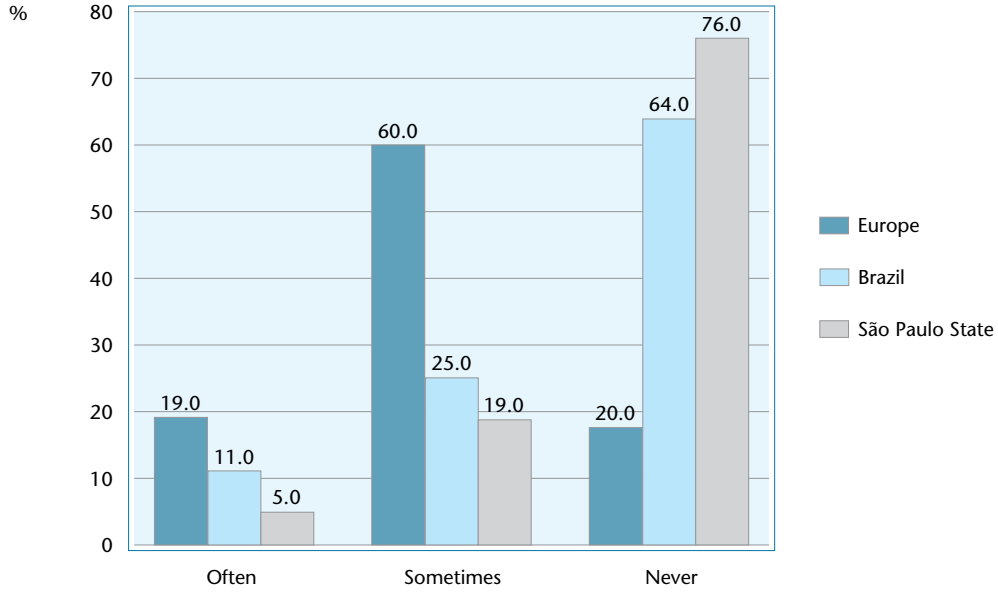
whether they regularly attend to scientific information in the media or have visited institutions and spaces where knowledge is available (museums, libraries, botanic gardens, zoos etc.) in the past year, the findings leave no room for doubt: 79% of respondents in the E.U. say they occasionally or frequently read science news in magazines and newspapers or online, compared with only 24% in São Paulo State (according to a statistical projection that can be made on the basis of the survey described here). This is notably less than the Brazilian average, which is 36% (Figure 12.29).

While declared access to zoos, parks or botanic gardens is no less frequent in Brazil than in the E.U. – and slightly more so in São Paulo, thanks to the diversity and quantity of supply in the state – the frequency with which other key spaces of knowledge diffusion and democratization are used is far lower: 24.1% of respondents in São Paulo say they have visited a public library in the past year, compared with 34% of Europeans. The proportion of E.U. respondents who go to art museums is about twice as high as that observed by the survey in Brazil and São Paulo. As for those who visit museums or centers of S&T, the frequencies for Europe are about three times as high as those for São Paulo, even though the state has a large number of centers and museums and in fact more than the average for Brazil (Figure 12.30).

This difference reflects another, which is the high level of social inequality in access to this type of service. An analysis of responses to the same question using the "Brazil Economic Classification Criterion" (CCEB, see Methodological Annex) shows that comparatively affluent Brazilians enjoy levels of access comparable to the European average, while those of lower socioeconomic status have very little access. In class A1, 20% of respondents say they have been to a museum or S&T center in the past 12 months, compared with only 4% in class C and 2% in class D (MCT, 2007).

More even than in S&T consumption, access and social appropriation, the gap between Brazil and Europe is conspicuous in areas relating to engagement and social participation. While more than a quarter of E.U. respondents say they participate at least occasionally in some kind of social activity relating to science, technology or the environment (such as demonstrations or protests, letters to newspapers, attending debating forums, signing petitions, voting in referendums etc.), the proportion in São Paulo is only 4.4% (Figure 12.31).

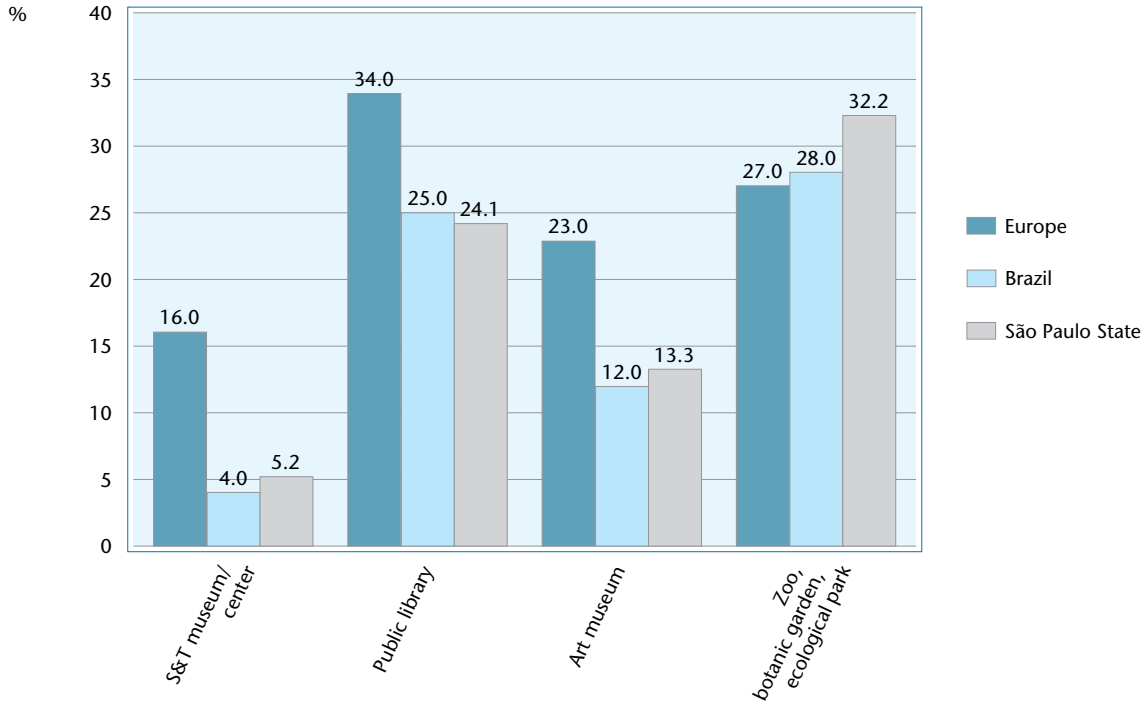
Figure 12.29
Comparison of frequency of information consumption in the media: "Do you read science news in newspapers and magazines or on the web?" – Europe, Brazil & São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; MCT (2007); Eurobarometer (European Commission, 2005).

Note: See Detailed Table 12.38.

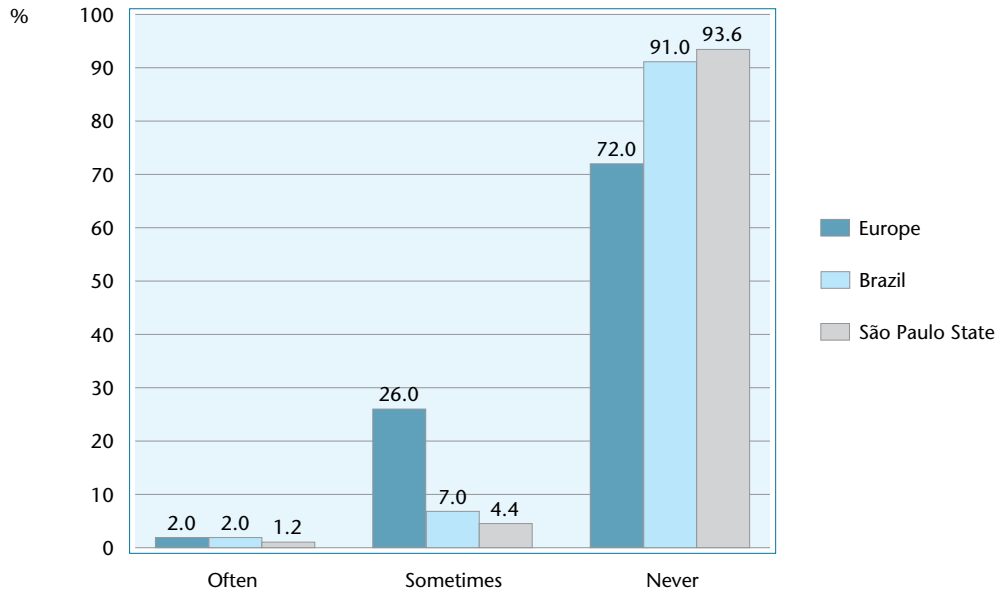
Figure 12.30
Comparison of frequency of respondents who visit public S&T venues – Europe, Brazil & São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; MCT (2007); Eurobarometer (European Commission, 2005).

Note: See Detailed Table 12.39.

Figure 12.31
Frequency of participation in activities relating to S&T and environment (demonstrations, forums etc.) – Europe, Brazil & São Paulo State, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; MCT (2007); Eurobarometer (European Commission, 2005).

Note: See Detailed Table 12.40.

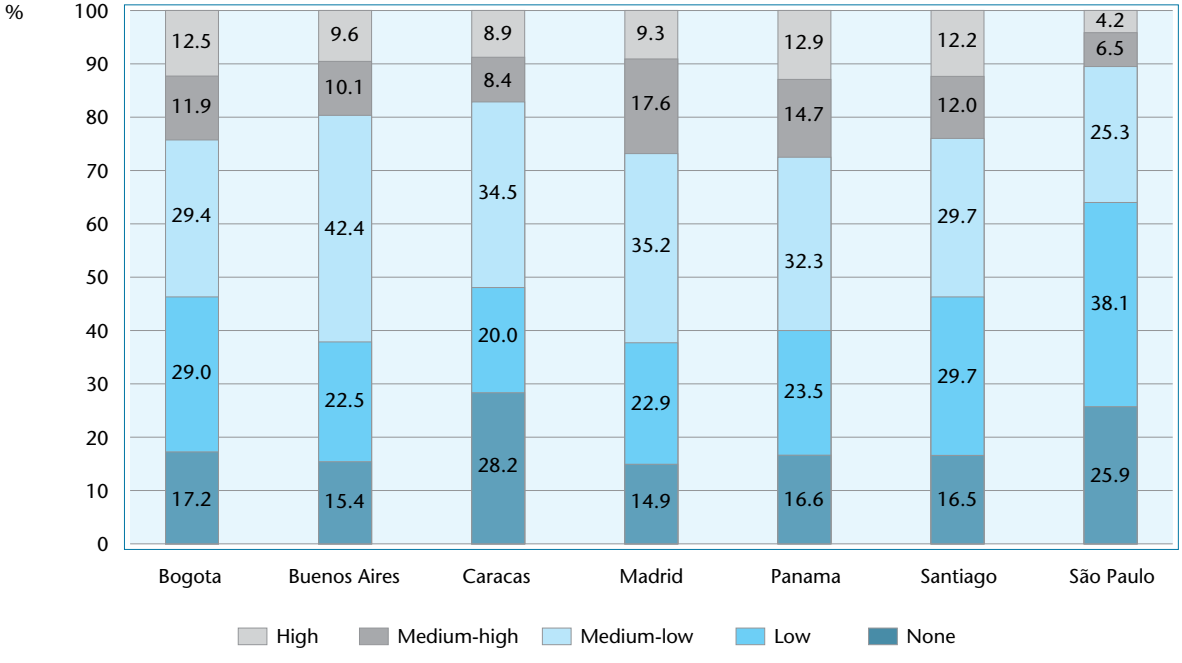
A comparison with other Ibero-American cities covered by the survey also evidences conspicuous differences. Respondents in the city of São Paulo, capital of a state that is home to some of the most important research institutions in Ibero-America, say they are interested in S&T yet have the lowest ICIC scores in the entire region. Indeed, São Paulo is the only city covered by the survey in which as large a proportion as 64% declare zero or very little consumption of S&T information. It is also the only city in which interviewees with high ICIC scores account for as little as 4.2% of the sample (Figure 12.32).

The average ICIC for the city of São Paulo is 0.63. The average ICIC for Caracas is 0.75. The averages for all the other cities surveyed are more than 0.87 (Figure 12.33).

In line with low access to information and low consumption of information declared by respondents in São Paulo, their knowledge of scientific institutions is also among the lowest in the Ibero-American region. More than 8 out of 10 respondents in São Paulo are unable to name any scientific research institutions. For the sake of comparison, in both Madrid and Panama the proportion able to name a research institution is twice as high (29.9% and 29% respectively), while in Buenos Aires over half declare knowledge of at least one research institution (Figure 12.34).

Attitudes, values and admiration for scientists also vary from country to country. The selected examples discussed here are part of an in-depth analysis in the context of this collaborative international project. The city of São Paulo stands out, among others, for the responses to questions dealing with admiration for journalists (extremely high in São Paulo and Bogota, and fairly low in Santiago, Madrid and Buenos Aires) and for teachers (distinctly higher than all other cities), as well as lack of admiration for politicians (Figures 12.35a, 12.35b and 12.35c).

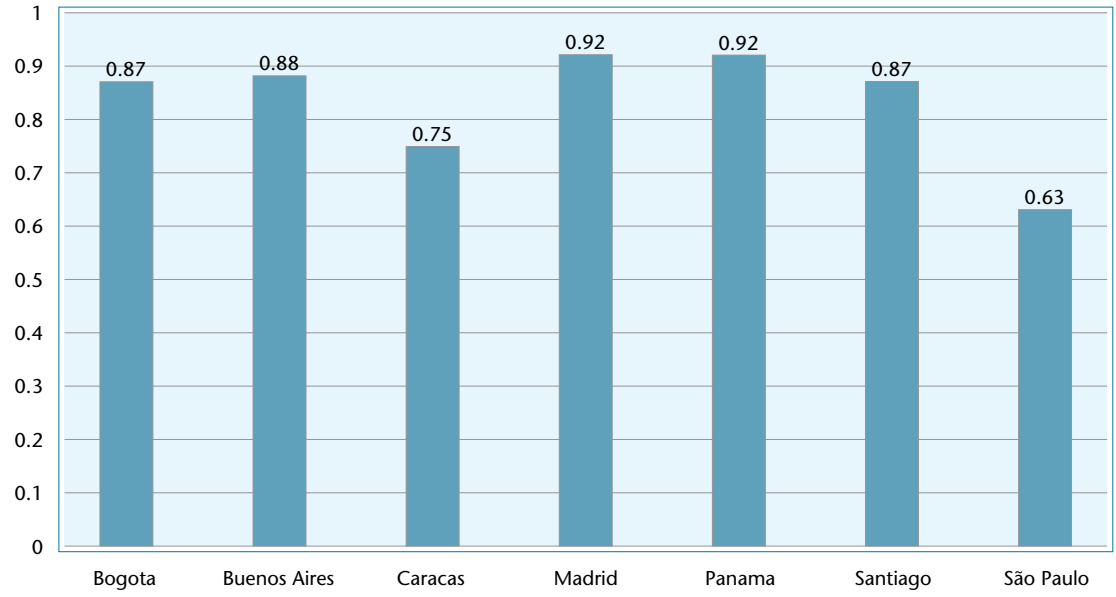
Figure 12.32
Breakdown of Scientific Information Consumption Indicator (ICIC) scores in cities surveyed – São Paulo & other cities surveyed by Ibero-American Project, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; López, Cerezo & Polino (2008).

Note: See Detailed Table 12.41.

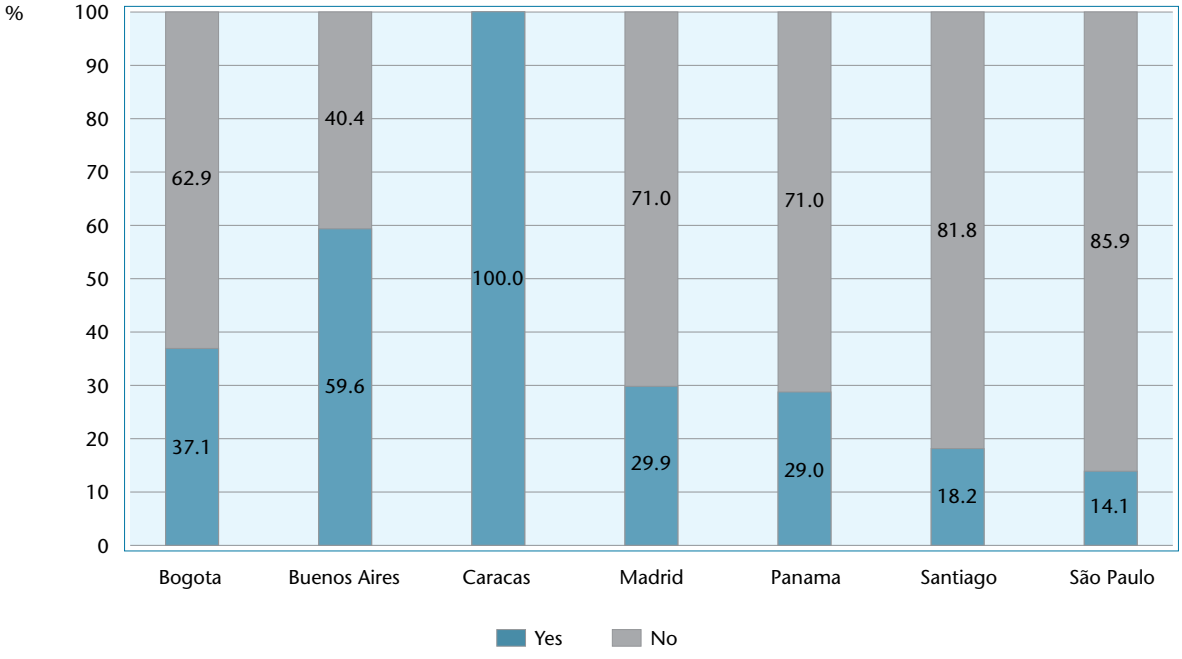
Figure 12.33
Average Scientific Information Consumption Indicator (ICIC) scores in cities surveyed – São Paulo & other cities surveyed by Ibero-American Project, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; López, Cerezo & Polino (2008).

Note: See Detailed Table 12.42.

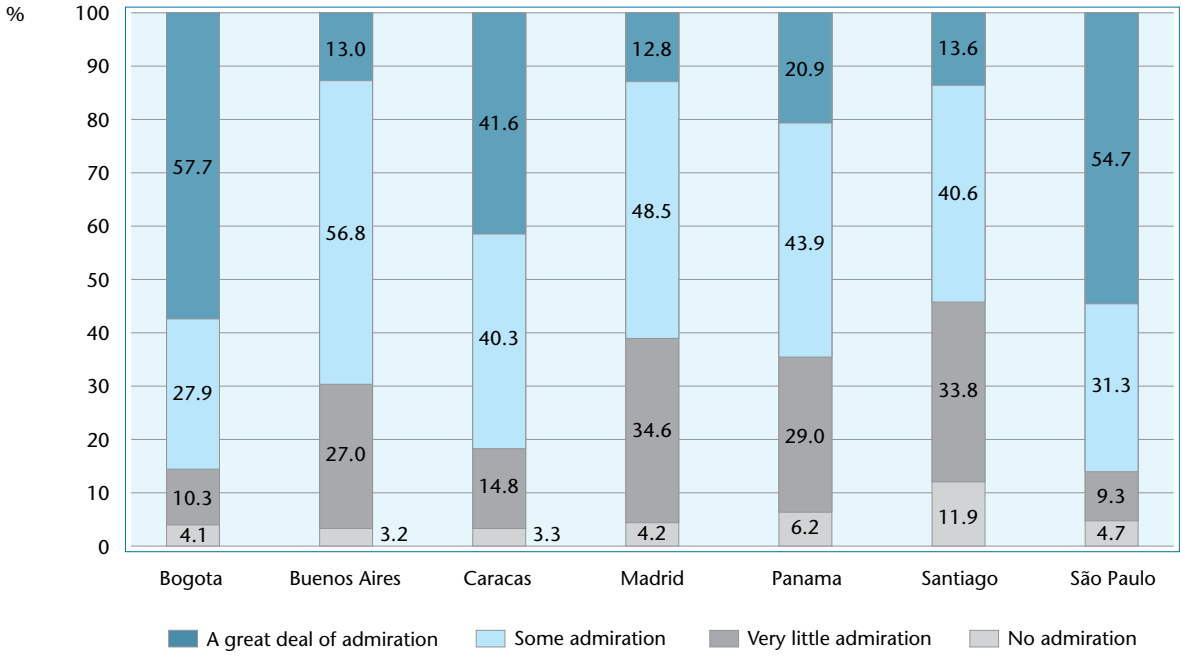
Figure 12.34
Breakdown of survey respondents by city surveyed and knowledge of scientific institutions – São Paulo & other cities surveyed by Ibero-American Project, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; López, Cerezo & Polino (2008).

Note: See Detailed Table 12.43.

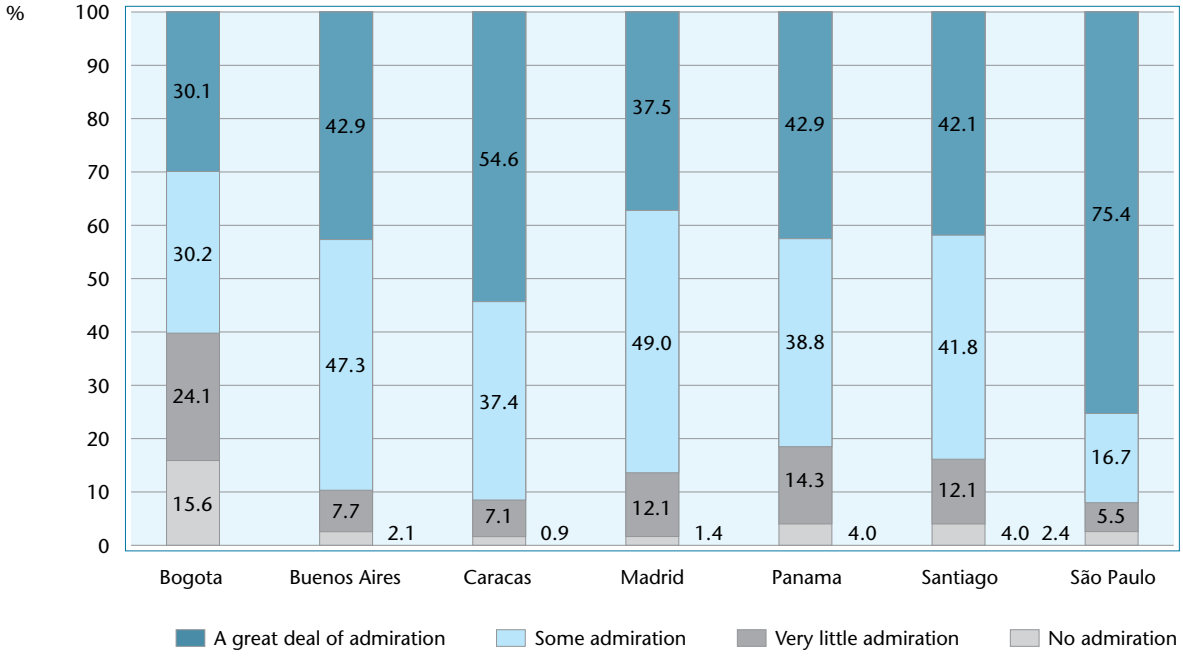
Figure 12.35a
Breakdown of survey respondents by city surveyed and admiration for journalists – São Paulo & other cities surveyed by Ibero-American Project, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; López, Cerezo & Polino (2008).

Note: See Detailed Table 12.44a

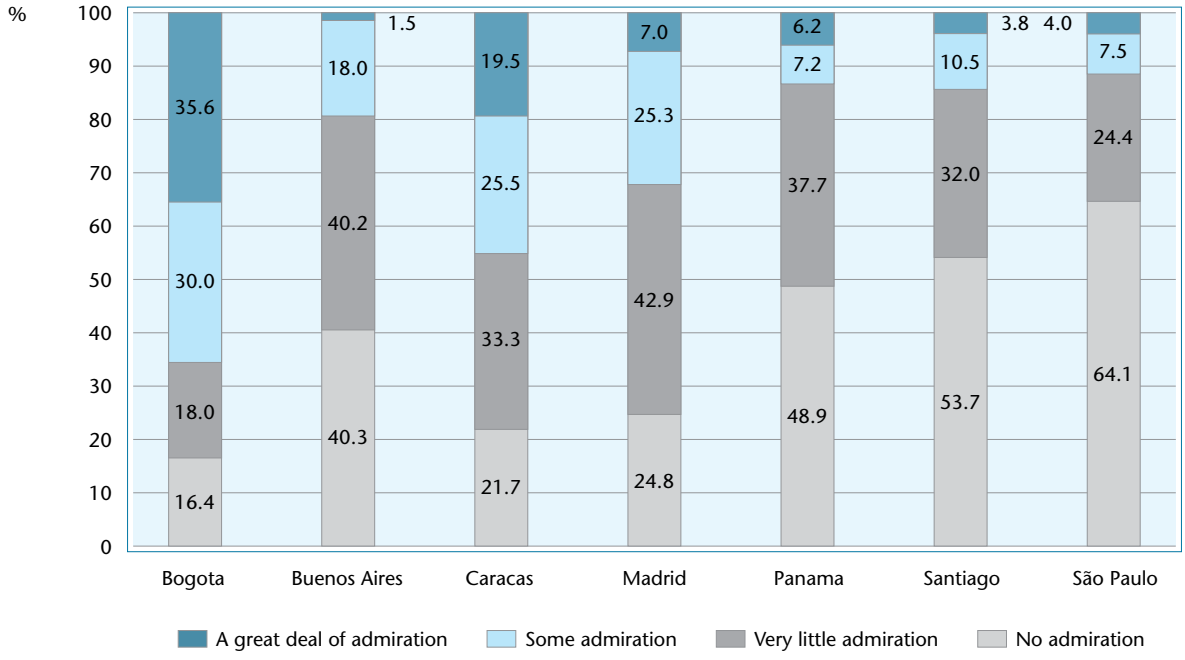
Figure 12.35b
Breakdown of survey respondents by city surveyed and admiration for teachers – São Paulo & other cities surveyed by Ibero-American Project, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; López, Cerezo & Polino (2008).

Note: See Detailed Table 12.44c.

Figure 12.35c
Breakdown of survey respondents by city surveyed and admiration for politicians – São Paulo & other cities surveyed by Ibero-American Project, 2007



Source: Labjor/Unicamp, survey on public perceptions of S&T conducted in São Paulo State; López, Cerezo & Polino (2008).

Note: See Detailed Table 12.44c.

4. Final considerations

This chapter is a theoretical and methodological contribution to the study of public understanding of S&T and also to the understanding of how citizens participate in S&T-related activities in São Paulo, Brazil and other Ibero-American countries. From the methodological standpoint, it is part of the Project to Develop an Ibero-American Standard for Indicators of Social Perception, Scientific Culture & Civic Participation in S&T, a groundbreaking initiative to construct a standard international methodology for research into the public understanding of science. This is the first major effort ever undertaken by so many countries to create a common instrument for measuring this important dimension of S&T indicators. It is also innovates by applying the same questionnaire across the entire region, with a single rigorous and advanced methodology resulting from three years of data analysis and theoretical discussion.

The quantitative analysis produced a wealth of interesting findings, as well as some surprises that will deserve further research. First, it is highly significant that social inequality is the key driver of the radical differences among the responses of the different groups at practically all levels of the analysis. While on one hand average attitudes to S&T and to the role and prestige of scientists in society are substantially positive for all socioeconomic classes, albeit with variations in intensity, and while the interest declared by respondents in São Paulo State in S&T-related subjects is not low (in the case of respondents in the state capital, indeed, it is comparable to the level observed in many European countries), on the other hand this interest is clearly associated with concrete access to information, habits of scientific information consumption and real knowledge of research institutions in the region concerned.

Nevertheless, a comparison with international findings shows real knowledge of S&T and consumption of information about S&T among respondents in the city of São Paulo to be among the lowest for all Ibero-American cities surveyed. A breakdown of this variable by socioeconomic class or educational attainment shows much greater inequality of access to in-

formation than in other countries to be the factor that most contributes to this gap.

The use of a probabilistic sample in proportion to the population shows no pronounced differences between respondents in the capital and interior of São Paulo State, and generally speaking there are no statistically significant correlations between the presence of important S&T research resources in certain areas and the behaviors and attitudes observed. Although the size of the sample is not sufficient to permit reliable comparisons between one area of the state and another, but only between groups of areas or cities, all the evidence points to a low correlation between the presence of S&T infrastructure and the average attitude of the sampled population, possibly owing to the fact made clear by the survey that a large proportion do not have access to spaces of S&T democratization, even in areas with a high density of museums, universities and S&T institutions.[32]

While geographical differences did not significantly affect the survey findings, the same cannot be said for variations by socioeconomic class. For example, the survey found that whereas respondents at higher levels of the socioeconomic scale tend to stress the future benefits of S&T, those at lower levels appear more sceptical in this regard, very probably because they believe the enjoyment of such benefits requires economic power they do not have. At the same time, the idea of grave risks is more present in the lower classes, possibly because environmental disasters, often attributed to human action, are historically more frequent in poorer locations. Furthermore, the lower classes face more difficulties in attempting to overcome the harmful effects of certain applications of technology, e.g. by vacating contaminated areas.

Considering that inequality is a well-known feature of Brazilian society, and that São Paulo is the richest city in the country, it is noteworthy that interest in S&T and consumption of information about S&T appear to be lower precisely in cities with relatively high per capita GDP, outstanding research centers and many institutions dedicated to the diffusion of scientific knowledge, such as São Paulo and Madrid (Spain). The level of interest and information is far higher in cities such as Caracas (Venezuela) and Bogota (Colombia), as noted above.

This question deserves further investigation and discussion, since not only did the survey not produce the expected findings but it showed that there is no direct correlation between S&T infrastructure and interest/information in the locations concerned.

Some items of the questionnaire can be used for the construction of indicators. This is in progress, and the series of indicators now being tested and validated – the Scientific Information Consumption Indicator (ICIC), described above, is a good example – are an indispensable tool for the utilization of this type of research to formulate concrete inputs for policymaking in Ibero-America. Future publications will show the results of this effort.

In sum, perceptions of S&T among the inhabitants of São Paulo State are substantially positive, optimistic, and characterised by support for S&T. However, there are profound differences in access to information and habits of information consumption, all of which have significant effects on attitudes, values and behavior. These consequences deserve in-depth analysis, among other things in order to serve as a foundation for the formulation of appropriate public policy. The establishment of more science museums, libraries and zoos would appear an ineffectual investment if that part of the population with the least information also has the most difficulty in accessing such facilities.

It is also worth stressing the necessity, evidenced by the above analysis, of conducting a survey that focuses specifically on the young. These individuals' understanding of S&T may be a factor that determines whether they opt for an academic or scientific career, for example. In this context a new study has been proposed by RICYT and taken on board by Labjor (Unicamp), including a specific survey of secondary school students at public and private schools, with a questionnaire suited to this segment. The aim is to analyze school students' perceptions of a career in scientific research, which is often mystified. The project is under development and in the final stages of preparation.

Alongside the ongoing project to survey perceptions of science among young people, further questions and hence new projects may and very likely will emerge on the basis of the findings from the survey discussed in this chapter. After all, continuity is the central objective of research performed to offer inputs for public policymaking. And inquisitiveness, the restless pursuit of knowledge, is the prime mover of scientific research.

32. This is also evidenced by the survey discussed in the previous edition, where respondents in Campinas do not display significantly different perceptions and general attitudes to S&T from those of respondents in Ribeirão Preto and São Paulo.

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