SISSA – International School for Advanced Studies Journal of Science Communication
ISSN 1824 – 2049 http://jcom.sissa.it/

Article

Cultural distance between peoples' worldview and scientific knowledge in the area of public health

Gauhar Raza, Surjit Singh

The objective of the present paper is an attempt to measure the public understanding of science in the area of health and hygiene and test the efficacy of "cultural distance model". A pre-tested open-ended questionnaire was used for administering cross-sectional surveys at a religio-cultural festival in India. 3484 individuals were interviewed and responses were coded and entered to construct computer database. The data was used for determining the cultural distance of five scientific concepts from the quotidian life of the target population. In developing countries, the formal system of modern education operates as a strong determinant in shaping cultural structures of thoughts prevalent among the citizens. There exists a cultural distance between the scientific structure of configuring natural occurrences and peoples' complexity of thoughts. The distance varies significantly across the concepts that were subjected to the inspection and is a function of the nature of scientific information.

Keywords: cultural distance, public health, public understanding

Introduction

Research in the area that has recently come to be known as Public Understanding of Science (PUS) started some time in the early 1980s.[1] Survey based studies in the United States of America remained, however, till late 1980 a subset of a large project initiated for the development of Science, Technology and Engineering Indicators.[2] As this research area developed in many countries, it cut across quite a wide range of fields of investigation, such as indigenous knowledge systems, agriculture, geography, environmental studies etc.[3] The PUS over the years has emerged as what could be legitimately called "a loose assemblage of interdisciplinary approaches".[4] Probably, this is why the consensus on the nomenclature of the area has not yet emerged.[5] Since it has remained a loose assemblage drawing upon the techniques tested in other established disciplines, a large gamut of tools has been used by the researchers to probe PUS of a given set of target population. However, there is no large-scale survey conducted in any country, which did not probe peoples' perception about public health issues.[6]

In India the first large-scale study on public understanding of science was administered in 1989 during the Kumbh Mela[7] that was held at Allahabad. In February 2001, after a period of 12 years, a similar survey was conducted during the Kumbh Mela at the same site.[8] The entire range of questions that constituted the interview schedule in 1989 was included in the latest questionnaire. A total number of 3484 pilgrims were interviewed during the four days of the survey operations. The respondents were asked questions in six areas of scientific knowledge. In addition to the questions posed on scientific issues, each respondent was asked to furnish demographic information as well. The coded data entered into the computer were subjected to various statistical tests including logic analysis. For this purpose SPSS[9] software package was used. It is only after ensuring the validity of the data that the authors applied the "cultural distance model", which, as of now is based on simple percentages.

In the first section of this article we discuss the model of analysis as it evolved during the past 12 years.[10] The second part describes the demographic characteristics of the sampled population. In the third section the analysis of the data collected and efficacy of the proposed model is discussed.

Cultural Distance

In one of our earlier articles we have proposed a simple method by which cultural distance of a given scientific idea or explanation from the quotidian life of a common person could be determined.[11] Firstly, in brief, we reiterate the proposed procedure and then test its efficacy on the data set collected during Kumbh 2001, at Allahabad. This cultural distance for the purpose of analysis is defined in terms of the years of socialization in modern education through which, reportedly, the populace has undergone. Thus "Education Variable" was plotted on an x-axis and Y-axis represented the dichotomous percentage response variable. The point of intersection of the two curves - scientifically valid and scientifically invalid response curves - represents the distance at which a concept, an idea or a piece of information becomes part of the cognitive structure of the fifty percent of the population under consideration. This point is called the Index of democratization *(id)* of the concept. Perpendicular drawn form the point of intersection on the percentage response line (Y-axis) determines the magnitude of the cultural distance (x_{ci}) for a given scientific concept (c_i).

Data Analysis

Before going into the details of the analysis, we present here some of the demographic features of the population sampled during the Kumbh Mela 2001. The purpose is to highlight how this universe is placed on the cultural distance. For some other sampled population, the relative cultural distance for each concept discussed here are likely to undergo changes that will characterize the relative positions of the cultural group *vis a vis* this set of scientific issues.

Characteristics of Sample

The following table explains the distribution of the sampled population (n=3484) over four independent variables i.e., gender, age, occupation and education, and also explains the sources of information to the sampled population.

Table I. Characteristics of the sample population (sample size = 3484)

Gender	(*Percentage*)	**Education**	(*Percentage*)
Male	81.3	Illiterate	17.7
Female	18.7	Primary	13.6
		Middle	13.5
Age		Secondary	17.0
Up to 20 yrs	10.1	Sr. Secondary	14.7
21-30 yrs	28.0	Graduate	13.6
31-40 yrs	23.9	Postgraduate	9.6
41-50 yrs	16.1		
51-60 yrs	12.5	**Information sources**	
Above 60 yrs	9.4	TV only	19.0
		TV+ others	38.3
Occupation		Radio only	6.7
Housewife	9.9	Radio+ others	3.3
Agriculture	34.5	Newspaper only	10.8
Student	9.1	Newspaper+ others	1.7
Business	10.7	Interpersonal	10.8
Workers (unskilled)	6.7	Text/books	1.2
Workers (skilled)	4.4		
Service	12.4		
Professional	2.2		
Unemployed	6.2		

Anvil of the test

The schedule prepared to conduct the interviews contained 36 questions in six areas of scientific enquiry. These areas were astronomy & cosmology, geography & climate, agriculture, health & hygiene, biotechnology and environment. For the purpose of the present analysis a dichotomous response variable was constructed by grouping all the scientifically invalid explanations together. The largest number of probing questions was posed to every respondent in this area of scientific investigation. In all, there were nine questions which addressed health related issues that were included in the schedule. Most surveys carried out globally included the area of health and hygiene in the probing list.

Area of Health and Hygiene

Among the set of questions that were posed during the survey in 1989, and those that were repeated in the schedule used for administering the survey in 2001, the query "At what age should the solid food be given to an infant?" could be placed at the largest cultural distance from the daily life of the people, see Figure 1.

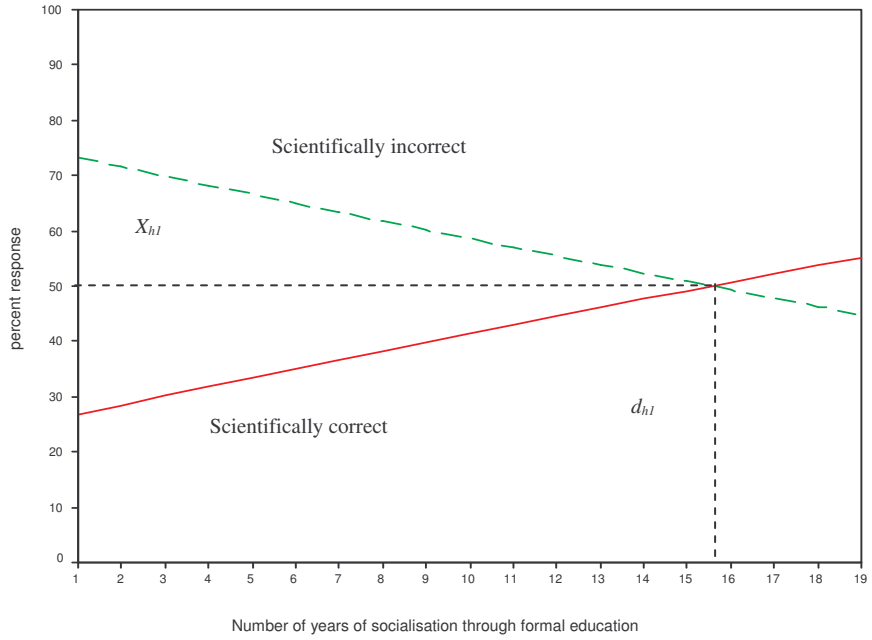

Figure 1. Cultural distance for "when solid food should be started for infants?"

It has been noted in the earlier reports and research papers that the burden of raising children and taking care of patients rest with the women folk.[12] This is so, not just in India but in most developing countries. Thus, it has been repeatedly observed that the knowledge level of women as a group in the area of health is fairly high compared to men.[13] Since rearing and feeding a child is the responsibility of the mother and not the father in an Indian family, it was expected that most men respondents would be unaware of the age at which a child needs to be initiated to the semi-liquid or solid food. The men - women ratio (81.3:18.7) was large enough to yield index of democratization (*id*) at a long cultural distance, i.e. 14-years. This shows that in order to popularize the correct age of administering the semi-solid or solid food to postnatal, workers, communicators of science and community of dieticians would have to make special efforts. Since the cultural distance of this information from the quotidian life of the people is quite large, the strategies for popularizing the information need to be devised with precision. Eradication of wrong notions about correct age for introducing semi-solid food would require what could be called "high energy campaign".

Jaundice is a disease that is quite rampant in the country and its cure is believed to be associated with a number of myths and irrational beliefs. The modern system of medication suggests that, more than administration of medicines, it requires bed rest and restrictions on the food intake. It happens to be highly infectious and thus the physicians suggest quarantine for the patient. The response to the question posed, i.e. "what should be done to a patient suffering from jaundice"? The cultural distance computed for the scientifically valid viewpoint was about nine years as depicted in Figure 2.

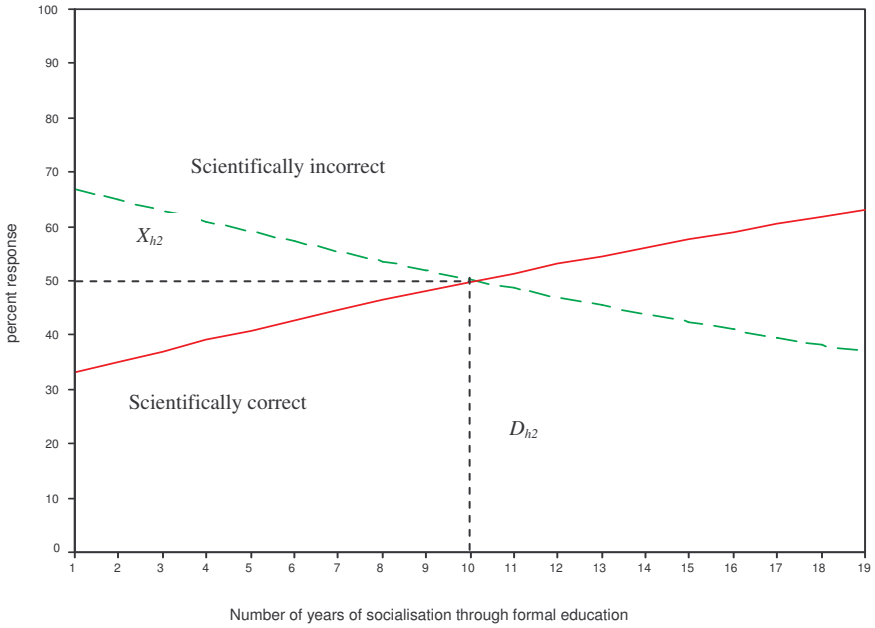

Figure 2. Cultural distance for "what should be done to a jaundice patient?"

The next lowest cultural distance determined was four years when the response to the question "what should be done on snakebite?" was analyzed. Snakebite is a frequent problem that people in rural part of the country encounter. Though most of the snakes found are non-poisonous, the victim cannot take a chance, because the risk to life is extremely high. A number of local remedies are practiced in the absence of proper medical care and first aid.[14] Hands and feet are the most vulnerable parts of the body to snakebite. The immediate action required is the isolation of the wound and the prevention of blood flow from the effected area. About 30% of the illiterate segment of the sampled population knew that this was the action to be taken in such eventualities. A large percentage of those who were interviewed also believed that the patient should be administered proper medical care after applying first-aid. Even though saving the life in such conditions involved a series of complex actions, the cultural distance for the correct scientific information was just four years. The plotted curve in Figure 3 also showed that the influence of education on the percentage of those who rendered the scientifically valid response was quite significant.

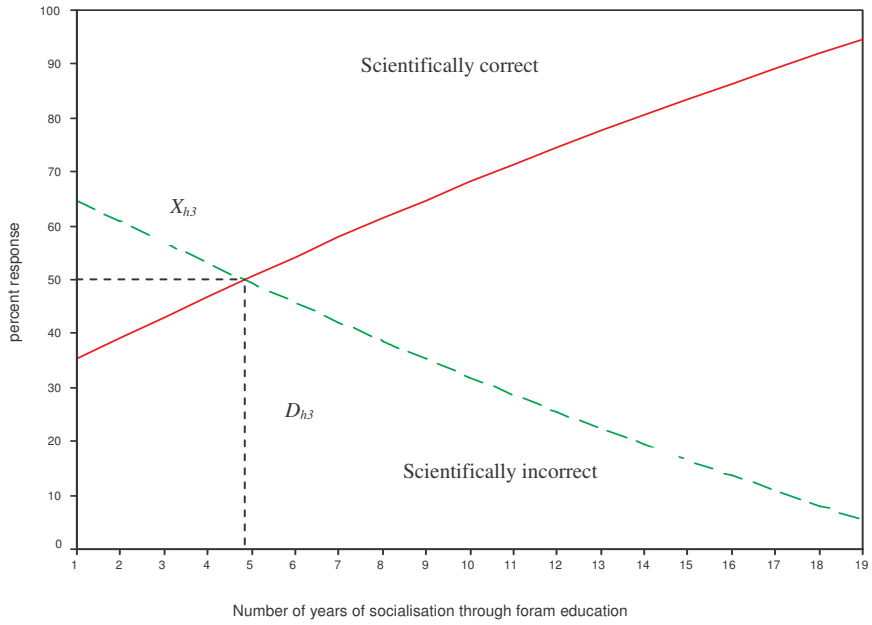

Figure 3. Cultural distance for "what should be done on snakebite?"

The analysis revealed that the rise in the percentage of valid answers was quite rapid and at 18-years of schooling, almost all the respondents knew the scientific method of handling a situation in case of a snakebite. The next poser where *id* was obtained in the fourth quadrant was related to the issue of causes of diseases. The two curves if extrapolated would intersect in space, which signifies the social domain and is outside the pail of formal education, see Figure 4.

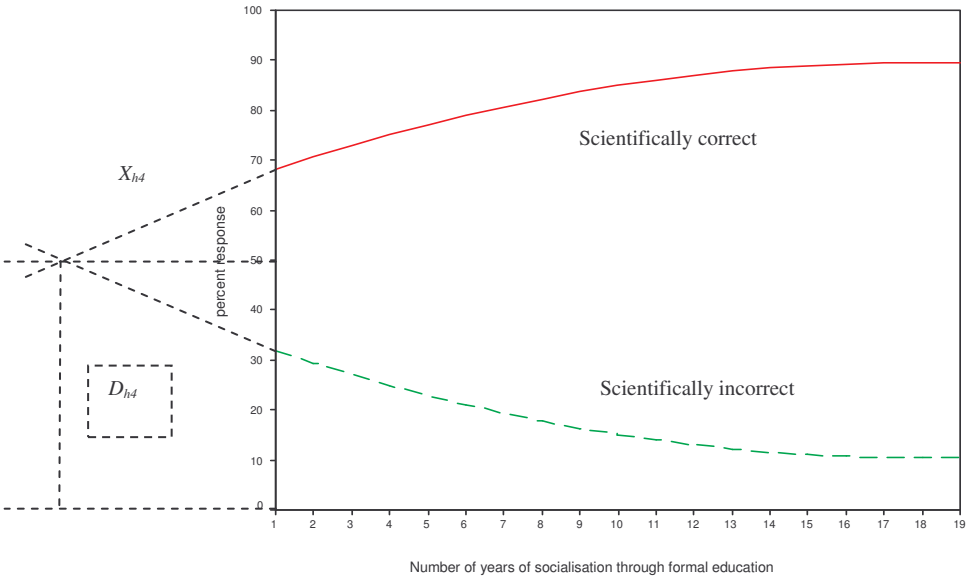

Figure 4. Cultural distance for "what is/are the cause/s of disease/s?"

Thus we may conclude that there are certain concepts which in Indian society have become integral part of the socio-cultural cognitive structures. The curves plotted in this case did not show any decrease in the percentage of those responses, which were categorized as scientifically valid. The percentage of those who knew he correct causes of diseases rose up to 90% of all the respondents at eighteen years of schooling. The nature of the curve showed that the initial years of education have a significant influence on the response variable and as the level of education rises the saturation level is achieved at around thirteen years of schooling.

In this area it was not unexpected that more than 60% of those who were put in the category of "illiterate" and about 88% who had just crossed standard one, knew the importance of the oral re-hydration therapy for a patient who suffers from loose motions. The surveys conducted earlier show that a high percentage of the populace knows that the body liquids lost in severe conditions of diarrhea should be replenished to avoid dehydration that could be fatal. This question has been repeatedly put in the schedule because all the traditional methods of medicine forbid diarrhea patient from taking water due to the prevalent myth that liquids given would increase the frequency of loose motions.[15] The data analysis, however, has revealed that the irrational belief is no more prevalent among the common citizens. What amazed the research team was the shape of the curve (see Figure 5), when the percentage response was plotted on the education scale.

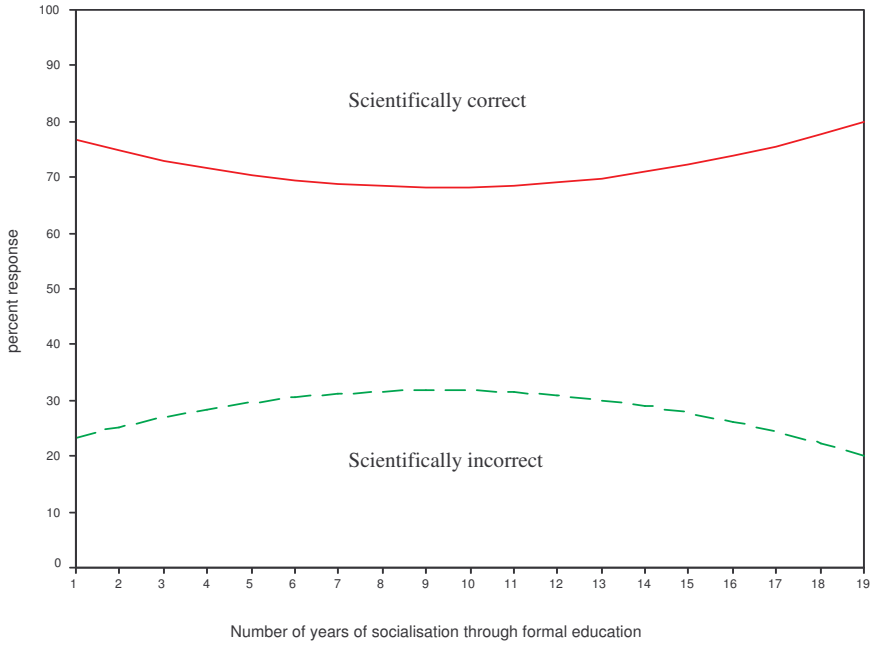

Figure 5. Cultural distance for "should water be given to patient suffering from diarrhea?"

There was a reduction in the percentage of those who said yes in response to the question, "should water be given to a patient suffering from diarrhea"? The highest frequency of correct response is observed at one year of schooling. The gradual reduction continues up till the IX standard and after nine years of formal education a similar rate of rise is observed till the 18 years of education. This gave the valid-response percentage curve the shape of an inverted dome. This would mean that the initial years of schooling works as an impediment to the correct response. This apparent observation is erroneous, a deeper analysis of curves plotted "age and education versus percentage response" and "gender and education versus percentage response" reveals that the highest concentration of those who gave invalid answers was at the two tail ends of the age graph, i.e. in the age 10-20 years and 61-above years. The percentage of women who gave valid responses, despite their low level of education, scored high compared to men folk, the difference was about 3%. The curves plotted for the age distribution on the education scale and the concentration of women on the education scale showed

that the percentage of respondents who had reported their age to be above 60 years or below 20 years reduced rapidly as the education level increased. The concentration of women who gave valid responses was also high at the lower levels of education.[16] This, in case of ORT, was sufficient to offset the effect of education on the percentage response. The resultant was a u-shaped curve. It also proves that the cultural distance so measured, represents the influence of all the decisive factors that determine the people's response to various scientific notions. It is also quite evident from the nature of the curve that the present information about ORT is in the socio-cultural domain and has become an integral part of the cognitive structures that the social processes constructed through cultural instruments.

Conclusions

The hypothesis that there exists a cultural distance between the scientific structure of configuring natural occurrences and peoples' complexity of thought, when subjected to empirical tests, proved to be well grounded. It is quite evident that this distance varies significantly across the concepts that were subjected to the inspection.

On the one hand, cultural distance would vary depending upon the nature of scientific information, but on the other, different sets of cultural sub-groups could be placed at varying distances for a given scientific concept. We believe that mapping the cultural distances of specific scientific information for distinct target groups could help the planners and communicators of science in devising effectual intervention strategies. It is evident that plans for the dissemination of information which has a low magnitude of cultural distance, needs to be rather radically different in nature *vis a vis* an approach required for popularizing scientific ideas that tend cluster at the farthest end of the scale.

We also conclude that, in developing countries, the formal system of modern education operates as a strong determinant in shaping cultural structures of thought prevalent among the citizens. It influences the worldview of even those who have never received any formal schooling and are categorized as illiterate.

The suggested model lends itself to varied uses for determining "cultural distance" of concepts not only in the field of sciences but it could also be employed for computing the distances of notions prevalent in other fields of investigations such as social sciences. In the end the authors have no hesitation in admitting that the proposed model of analysis needs further refinement and testing on various data sets.

Notes and references

[1] B. Wynne, "The Public understanding of science", *Hand Book of Science and Technology Studies,* SAGE, 1995.
[2] National Science Board, "Science and Technology: Public Attitude and Public Understanding", *A Report on Science and Engineering Indicators,* National Science Foundation, USA, 1998.
[3] G. Raza, H. du Plessis, "Science and indigenous knowledge in a culturally diverse world", *Africa Insight*, 33, 2003, p. 37-42.
[4] P. Sturgis, N. Allum, "Science in society: re-evaluating the deficit model of public attitudes", *Public Understanding of Science*, 13, 2004, p. 55-74.
[5] N. Pitrelli, "The crisis of the 'Public Understanding of Science' in Great Britain", *JCOM*, 2(1), 2003.
[6] *Public understanding of science*, Organization of economic co-operation and development from <http://www.oecd.org/document/23/0,2340,en 2649_34269_1962007_1_1_1_1,00.html>
[7] N. Bhattacharya, "The Religions"*, The cultural heritage of India*, The Ramakrishna Mission, Institute of Culture, Calcutta, IV, 1983.
[8] G. Raza, S. Singh, "Tryst with Science: Study based on survey conducted during Mahakumbh-2001 at Allahabad", *A Nistads Report*, 2002.
[9] SPSS Inc., *Statistical Package for Social Sciences*, Version 10.5, 1999.
[10] G. Raza, S. Singh, B. Dutt, "Peoples' attitude to scientific knowledge: The context of culture", *Journal of Scientific and Industrial Research*, 54, 1995, p. 108-121.
[11] G. Raza, S. Singh, B. Dutt, "Public, Science and Cultural Distance", *Science Communication*, 23, 2002, p. 293-308. Also see: <http://203.197.212.81/people/people.cfm?recordID=32>
[12] B.C. Hayes, V.N. Tariq, "Gender differences in scientific knowledge and attitude towards science: a comparative study of four Anglo-American nations", *Public Understanding of Science*, 9, 2000, p. 433-447.
[13] G. Raza, B. Dutt, S. Singh, "Kaleidoscoping public understanding of science on hygiene, health and plague: a survey in the aftermath of a plague epidemic in India", *Public Understanding of Science*, 6, 1997, p. 247-267.

[14] *First Aid to the Injured*, St John Ambulance Association, New Delhi, 1993.
[15] *The Management and Prevention of Diarrhoea: Practical Guidelines*, World Health Organisation, 1993.
[16] Census of India (2001), <http://www.censusindia.net/t_00_006.html>.

Authors:

GAUHAR RAZA is a scientist at the National Institute of Science, Technology and Development Studies, New Delhi, and is working in the area of public attitudes toward, and understanding of, science for the past fifteen years. He has also produced a number of films and weekly programs for television on popular science issues. Currently he is working on a cross-cultural project on Indigenous Knowledge Systems in India and South Africa. His recent work includes the book *Science, Craft and Knowledge: Understanding of Science among the Artisans in India and South Africa - a Cross-Cultural Endeavour*, Gauhar Raza & Hester du Plessis, Pretoria, 2002. gauhar_raza@yahoo.com

SURJIT SINGH is a researcher at the National Institute of Science, Technology and Development Studies, New Delhi, and has been working in the area of public attitudes toward, and understanding of, science for the past fifteen years. He has co-authored two books with Gauhar Raza. ssdabas@yahoo.com