

Public perception of science: a preliminary analysis and interpretation of the questionnaire data applied in the city of Campinas, Brazil

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Presentation

This article will discuss and comment some of the results obtained by the application of the questionnaire “Public perception of Science and Technology”. The questionnaire is a translated and adapted Portuguese version from the original in Spanish produced by the group Centro de Estudios sobre Ciencia, Desarrollo y

Educación Superior of Buenos Aires, Argentina.

a) the sample

Applied in the city of Campinas, the poll was intended to show some ideas that a certain social class resident in the so-called noble neighborhoods of the city has on science and technology. The reason for choosing this outline is that it represents the population layer that has greater access to scientific information and popular science publications, besides, it is overall the most educated part of society. The high education degree of the chosen sample can be confirmed with the data available. The chart below shows the distribution of questionnaires according to the educational level:

	Number of citation	Frequency
High School graduate	22	13,6%
University undergraduate	38	23,5%
University graduate	90	55,6%
Postgraduate	12	7,4%
TOTAL	162	100%

From 162 interviewed people, distributed among 20 high and high middle class neighborhoods of Campinas, 86.4% have had some contact with a university level course (undergraduate, graduate or postgraduate). The remaining 13.6% have finished high school.

The city of Campinas, located in the countryside of São Paulo State, has 969,386 inhabitants according to the data presented by the Brazilian Institute of Geography and Statistics in 2000. The majority of people live in urban regions of Campinas, which is also known for being a center of high-tech enterprises and it has two universities of great merit, the Universidade Estadual de Campinas (Unicamp) and the Pontifícia Universidade Católica de Campinas (Puccamp), besides several other institutions of higher education. Unicamp is one of the best five universities in Brazil and it currently has more than thirty-five thousand students.

The participation of students, who can be in some way involved with higher education institutions, was relatively low (12,3%). This is shown in the table below, which contains the distribution of interviewees by occupation.

	No. citation	Frequenc y
Architect	7	4,3%
Business manager	6	3,7%
Craftsman	2	1,2%
Administrative assistant	5	3,1%
Social Assistant	3	1,9%
Bank clerk	4	2,5%
Trader	13	8,0%
Concelour	4	2,5%
Accountant	4	2,5%
Dentist	3	1,9%
Detective	2	1,2%
Typist	1	0,6%
Educator	5	3,1%
Housewife	8	4,9%
Economist	1	0,6%
Businessman	6	3,7%
Nurse	1	0,6%
Trainee	5	3,1%
Press Agent	1	0,6%
Driver	1	0,6%
Student	20	12,3%

	No. citation	Frequenc y
Pharmacist	3	1,9%
Phonoaudiologist	3	1,9%
Purchasing manager	5	3,1%
Judge	2	1,2%
Laboratory assistant	1	0,6%
Physician	2	1,2%
Petrol worker	1	0,6%
Teacher	17	10,5%
Lawyer	1	0,6%
Sales executive	2	1,2%
Publicist	1	0,6%
Secretary	4	2,5%
Telecommunication supervisor	1	0,6%
Telemarketing	2	1,2%
Sanitary supervisor	1	0,6%
Engineer	4	2,5%
Handyman	1	0,6%
Photographer	1	0,6%
Government worker	7	4,3%
Masseur	1	0,6%
TOTAL	162	100%

Keeping the same genre outline of the population of Campinas provided by the IBGE, 84 women (51.9%) and 78 men have been interviewed (48.1%). The interviewees age distribution has also kept the standards established for Campinas on the last population census compiled by the IBGE.

	No. citation	Frequency
18 to 24 years old	31	19,1%
25 to 39 years old	58	35,8%
40 to 59 years old	50	30,9%
over 60 years old	23	14,2%
TOTAL	162	100%

b) the questionnaire

The questionnaire “Public Perception of Science and Technology” was prepared by the staff of the Centro de Estudios sobre Ciencia, Desarrollo y Educación Superior and translated into Portuguese by researchers of Labjor. It was made up of both open and multiple-choice questions, in other words, it allowed the interviewees to answer freely and to select several previously established answers.

While analyzing the characteristics of the questions established it is possible to say, in general terms, that they point up some types of questions to be surveyed as:

- Questions related to the image (positive, negative, trustful and doubtful, among others) that the interviewees have about Science and Technology;
- The knowledge that the interviewees possess on general contents of science;
- The relationships between Science and the systems of power that the interviewees can identify;
- Questions related to the effectiveness and efficiency of popularization of science;
- The profile (social, cultural) of the interviewees.

Above all, the above-mentioned classification works as a tool to understand, interpret and provide a meaningful explanation to the answers collected. Far from being definite and exclusory, it integrates a set of questions that can refer to one or more raised questions. Other researchers, with different points of view of the research, can establish different groupings from the established one, combining questions or creating new divisions.

In this text, we intend to focus mainly on the first established group of questions, which is: “Questions related to the image (positive, negative, trustful and doubtful, among others) that the interviewee has about Science and Technology”. However, this does not mean that other sets of questions - especially the one that gathers information about the profile of the interviewee - are being ignored. On the contrary, the questions related to the image of Science and Technology will be carefully examined.

The authors think that, in the future, the other sets of questions can receive a detailed analysis, so that a full interpretation of the research results can be established. It will be also important to compare the answers of Brazil with the ones obtained from the same questionnaire applied in other countries.

2. Results

The first question that identifies the image the interviewees have of science is the question seven of the research. The question was “Which of the following sentences do you consider to express the best idea about science”, which allowed the interviewee to select two possible answers.

	No. citation	Frequency
Great discoveries	65	40,1%
Technical advances	66	40,7%
Controlling Nature	11	6,8%
Improvements on human life	76	46,9%
Understanding the natural world	25	15,4%
Fast transformation	25	15,4%
Danger of losing control	20	12,3%
Concentration of power	11	6,8%
Ideas that few understand	10	6,2%
Don't know/No answer	3	1,9%
TOTAL	162	100%

The phrases above show positive, negative and ambiguous images of science. If we adopt this criterion of classification there will be clearly positive phrases like: great discoveries; technical advances; improvements on human life and understanding the natural world. These four items have been chosen 232 times, which represents 74% of the total. On the other hand, the sentences that represent negative points of view (danger of losing control; concentration of power; and ideas that few understand) have been chosen 41 times, or 13% of the total. Two of the phrases quoted (controlling nature and fast transformation) can represent either positive or negative concepts, depending on other information supplied by the interviewees, and have been selected 36 times, which means 12% of the inquiries.

The following question was “Which image do you think about when you see the word technology”. It follows the same pattern of the previous query, but this one deals only with technology (and not science) and the interviewee can only provide one open answer. It must be stood out that the answers mainly refer to objects, which suggests

that technology is seen more as something material than as knowledge.

	No. citation	Frequency
Advance	39	24,1%
Automation	4	2,5%
Computer	47	29,0%
Discoveries	6	3,7%
Development	6	3,7%
Engine	2	1,2%
Laboratory	4	2,5%
Machines	21	13,0%
Fear	1	0,6%
New Technologies	6	3,7%
Nuclear Reactor	3	1,9%
Robots	1	0,6%
Danger	2	1,2%
Chips	2	1,2%
Electric wire	2	1,2%
Don't know/No answer	5	3,1%
Eletronics	6	3,7%
Nasa	2	1,2%
Science domain	3	1,9%
TOTAL	162	100%

When the answers have been classified in the same way that was done in the previous question (positive, negative and ambiguous or neutral concepts), 37% of the interviewees have selected the positive images (advance, discoveries, development, new technologies and science domain). The negative images (fear, nuclear reactor and danger) have been chosen by 4% of the interviewees, and most of the answers, 56%, belong to ambiguous images.

The next the six questions are, indeed, assertions that the interviewees should

agree or disagree (strongly agree, agree, strongly disagree, disagree).

The disagreement reached close to 65%, with emphasis in the non-emphatic disagreement (54.3%), when the statement “The world of science cannot be understood by the common people” was placed. A significant part (36%), however, considers that common people cannot understand science.

	No. citation	Frequency
Strongly Agree	10	6,2%
Agree	47	29,0%
Disagree	88	54,3%
Strongly disagree	17	10,5%
TOTAL	162	100%

The following statement is “Life quality improves mainly because of science and technology advances”. A total of 76.5% of the interviewees agreed with it, a result that is very close to the one obtained by those who see science as positive concepts (74%), the first question

analyzed here. The disagreement about science as the major cause of life quality corresponds to 23%.

	No. citation	Frequency
Strongly Agree	14	8,6%
Agree	110	67,9%
Disagree	32	19,8%
Strongly disagree	5	3,1%
Don't know/No answer	1	0,6%
TOTAL	162	100%

The following question “Do we excessively attach truth to science and little to religious faith” refers to the opposition between science and religion. It claims that, currently, society has placed religion aside for the benefit of science. Besides, the way the sentence has been built up seems to condemn this fact, almost asking for the agreement of the interviewee.

	No. citation	Frequency

Strongly Agree	15	9,3%
Agree	99	61,1%
Disagree	40	24,7%
Strongly disagree	4	2,5%
Don't know/No answer	4	2,5%
TOTAL	162	100%

For this question, the most interesting point is that the number of disagreements summed up achieved 27%. These disagreements can represent a minimum amount of interviewees that have very positive ideas about science and think that scientific ideas must be spread over.

The next question, “ Applied science and technology will increase employment”, refers to a current problem which is the reduction of opportunities due to the high process of technological improvements in industries. The answers, however, oppose to this diagnosis. Sixty-two percent of the interviewees think that applied science and technology will increase the employment rate. The disagreement rate achieved 38% of the inquiries.

	No. citation	Frequency
Strongly Agree	17	10,5%
Agree	83	51,2%
Disagree	52	32,1%
Strongly Disagree	9	5,6%
Don't know/No answer	1	0,6%
TOTAL	162	100%

From now on, a division of two groups starts to be outlined: one includes those that refer positively to science and technology and the other group contains those that are somewhat distrustful. The first group is mainly based on the disagreements presented on the previous question..

The following question can contribute to a better understanding of what is the

basis of groups that have negative ideas toward science. The sentence with which the interviewees are asked to agree or disagree with is “if the benefits of science and technology are greater than the negative ones”. Among the interviewees 21% disagreed with this statement while 76% agreed with it.

	No. citation	Frequency
Strongly Agree	12	7,4%
Agree	111	68,5%
Disagree	32	19,8%
Strongly Disagree	2	1,2%
Don't know/No answer	5	3,1%
TOTAL	162	100%

The next question regards the main concerns of science and technology. A high number of interviewees (64%) disagree with the idea that “Science and technology do not usually worried about the problems of people”. However, if we consider the feature of the question, the number of people who agreed with this statement (35%) is also high.

Another relevant aspect to our analysis is the query “Many people find that the development of science brings problems to humanity, do you think this is true?” for which the interviewees must answer “yes” or “no”.

	No. citation	Frequency
Yes	69	42,6%
No	85	52,5%
Don't know/No answer	8	4,9%
TOTAL	162	100%

At this point, 42.6% of the interviewees said that the development of science brings problems for humanity, which shows that science is being evaluated with critical eyes. It is worth noticing that they are not saying that science does not bring benefits - 76% have already said that it brings more benefits than damages -, they are only indicating that its development also brings problems. A total of 52.5% believe that the

development of science does not bring any problem.

The following question is like a sequence of the previous one. The interviewees are asked to select sentences that represent the problems brought by science. Even the ones that had said that the development of science does not cause problems had to answer the question.

	No. citation	Frequency
The loss of moral values	20	12,3%
The risks of applications of knowledge	39	24,1%
Excesss of knowledge	3	1,9%
An even greater concentration of power and wealth	31	19,1%
The use of knowledge for war	37	22,8%
TOTAL	162	100%

The answers above allow us to better characterize the group of those that have negative images toward science. It is necessary to mention that the poll was conducted during the attack of the Anglo-American coalition against Iraq, when the high technology available was sufficiently divulged, which can explain why 22,8% of the answers were concerned about “the use of knowledge for war”.

The most chosen alternative was “The risks of applications of knowledge” (24,1%), followed by the previously mentioned allusion to war and by the reply “An even greater concentration of power and wealth” (19,1%). The last reply turns our attention to its political content. The alternative “The loss of moral values”, which corresponds to 12.3% of the answers, also worth taking a close look. This figure may correspond to the group of those who do not trust science, based on moral and religious issues.

The question “What are the main reasons for a scientist to dedicate his life to his work?” can help us understand the image that the interviewees have about scientists and their profession. Most of the answers alluded the altruistic goals that some researchers may have. Seventy-four percent of the answers to this question reflect altruistic feelings such as vocation to knowledge; looking after the well-being of society; and solving people’s problems. The interviewees that have pointed out egocentric reasons for

scientists (earning money; having prestige; winning an important award and getting power), on the other hand, reached 24%. The answers show that the scientific community is positively seen, despite the distrust presented by the group that mentioned the selfish reasons.

	No. citation	Frequency
Earning money	18	11,1%
Vocation to knowledge	102	63,0%
Having prestige	38	23,5%
Winning an important award	10	6,2%
Looking after the well-being of society	49	30,2%
Getting power	12	7,4%
Solving people's problems	86	53,1%
Don't know/No answer	5	3,1%
TOTAL	162	100%

The question “In your opinion, who leads the development of science in the world?” is opposed to the previous one and provides an interesting panorama. Although the scientists are positively evaluated, the interviewees perceive a process of domination in the conduction of science development. The majority, 67%, opted for the government of rich countries, great multinationals companies or the spontaneous market demand as the main factors for leading science development. Only 33% of the answers affirm that science is lead by international organizations or scientists themselves.

	No. citation	Frequency
The government of wealthy countries	89	54,9%
Great multinational enterprises	86	53,1%
Scientists themselves	35	21,6%
The spontaneous market demand	32	19,8%
International organizations	68	42,0%
Don't know/No answer	5	3,1%
TOTAL	162	100%

The distrust on scientific experiments - unsafe because they are uncontrollable or because they can be used for questionable goals - appears in the reply to the question “In your opinion, why did AIDS emerged in the world?”. A percentage of 17.9% of the interviewees pointed “experiments made by scientists” as their answer. The natural arguments (natural evolution of illnesses and the appearance of new diseases while the cure for the existing ones are been found) represented 43% of the answers. The moral arguments (people have changed their sexual behavior; immoral behavior of people; and ignorant people) summed up 34% of the answers.

Two controversial questions relative to the development of science, a more recent and an older one, were presented to the interviewees and can be used to confirm their reliability on scientists. “Imagine you want to get information about the advantages and risks on the use of biotechnology in agriculture and foods, in whom would you trust better to get the correct information on the subject?” was initially asked. For this question two options were available. It is possible to affirm that interviewees answer shown a reasonable distrust on scientists.

	No. citation	Frequency
In a journalist	6	3,7%
In an engineer	29	17,9%
In the government	8	4,9%
In a doctor	33	20,4%
In a university scientist	100	61,7%
In an organization that protects the environment	113	69,8%
Nobody	10	6,2%
Don't know/No answer	3	1,9%
TOTAL	162	100%

From a total of 299 citations, we got 133 citations if we consider doctors and university scientists as representatives from the scientific community, which

corresponds to 45% of the answers that trust the community to make a decision on biotechnology. For a minor difference, the group that would rather choose the opinion of a non-scientist represents the majority (55% within 166 citations).

When the subject is the residue of nuclear plants there is the same distribution. In this case we consider the engineers as scientists instead of considering the doctors. Those that trust scientists are 46% (139 of a total of 303 citations), while the ones who prefer another opinion or none represent 56% (164 citations). The question was "Imagine you want to get information on the advantages and risks of a subject related to nuclear energy like nuclear residue. In whom would you trust more?". Two answers were also allowed.

	No. citation	Frequency
In a journalist	16	9,9%
In an engineer	46	28,4%
In the government	16	9,9%
In a doctor	16	9,9%
In a university scientist	93	57,4%
In an organization that protects the environment	106	65,4%
Nobody	10	6,2%
Don't know/No answer	4	2,5%
TOTAL	162	100%

Although more than half of the interviewees (53.1%) have said that there must not have boycotting of research of any subject, the remaining 45.1% were asked under which circumstances this kind of boycotting must happen.

	No. citation	Frequency
Yes	73	45,1%
No	86	53,1%

Don't know/No answer	3	1,9%
TOTAL	162	100%

	No. citation	Frequency
Does not apply	89	54,9%
Only changing organs	3	1,9%
For risks	6	3,7%
Only God can create	15	9,3%
Interfere in natural evolution	5	3,1%
Without benefits to human beings	2	1,2%
It does not have style	2	1,2%
Nothing should be modified	3	1,9%
Technology domain	1	0,6%
Cruelty	11	6,8%
Damages only	5	3,1%
By the consequences	13	8,0%
Religious issue	1	0,6%
It is a threat	5	3,1%
Market competitiveness	1	0,6%
TOTAL	162	100%

An analysis of those answers can help us understand the reasons that lead to a parcel of the interviewees that are distrustful and critical regarding contemporary Science and Technology. The presented reasons can be roughly divided into three groups: the moral/religious reasons (only God can create; cruelty; religious issue); the economical/political reasons (without benefits for human beings; technology domain; damages only; market competitiveness); and non specific fears (for risks; nothing should be modified; by the consequences; it is a threat; interfere in natural evolution). The non specific fears correspond to 20% of the total, the religious/moral reasons correspond to 17% and the political/economical reasons to 6%.

3. Conclusion

The analysis of the data allows us to delineate, on a first approach, that there is a majority of answers that positively evaluate science and technology. This group can vary from a minimum percentage of around 40% to a maximum percentage of 80%, when the questions involve little controversies. The figures relative to distrust or rejection of science are between 20 to 40%.

It is not possible to evaluate if the individuals have followed the same coherent logic while providing the answers. It is more likely that they have sometimes been favorable and sometimes critical using different arguments. But the set of answers allows us to hypothetically build up two main groups, which contribute to evaluate and interpret the results of the research.

It is possible to establish another group, regarding the percentage of answers that are critical toward science. This group, which varies from 20 to 40%, can be divided into two sets of arguments: the moral/religious and the economical/political one, while the first one has a little quantitative superiority. The minimum rate for each of the two groups seems to be around 10%, topping out at 20%. As already it has been demonstrated above, some questions allow the construction of this framework. The last question analyzed, for example, that included a bit more than 45% of the interviewees, support this percentile division. The low number of answers of the group that has used political/economical arguments (6%) seems to be related to non-detailed arguments of those that have alleged non-specific fears, which correspond to 27% of the total.

It is also important to focus that the results and data collected on this research should not be automatically generalized for Brazil. The country keeps great regional disparities and the city of Campinas itself differs sufficiently from the majority of other Brazilian cities. As it has been already said, Campinas is a high-tech centre and has two important universities. Moreover, it is reasonable to believe that its high social class (used as the base of the research) differs from the one present in the rest of the country. This is due to the fact that a considerable part of the wealth created in the city is based on activities associated to scientific knowledge and that the production based on technology is joined with universities and high-tech development. It is plausible to

affirm that the favorable group, which has a positive image toward science, is smaller in other regions of the country. It is also reasonable to infer that those that distrust science based on moral/religious arguments are more numerous in less educated regions of the country even when the high social class is considered. It is, however, a real sample of Brazil, which is more and more reflected by the different regions of its vast territory.

The next step will be to deepen the analysis of the data collected on the research. We think that it would be interesting to oppose the analyses carried out on the image of science and technology to a detailed examination of the questions related to the effectiveness and the efficiency of the popularization of science. The questionnaire certainly allows the survey of these questions. This analysis will be included in a publication of the State of São Paulo Research Foundation (Fapesp), to be edited in 2004 and that will examine several indicators of the Brazilian science and technology. Another future research will be to compare and analyze the data collected on questionnaires both in Argentina, Brazil, Uruguay and Spain (to be published in 2003, Editora da Unicamp). This analysis will allow to pinpoint the differences and similarities in the perception of science in the four countries and raise new questions that may serve to reflect on them.

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