The Evolution of Public Understanding of Science—Discourse and Comparative Evidence

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Public Understanding of Science (PUS) is a field of activity and an area of social research. The evolution of this field comprises both the changing discourse and the substantive evidence of a changing public understanding.[1] *In the first part, I will present a short account on how the discourse of PUS moved from Literacy, via PUS, to Science-in-Society. This is less a story of progress, but one of false polemics and the multiplication of concerns. In the second part, I will show some empirical evidence on how PUS has changed by drawing on mass media data and large scale comparative survey evidence. I conclude by stressing that the Science-Society relationship is variable both in distance between science and the wider society and in the quality of this relationship.*

Social psychology comes to this field of societal interest not by conversion from a natural science lab bench, but from a focus on 'common sense', its processes, structures and functions. Common sense takes inspiration from many sources, and during the twentieth century science became a very important, if not the most important, inspiration of common sense. Thus, the problem of public understanding of science hinges on understanding common sense.

Like any social phenomenon, the 'PUS' is a matter of factual description, but also of societal discourse. The world we live in and take for granted as 'natural' is raised and sustained through communication (Luckmann 1995).

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In addressing the evolution of PUS, I must juggle two balls: in the one hand, the evolution of the discourse, in the other the empirical evidence of changes in public understanding. I will end with some speculations on the future of research into PUS. I am in the situation of an epidemiologist who is asked: are people more depressed in 2000 than they were in 1900? He or she is painfully aware that the definition of depression has changed, and that any 'change in the rate of depression' might only reflect the change of definition. It is like scoring a game where the rules frequently change.

Evolution of Discourse

The academic discussions of PUS are increasingly reviewed. I will base my story largely on our recent account (Bauer et al. 2007a), mainly based on the British experience over the past twenty-five plus years: from Literacy, to PUS, to Science-in-Society. Each of these phases is moved by a polemic, attributing a particular deficit, and encouraging particular research questions and forms of interventions. Contrary to the rhetoric of polemicists, this is not a narrative of progress, but one of multiplication of discourses. What might look like a chronology in Table 1 simply shows the relative age of discourses; the latter does not entirely supersede the former.

Science Literacy

The idea of scientific literacy sees science as an extension of the quest for reading, writing and numeracy. Furthermore, in a democracy, people

Table 1
Different Paradigms, Problems and Solutions

Period	*Attribution diagnosis*	*Strategy research*
Science literacy 1960s–1980s	Public deficit knowledge	Measurement of literacy education
Public understanding 1985–1990s	Public deficit attitudes	Know × attitude Attitude change Education Public Relations
Science-in-Society 1990s–present	Trust deficit	Participation deliberation
	Expert deficit Notions of public Crisis of confidence	 'Angels' mediators Impact evaluation

make political decisions. However, the public voice can be effective only if citizens command relevant knowledge. Thus, scientific ignorance, like political ignorance, only breeds alienation, demagogy and extremism.

The idea of literacy attributes a knowledge deficit to the public. This deficit model of the public calls for increased efforts in science education. However, it also plays into the hands of technocratic attitudes among decision makers: an ignorant public is not qualified to take part in decisions.

An influential concept of science literacy includes four elements: (*a*) knowledge of basic textbook facts of science, (*b*) an understanding of methods such as probability reasoning and experimental design, (*c*) an appreciation of the positive outcomes of science and technology for science, and (*d*) the rejection of superstitious beliefs such as astrology or numerology. This became the basis of the bi-annual science indicator surveys of the US National Science Foundation (NSF) from the late 1970s onwards.

The measurement of factual knowledge is the key problem of this paradigm. Knowledge is measured by quiz-like items. Respondents are asked to decide whether a statement of a scientific fact is true, false or whether they do not know. Some of these items have travelled far across the globe, and hit the news headlines.

Critics have argued that the essence of science is method, and not facts. Therefore, awareness of issues like uncertainty, peer reviewing, the settling of scientific controversies, and replication of experiments should be reflected in the assessment of literacy.

Since the 1970s, many countries have undertaken audits of adult scientific literacy: USA, Canada, China, Brazil, India, Korea, Japan, Bulgaria, Switzerland, Britain, Germany and France, as well as the EU, generally through Eurobarometer. The analysis of these data remains problematic. A possible problem of any comparison remains the fairness of the indicator. Countries have different science bases, and literacy reflects these science bases. The issue of unbiased literacy measures deserves more attention (Raza et al. 2002).

The critique of the idea of literacy focuses on several issues. Why should science deserve special attention? What about flower binding? What about history, accountancy or law? Arguments abound for the societal significance of knowledges other than scientific knowledge. The case for 'science literacy' has recently seen a renaissance with the efforts of the Organisation for Economic Co-operation and Development or OECD (PISA 2006). Its 2006 survey in seventy-plus countries assessed the performance in science and mathematics in primary education: this is likely to reopen the debate on adult literacy.

Public Understanding of Science

In the second half of the 1980s, new concerns emerge under the title 'public understanding of science'. This transition is marked by the influential report of the Royal Society of London of 1985. Like the previous literacy phase, the diagnosis is that of a public deficit. However, the attitudes to science are now fore-grounded. The public does not show sufficient support for science, and this is of concern to scientific institutions. The Royal Society took the view of many of its members and assumed that better knowledge will be the driver of positive attitudes; hence the axiom: 'the more you know, the more you love it'.

This research agenda moved away from knowledge to that of attitudes. The concern for scientific literacy carried over to test the expectation 'the more you know, the more you love it'. However, the emphasis shifted from a threshold measure to that of a continuum: one is not literate or illiterate, but more or less knowledgeable. And the correlation between knowledge and attitude becomes the main focus of research. But the expectation that better knowledge drives positive attitudes is not confirmed. Although overall there may be some relation, on controversial issues there is no correlation at all. Well-informed and less well-informed citizens are to be found on either side of the controversy. Social psychology, though not the Royal Society, knows for some time that knowledge is not a driver of attitude, but a quality index: attitudes that are based on knowledge—whether positive or negative—are held more strongly and thus resist change. Well-informed and less well-informed citizens make up their minds differently, but do not necessarily come to different conclusions.

PUS research extended its concepts, methods and data. Attitudes to science may be part of general political sophistication, a public resource not specific to science. The polemic over public deficits also stimulated complementary data streams, such as qualitative discourse analyses and mass media monitoring, which reveal long-term trends such as the medicalisation of science news over the last 30 years (Bauer 1998).

PUS had a rationalist and a realist agenda. For the rationalist, attitudes arise from information processing with a rational core. It is assumed that if people had all the information, and were able to understand probabilities, they would be more supportive of science. The battle for the public is a battle for minds with more information and the correct statistical reasoning (that is, correct risk perception).

For the realist, attitudes are emotional relations with the world. How emotions may relate to rationality is a vexing question. Realists understand emotions with the logic of advertising. Thus, the battle for the public mind becomes a battle for hearts. How to attract public attention? The issue becomes one of 'sexing up' evidence. The public is the consumer who is to be seduced. In this log, there is little difference between scientific news and washing powder.

The critique of PUS again focused on the deficit models of knowledge or attitude: negative attitudes are neither an expression of lack of knowledge nor of good judgment. However, the attribution of a public deficit expresses the timidity or even 'institutional neuroticism' (Wynne 1993), the diffuse anxieties and condescendence of scientific actors vis-à-vis the public. The public deficit model is in fact a self-fulfilling prophecy: the public, a-priori deficient, cannot be trusted. Mistrust on the part of scientific actors will be paid back in kind with public mistrust. Negative public attitudes then confirm the assumption among scientists: the public is not to be trusted. This circularity called for 'soul searching' among scientific actors.

Science in-and-of Society

Science-in-Society reversed the deficit idea: not with the public, but with the scientific institutions and their actors who have lost the trust of the public. Evidence of negative attitudes to science during the BSE crisis (early 1990s), the debate over GM food (late 1990s), and diverse social research led to the diagnosis of a 'crisis of confidence' in the famous House of Lords report of 2000. Science and technology stand in a relationship with society. A crisis of trust indicates a breach of contract that needs patching up. False conceptions of the public operate among scientists and in policy making, that is deficit concepts of the public, and these misguide communication efforts and interventions and alienate the public still further.

Many Science-in-Society activists are committed action researchers who do not separate analysis from intervention. The aim is to change science policy. This agenda, academically grounded as it may be, often ends up as political consultancy. Advice is offered on how to rebuild public trust. Public deliberation and participation is the Lord's road to rebuild trust. Event making is advocated: hearings, citizen juries, deliberative opinion polling, consensus conferencing, *tables rondes* (round table discussions) scoping exercises, science festivals, national debates, and so forth. As these events are costly and require know-how to organise, they become the remit of private 'angels' rather than civil servants or academics. 'Angels' are age-old go-betweens, however, here they not between heaven and earth, but between a disenchanted public and the institutions of science, industry and policy making. Thus, an industry emerges that exudes confidence by apparently knowing how to overcome this crisis of public trust.

The ethos of public participation was soon complemented by an ethos of evaluation. In the utilitarian spirit of modern politics sooner or later the question arises: And what do these science events bring (effectiveness)? What is their value for money (efficiency)? Are there any unintended consequences that are better avoided?

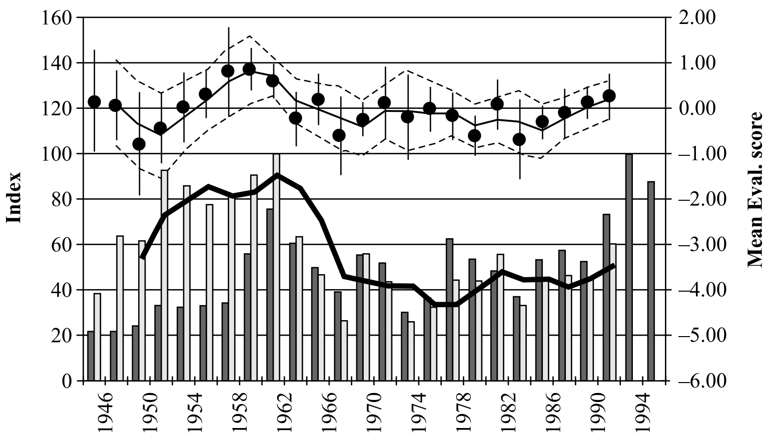
Ironically, to evaluate participatory policy makers re-turn to traditional ideas of public literacy of science research, running the risk of re-inventing the wheel of literacy, attitudes, interests and media attention, albeit this time for a different car, namely the evaluation of public deliberation. The re-entry of PUS via the backdoor of evaluation research is ironic but unavoidable. I spend much of my public speaking reminding people of what we already know in order to avoid the inefficiencies of re-invention of the wheel.

Evidence of Change in Public Understanding

In this context, assessing the evidence of changes in PUS becomes highly relevant. I will present two kinds of data streams. First, there is the evidence for changes in the public attention to science taken in mass media monitoring over a longer period of time. Second, I will report on large scale comparisons for scientific literacy, attitudes and interest, across very different contexts and over time, from 1989 to 2005 in Europe.

Figure 1 shows the coverage of science and technology in the British press between 1946 and 1992 (Bauer et al. 2006). This is a study we completed in the mid-1990s and since seek to update. Among other things, we asked ourselves how much science coverage there was, and how does news relate to science, positively or negatively. The figure shows that the presence of science in the public is not a constant, nor is its evaluation.

FIGURE 1
Science and Technology in the British Press, 1946–1992: Intensity and Evaluation



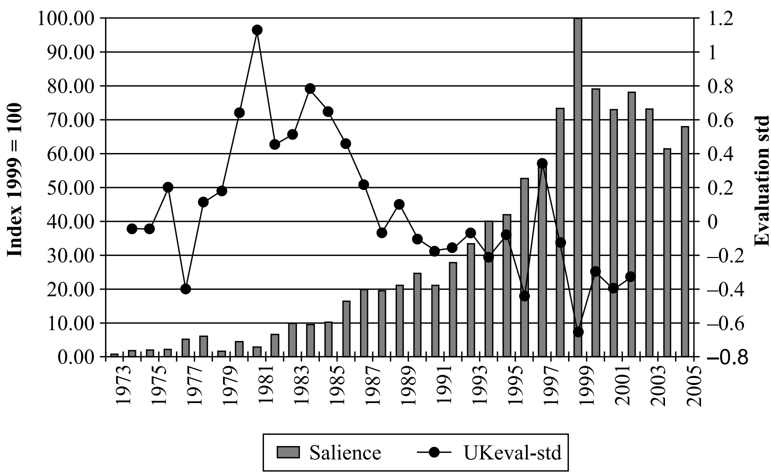
Source: Bauer et al. 2006.

There are two kinds of intensity figures: one is the estimate of absolute numbers of articles; the other relative to the news space, which expanded enormously since the 1940s when there was paper rationing. Public attention peaked in the early 1960s, declined into the 1970s, and seems to recover since. The moving average is like a heat indicator of science. The relative figures clearly mark the peak in the early 1960s, which as it seems has not been recovered since.

Evaluation equally fluctuates—this fluctuation, however, is not entirely parallel to news intensity. Only in the 1950s does more news also mean good news. Here we are in the post-war era and its enthusiasm for 'atoms for peace' and the roll out of civil nuclear power that carries public opinion. In the second half of the 1960s, the British press turns more sceptical and remains so, only to recover a trend towards more positive tone into the 1990s. It might well be that this shows the influence of the Royal Society's 1985 appeal to more coverage and more positive coverage on the part of the mass media.

Figure 2 shows what happened since the 1970s: biotechnology news (answering to keywords like genetics, genes, cloning, biotechnology and so on) in a single British newspaper (see the bar chart in Figure 2). Coverage reaches its peak in 1999 with the 'Great Food Debate' over genetically modified crops and derived food products. Our score shows more than 1600 references in a daily paper in one year. This was a news event, though not at the level of war (Iraq) or terrorism (Northern Ireland; 9/11 in New York or 7/05 in London).

FIGURE 2
Intensity of Biotech News in the British Press, 1973–2002: Intensity and Evaluation



Source: Bauer 2007; Gaskell and Bauer 2006.

The line graphic shows the tone of the news, deviating from the overall positive average. It shows highly positive news in the early 1980s, then with rising news intensity the declining enthusiasm of commentary. After 1996, with the arrival of GM crops and Dolly the sheep, news became rather erratic, but stayed overall with a more sceptical tone. These two graphics suggest the following:

- The flow of science news in British society, and probably elsewhere, is not a constant.
- The tone of evaluation of science news is similarly not a constant.
- Negative news is not an expression of an anti-scientific complex: overall science news and genetic news do not run in parallel. They do from 1946 to the 1970s—since then they part ways. General science news becomes more positive again; biotechnology news is treated in a more sceptical manner.
- Contrary to assumptions of a natural cycle of public attention, science news does not move from initially negative news and public outcry to more considerate and positive news with time (such as, Haldane 1925). To the contrary, initial hype, as with new genetics, gives way to more considered coverage later.

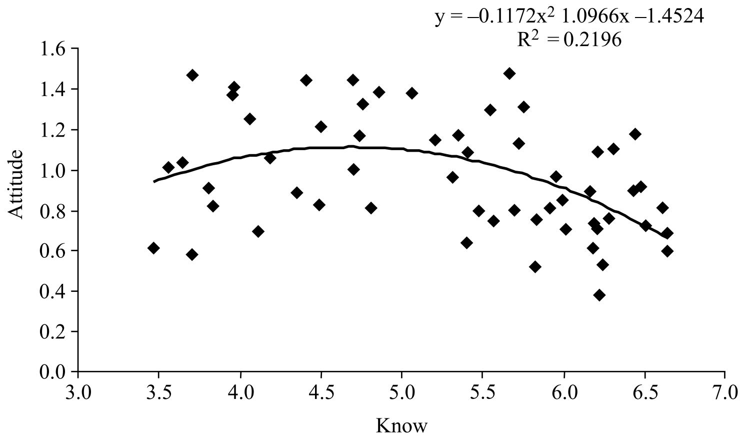
Industrial and Post-industrial PUS

Let us now turn to the evidence of changing PUS that emerges from comparative survey research. Some years ago (Bauer et al. 1994) wanted to put to rest the debates over the knowledge-attitude model of the Royal Society: 'the more you know, the more you love it'. This was not so much a false observation, but one that was not universally valid. We called our model the post-industrial model of PUS: as a society moves along the axial transition from an industrial to a post-industrial and knowledge intensive economy, the distribution and relation between people's knowledge, their interests and attitudes to science fall differently.

A recent collaboration with Indian colleagues allows us to test this idea. We are dealing with large scale observations of knowledge and attitudes in very different socio-economic contexts: 30, 000 interviews in twenty-three Indian states and 32, 000 interviews across thirty-two Europe states and beyond. This database allows us to measure both literacy and attitudes and relate these two measures as national indicators.

The results confirm what was initially observed across Europe in a global context. Moving along the scale of economic development, as indicated by Gross Domestic Product (GDP) per capita, people are generally more knowledgeable of science, not least because education is the key driver of scientific literacy and economic development. If we compare literacy levels with aggregate attitudes to science (see Figure 3: two attitude items combined: 'S&T makes our lives more comfortable, easier,

Figure 3
The Correlation between Knowledge and Attitude to Science across India and Europe

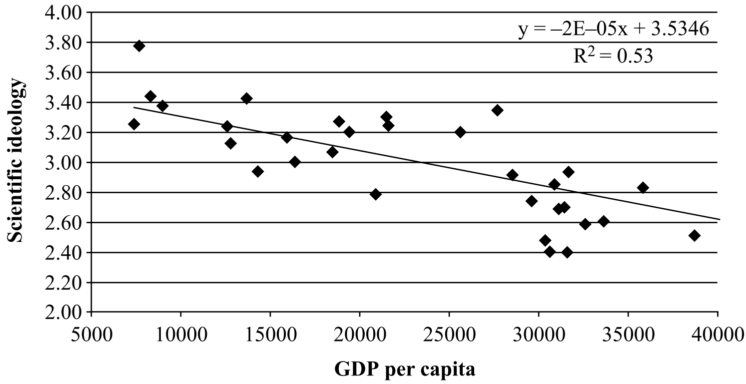


Sources: Eurobarometer 2005; NCAER 2004.

and healthier'; 'Scientists should be allowed to experiment on animals'), we find the non-linear relationship that we predicted. India lies generally on the left side of the development scale, Europe on the right hand side. As Indian states move up the knowledge scale, so do positive attitudes; while in Europe more knowledge comes with more sceptical attitudes. Overall we can model this with an inverted U-shape relationship between knowledge and attitudes. It seems that somewhere on this axial transition the inversion occurs: below a certain level knowledge drives positive attitudes, beyond that point knowledge drives sceptical attitudes towards science. This is only cross-sectional evidence, comparing European and non-European contexts. A conclusive test of the post-industrial PUS hypothesis, a dynamic model, requires longitudinal evidence in any one of these contexts.

Eurobarometer 63.1 (2005) included four propositions, each one of them expressing a philosophical postulate of science. People were asked to agree or disagree with each of them: science is omnipotent; science is part of the solution not the problem; science will one day provide a complete world picture; and science should have full autonomy. Statistically, these items form a consistent scale, positioning people with regard to the ideology and myth of science.

FIGURE 4
The Correlation between GDP and Endorsing the 'Myth of Science'



Source: Eurobarometer 2005.

By plotting the average scores of 'scientific ideology' we find a negative correlation with level of socio-economic development across Europe. As economic development and science literacy increase, belief in scientific ideology decreases (correlation is $r = -0.74$). The negative correlation between knowledge and the myth of science also holds at the individual level (not shown here). In European countries which are low on the GDP scale, the correlation between knowledge and myth of science is positive—the more literate you are, the more you subscribe to the ideology of science. As you move to the higher end of the GDP scale, this correlation becomes ever more negative: the more you know, the less likely you are to subscribe to a view that science is omnipotent, always part of the solution, will offer a complete world picture and should have no constraints. Our analysis of the same data also shows (not shown here), that the rejection of an ideology of science goes together with a utilitarian view of science: it depends on the consequences, case by case.

- These comparisons show that for once and with regard to public understanding of science, the Royal Society's 1985 view is not universally true, but particular. The operational axiom 'the more you know, the more you love it' might be correct in the context of a developing and industrial society. But in the knowledge intensive post-industrial context this is no longer the case, rather: 'familiarity might breed (some) contempt' (or at least a sceptical loyalty).

- Furthermore, the educated publics of Europe are more and more sophisticated as to their image of science. Citizens are less impressed by views of science which amount to a modern 'myth of science'. The more knowledgeable people are, the less they are inclined to ideological views of science; they assume a more utilitarian assessment.

Changes across Europe: 1989 to 2005

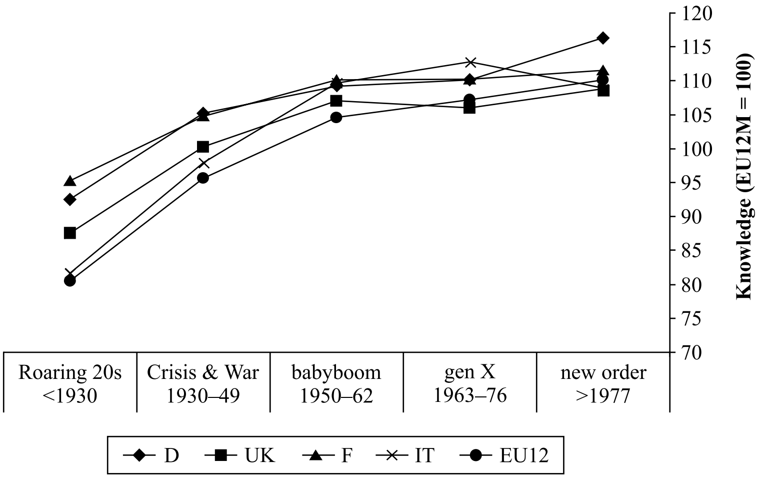
What is the evidence of longitudinal change? I have recently embarked to construct a European database of all comparable surveys of public understanding since the 1970s.[2] This database will allow us to look at four waves of questions asked in twelve European countries four times since 1989. Each survey collected 1,000 interviews across EU-12 and we have about sixty comparable questions.

We can now construct age cohorts across these different surveys (technically speaking these are quasi-cohorts because they were constructed ex-post). This means we regroup for each survey the respondents born in a particular period of European history. A cohort is defined as entering a system at the same time. This gives us a virtual view of historical developments across different generations and their experiences.

We defined five cohort groups: Roaring 1920s, War and Crisis, Baby Boomers, Gen X and New Order (see Appendix). For each of our variables—knowledge, interest and attitude—we can now trace the virtual trajectory through five generations and compare these in twelve EU countries.

Let us look at knowledge in Figure 5. The overall picture is one of increasing knowledge with generations. The large step was from Roaring 20s to Baby Boomers—little has been moved since then. One can compare the different countries for each generation, but we would probably be most interested in the more recent generations, as they carry the 'torch of the future'. The ordering between the countries seems to be rather different in Generation-X and New Order. For example in Italy, there is a significant decline in scientific knowledge from the generation of the 1960s to that of the 1980s. In the UK, it seems that the Baby Boomers are the leaders in scientific literacy, not to be rivalled by later generations.

FIGURE 5
Knowledge of Science and Generational Cohorts

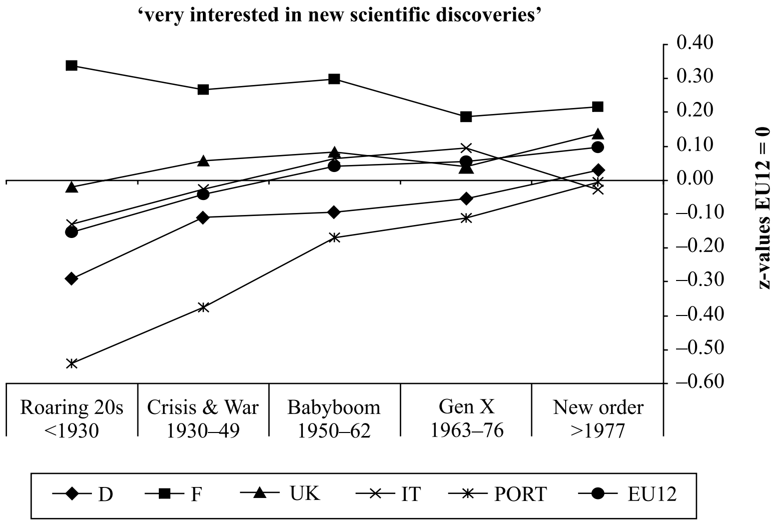


Source: Bauer et al. 2008.

Let us look at interest in science in Figure 6. Overall, EU unification manifests itself in converging levels of scientific interest among the later born generations: we see an overall regression towards the mean, and declining variance. France shows an inter-generational decline of interest in science, Germany and Portugal show continuous increase, most accentuated in the latter. In Italy and the UK, there were ups and downs. The Italian New Order generation is clearly less interested in science than its predecessor, the Gen X of the 1960s.

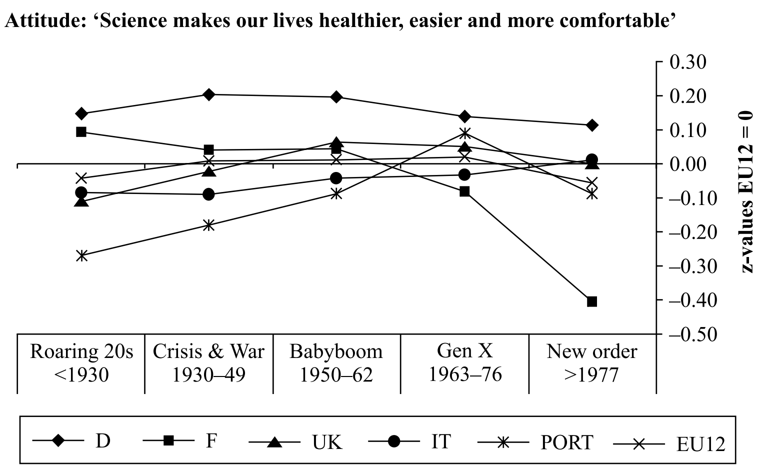
Finally, let us look at attitudes to science in Figure 7, in particular the expectation that 'science makes our lives more comfortable, easier, and healthier'. The picture, in contrast to interest, is one of divergence rather than convergence across Europe. Overall, the Baby Boomers and Generation-X are the most positively inclined in their view of science. While Germany shows very little inter-generational difference, and rather positive attitudes; the Portuguese are on a bumper ride, the New Order with less positive attitudes than their predecessors. On the other hand the French are in secular decline with their positive view of science, the war generation being the most positive of all.

FIGURE 6
Interest in Science and Generational Cohorts



Source: Bauer et al. 2008.

FIGURE 7
Attitude to Science and Generational Cohorts



Source: Bauer et al. 2008.

These data show us diverse trajectories of PUS across the Europe EU-12 with the following conclusions:

- Data integration carries enormous potential to create indicators of cultural, inter-generational dynamics.
- This dynamics is likely to be different in different contexts which would suggest that we are tapping into a 'scientific culture' with a specific dynamic that needs to be explained.
- Knowledge is overall increasing across the generations in all contexts; while the literacy of different generations rank order differently across different countries.
- Interest is converging across generations. Some countries shows secular decline, while others show increase in scientific interest.
- Attitude to science shows very diverse inter-generational dynamics in different countries.

Mapping the Societal Conversation of Science: Distances and Topography

The article ends with some speculation on where this all might lead to and come together. The public understanding of science always had a double nature. It is on the one hand a field of activity of outreach from science to the public. This includes traditional activities like lecturing, writing popular books and organising science museums, to making radio and television programmes, to more recent science centres, cafe scientifique, and consensus conferences and deliberative forums on controversial matters. It seems that this field of activity has expanded considerably over the last ten or more years, internationally. On the other hand, PUS is a small field of social scientific research full of common sense speculations. After all, it is rather difficult to step out of common sense and to be scientific about common sense.

Faced with the task of describing the evolution of public understanding of science, one faces an evolution with two strands: first, the evolution of discourse from Science Literacy to Science and Society with its polemic over the notion of 'public deficits'; secondly, the evidence on substantive changes in the public's relation to science.

The presence of science in public conversations, as indicated by media presence, is not a constant. It comes in waves, one in the 1950s and 1960s, and again since the 1990s to the present.

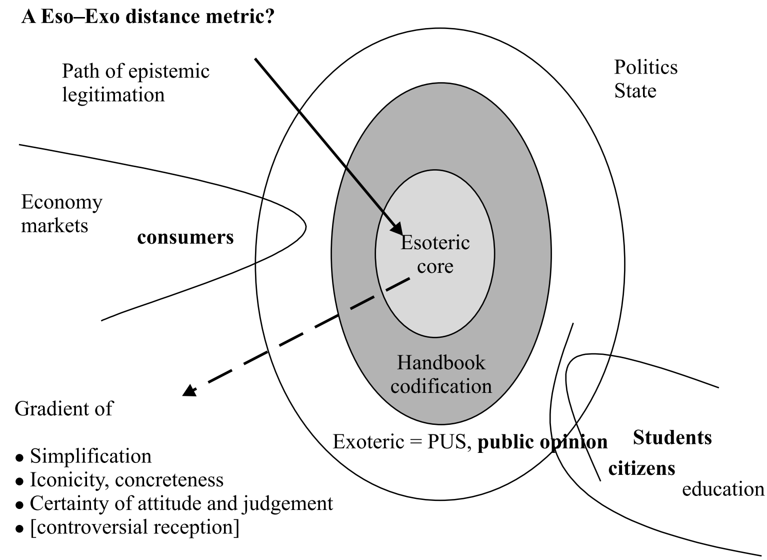
The survey evidence shows that the public understanding of science might be significantly different in an industrial-developing context and a knowledge-intensive developed context. In the latter, more knowledge does not bring more support for science. Rather, it brings in utilitarian scrutiny, and an end to widespread beliefs in ideology and myths of what science might be.

Contrary to the tenants of the 'public deficit' idea, I do not consider a sceptical public as a problem, rather as a resource that needs to be maintained and invested in. This is particularly important as science becomes a greater part of the private sector, operating within a commercial logic. In this context, a critical public is an asset rather than a problem for the future of science (Bauer 2008b; Bauer and Gregory 2007).

But to establish what proportion of the public is critical of science, and to spread worry about this, has not been my purpose today. My main point is to demonstrate the viability of indicators of PUS, both in the context of large scale international comparisons, but also longitudinally over time. Such indicators are important to map out the changing relations between science and society, which is both a historical and a global variable. This is very much the future of survey research in PUS. Surveys are ultimately, despite their reputation as the 'Gold Standard' of social research, just snapshots in time. If we are seriously interested in dynamics and processes, we need to consider repeated measures and advocate the survival of such measures in a time of short memory and shifting agendas, but we also need to consider complementary data streams such as media monitoring and discourse mappings (Bauer et al. 2007b).

It might be informative to go back to a classical text in the sociology of knowledge by Fleck (1935) on the 'making of a scientific fact'. Fleck suggested an image of concentric spheres of science, similar to a planetary system of a centre and circulating peripheries (see Figure 8). With this core–periphery model of science, Fleck intimates that an esoteric centre of scientific activity is surrounded by concentric exoteric genres of public communication such as handbooks and textbooks, popular science productions, mass media coverage of science and everyday conversations. As we move from the esoteric to the exoteric spheres, things get simplified, more concrete and more certain in judgement, exactly what one expects popular science to do: tell us how things are or how they are not, the known knowns and the known unknowns!

FIGURE 8
Concentric Sphere of Science Communication



Source: Dervied from Fleck 1935.

Fleck claims that scientists depend on these exoteric circles not only for social legitimacy but also for epistemic reassurance. Public communication is the elixir of life of science. Thus, the public opinion of science is not an epiphenomenon of scientific activity that can be considered or dismissed at a whim. To the contrary, it is a crucial feature of its operations and a condition of continuity. It is also important to recognise that this Eso–Exo relationship cannot be accounted for as mutual deficits. First and foremost, relationships are characterised by relative distance and quality of conversations. And this topography must be our research focus.

Thus, the problem of PUS research for the future will be to map the esoteric-exoteric distance of the public conversation from science. To make this an informative exercise, this must be an international exercise based on comparable data streams, like Eurobarometer has achieved to some extent across Europe. At a conference in November 2007 at the Royal Society in London, an international team of researchers began to inventory the existing databases and to assess their comparability. We have even attempted to construct a 'Cultural Indicator of Science', giving each country an index value similar to the Human Development Index (Shukla and Bauer 2007). The idea of measuring a cultural distance between science and the public is not an entirely new idea, but emerges from discussions with Indian colleagues (Raza et al. 2002). In time such measures of distance will make useful tools to evaluate the current proliferation of scientific events. How do these events scale up from local activities to the scientific culture of the nation and its conversations? Do they increase or decrease the science–society distance? These events are designed to decrease distance and to create a certain quality of relationships, but do they really achieve what they set out to achieve? This is an eminently empirical question. Good intentions are no substitute for outcome monitoring. Like for any strategic action, there are potential unintended negative consequences that deserve attention (Weingart 2001).

Like other relationships, science–society is not just a matter of distance, but also one of quality. We need to explore in some detail how different groups, maybe in equidistance from science, relate to its achievements and propositions. Here the analysis of generational cohorts in different contexts might be the way forward. Knowledge matters, but differently in different contexts. A highly educated person in India, Turkey or Brazil might relate differently to science than a highly knowledgeable person in Sweden, Germany or Italy. It will be a key problem for future research on the PUS to compare the social representations of science across different milieus and historical contexts with all the available tools of social research and with the necessary reserve of judgment.

Appendix

The definition and characterisation of age cohorts in the integrated Eurobarometer database:

- New Order, born 1977: this is the youngest cohort of respondents, growing up after the end of the Cold War and waking up to the rhetoric of the 'new world order' and the final victory of the capitalist style of economy, and living through the rhetoric of an IT and biotech 'revolutions' of the late twentieth century. This is the generation of the personal computer (PC) and Internet euphoria of 1995–2000.
- Generation X is the generation born between 1963 and 1976. They are the outcome of the birth control 'revolution' and grow up through the oil crisis

of the 1970s, and the nuclear issues of the 1980s, the anti-nuclear protest, nuclear armament debates and the Star Wars initiative.

- Baby boomers are born between 1950 and 1962. They grow up in the optimism and modernisation drive of the post-war period. They witness the longest period of economic prosperity in history. During this period Western societies become ‘affluent’ and free of material concerns. This generation is the protest generation of the 1970s, with idealistic worldviews. They are more sceptical with regard to progress and its link with science and technology.
- War and crisis were born between 1930 and 1949. This generation witnessed World War II and formed the immediate after-war generation entering the Cold War. This generation also carried the ‘nuclear enthusiasm’ of the 1950s, which promised a scientific revolution and ‘energy too cheap to meter’ in the atomic society.
- The Roaring 20s, finally is the generation born before 1930, growing up through the buzzing period of the 1920s which ended in the big crash of 1929 and the economic crisis that followed.

NOTES

1. An earlier version of this article was presented as a public lecture on the occasion of the twentieth anniversary of the Science Day at the Spoleto Festival in Italy, 12 July 2005 sponsored by Fondazione Sigma-Tau.
2. This is a project funded by the German data archive in Koln (GESIS) and integrates Eurobarometer surveys on perceptions of science from 1977 to 2005. The final database should be in the public domain later in 2009.

REFERENCES

Bauer, M.W. (1998), ‘The Medicalisation of Science News: From the “Rocket-scalpel” to the “Gene-meteorite” Complex’, *Social Science Information*, 37(1), pp. 731–51.

——— (2007), ‘The Public Career of “Genes”—Trends in Public Sentiment from 1946 to 2002’, *New Genetics and Society*, 26(1), pp. 29–45.

——— (2008a), ‘Survey Research and the Public Understanding of Science’, in M. Bucchi and B. Trench (eds), *Handbook of Public Communication of Science and Technology*. London: Routledge, pp. 111–30.

——— (2008b), ‘Paradigm Change for Science Communication: Commercial Science Needs a Critical Public’, in D. Cheng, M. Claessens, T. Gascoigne, J. Metcalfe, B. Schiele and S. Shi (eds), *Science Communication in Social Context*, Chapter 1. New York: PCST/Springer, pp. 7–25.

Bauer, M., J. Durant and G. Evans (1994), ‘European Public Perceptions of Science’, *International Journal of Public Opinion Research*, 6(2), pp. 163–86.

Bauer, M.W. and J. Gregory (2007), 'From Journalism to Corporate Communication in Post-war Britain', in M.W. Bauer and M. Bucchi (eds), *Science, Journalism and Society: Science Communication Between News and Public Relations*. London: Routledge, pp. 33–52.

Bauer, M.W., K. Petkova, P. Boyadjieva and G. Gornev (2006), 'Long-term Trends in the Representations of Science Across the Iron Curtain: Britain and Bulgaria, 1946–95', *Social Studies of Science*, 36(1), pp. 97–129.

Bauer, M.W., N. Allum and S. Miller (2007a), 'What Have We Learnt From 25 Years of PUS Research—Liberating and Widening the Agenda?' *Public Understanding of Science*, 15(1), pp. 1–17.

Bauer, M.W., R. Shukla and N. Allum (2007b), 'International Indicators of Science and the Public', Technical Summary of the Proceedings of an International Workshop held at the Royal Society, London, LSE, 5–6 November 2007. Retrieved from http://www.psych.lse.ac.uk/socialpsychology/events/seminars/2007–08/SummaryRoyalSocietyws2007_PUS.pdf, accessed 15 June 2008.

Bauer M., R. Shukla and P. Kakkar (2008), 'The Integrated Data on Public Understanding of Science [EB_PUS_1989–2005], Codebook and Un-weighted Frequency Distributions', London and Delhi, LSE & NCAER, November.

Fleck, L. (1979 [1935]), *Entstehung Einer Wissenschaftlichen Tatsache*. Frankfurt: Suhrkamp.

Gaskell, G. and M.W. Bauer (eds) (2006), *Genomic and Society. Legal, Ethical and Social Dimensions*. London: Earthscan.

Haldane, J.B.S. (1925), *Daedalus, or Science and the Future*. London: Kegan Paul, Trench, Trubner & Co.

Luckmann, T. (1995), 'Der kommunikative Aufbau der sozialen Welt und der Sozialwissenschaften', *Annali de Sociologia*, 11(1), pp. 45–71.

Programme for International Student Assessment (PISA) (2006), *Science Competencies for Tomorrow's World*. Paris: OECD.

Raza, G., S. Singh and B. Dutt (2002), 'Public, Science and Cultural Distance', *Science Communicaiton*, 23(3), pp. 292–309.

Shukla, R. and M.W. Bauer (2007), 'Science Culture Index—Construction and Validation', Concept paper. London and Delhi: LSE and NCAER.

Weingart, P. (2001), 'The Loss of Distance: Science in Transition', in G.E. Allen and R.M. MacLeod (eds), *Science, History and Social Activism: A Tribute to Everett Mendelsohn*. Amsterdam: Kluver Academic Publishers, pp. 167–84.

Wynne, B. (1993), 'Public Uptake of Science: A Case for Institutional Reflexivity', *Public Understanding of Science*, 2(3), pp. 321–38.