MYTHS OF THE PSYCHOMETRIC PARADIGM AND HOW THEY CAN MISINFORM RISK COMMUNICATION

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Lennart Sjöberg[2]

Abstract

Extensive research on risk perception has led to a received view (the psychometric model or paradigm), which stresses that members of the public react negatively to technology whenever it (a) is new, (b) causes "dread", and (c) there is low trust in experts and organizations concerned with managing the risk. Experts, on the other hand, are said to be "objective" and unaffected by "subjective" factors. However, this research has used the same - misleading - methodology in almost all cases and the fact that some of the results have been "many times replicated" is therefore irrelevant to its validity. Analyses of the psychometric model have repeatedly shown that it leaves most of the variance of perceived risk and policy attitudes unexplained. A closer look at several decades' work shows that (a) novelty carries little weight in risk perception, (b) "dread" has not been measured in an appropriate manner and is little powerful, and (c) social trust has a marginal influence as compared to trust in science, epistemological trust. Furthermore, antagonistic attitudes are common and important. Experts exhibit the same structure and level of risk perception as the public; unless they assess risks, they are responsible for managing. In that case, they judge the risk to be drastically smaller than the public does. The importance of epistemic as opposed to social trust stresses the need to take peoples' concern seriously, not only establish good social relations. The finding that antagonistic attitudes are common and important suggests that being "respectful of people's feelings" will not be sufficient to establish trust. Failures of risk communication can probably be explained to some extent by the fact that practitioners rely on the misleading notions of the psychometric paradigm.

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Peoples' reactions to risky technologies have been in the focus of policy debates since the 1960's. It appeared to many that *risk* was the key to understanding the policy problems. Early work by Starr showed that "real risk", as measured by accident statistics, did not suffice to account for "societal acceptance" of technologies (Starr, 1969). Starr suggested that one must also take into account if activities involving such technologies are perceived as voluntary or not, and this suggestion stimulated a number of authors to speculate about somewhat different interpretations[3]. The development of research on these matters during the 1970's did not lead

[1] . Work supported by a grant from the Social Science Research Program of the Swedish Nuclear Fuel and Waste Management Co (SKB).

[2] . I am indebted to Peter Sandman and Andreea Vintila for their comments on the manuscript.

[3] . Traveling on a bus is safer that driving your own car by a factor of 10, but is hardly less "voluntary".

to agreement about factors of perceived risk, but few if any questioned the relevance of focusing on risk rather than other possible dimensions. The stage was set for empirical research on perceived risk.

It should be noted that initial work on risk perception was concerned with policy matters and related political attitudes, nuclear power policy being the prime example. However, later work on lifestyle risks, arising from risk-taking behavior, has shown that similar factors enter the picture as in the case of policy matters (Sjöberg, 2004b). The present paper will deal mostly with policy but what is said is largely relevant also for lifestyle risks. Health communication and risk communication are often treated within the same conceptual framework (McComas, 2006).

It is obvious that successful risk communication should be facilitated by knowing how people think about risks. On the other hand, if such knowledge is faulty or incomplete, communication is hampered. Since the risk communication literature mainly relies on the psychometric paradigm, the present paper will analyze that paradigm critically and in detail. The agenda of a recent symposium on risk communication, organized by the US National Science Foundation, states:

> "Research in risk perception has been guided by the psychometric paradigm. From its beginning, this approach was fundamentally quantitative and empirically driven, with theories arising from analyses of observations and experiments. Agreement exists regarding the importance to risk perception of specific factors such as information context, uncertainty, trust, control, voluntariness, and emotional response." (<http://www.ramas.com/riskcomm1.htm#agenda>, retrieved May 13, 2006).

Ropeik (Ropeik, 2004) is an example of the many papers which summarize the psychometric model and presents a list of the traditional risk attributes claimed to be important for understanding risk perception. And, as so many others, it does so without a hint that the model may be misleading. One of the best-known risk consultants, Peter Sandman, based his "outrage" model on the factors specified in the Psychometric Model (P. M. Sandman, 1987; P. M Sandman, 1989; P. M. Sandman, 1993; Weinstein & Sandman, 1993). Sandman's work is impressive and stimulating, but it is limited by its reliance on a model, which only explains risk perception in a very limited sense, as we shall see.

It is of course not claimed here that the psychometric paradigm is the sole basis for risk communication in theory and practice. It is clear, however, that it is an important part of current thinking about risk perception and risk communication.

The psychometric paradigm was initiated in 1978 in a paper proposing the Psychometric Model of risk perception (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978). The model implied, or so it seemed, that perceived risk was strongly determined by two factors: novelty and dread. Nuclear power was, at the time, perceived as new, and dreaded. This finding appeared to explain the strong negative reactions to nuclear technology. Similar conclusions were drawn about other kinds of more or less hazardous technologies.

The psychometric model exists in at least three different versions, depending on which attributes of hazards are included. The most common version is probably the one discussed here, which is based on factor analysis of the attributes, amounting to the two over-arching factors of novelty and dread. The original lists of attributes included several aspects which may have been forgotten by some researchers and practitioners. Sandman stressed this point

(personal communication, May 18, 2006) and his original 12 outrage components, which include fair-unfair, morally relevant - morally irrelevant and natural-industrial, as well as some which seem somewhat less interesting such as memorable - not memorable

Around 1990, results were published on social trust, which was suggested as another powerful determinant of perceived risk (Slovic, Flynn, & Layman, 1991). These results, together with the original model, could be summed up as implying that people's reactions to hazardous technologies were dependent on how they perceived core properties of the technologies (novelty and dread), and how much they trusted experts and organizations responsible for risk management with regard to these technologies.

In current discourse, affective reactions and feelings are held to be of great importance for understanding risk perception (Loewenstein, Weber, Hsee, & Welch, 2001). Part of the support for this statement comes from the traditional concept of dread. Part of it comes from the newer work on an "affect heuristic" (Finucane, Alhakami, Slovic, & Johnson, 2000), which is based on the solid evidence for a correlation between attitudes and perceived risk. People with a positive attitude to an object also tend to perceive that it is of low risk. The bridging of this finding with the dread concept is done by widening the meaning of the word affect to include also attitude, creating considerable coinfusiuo9n (Sjöberg, 2006). See Fig. 1 for a summary of the received message from the psychometric paradigm, in its current form.

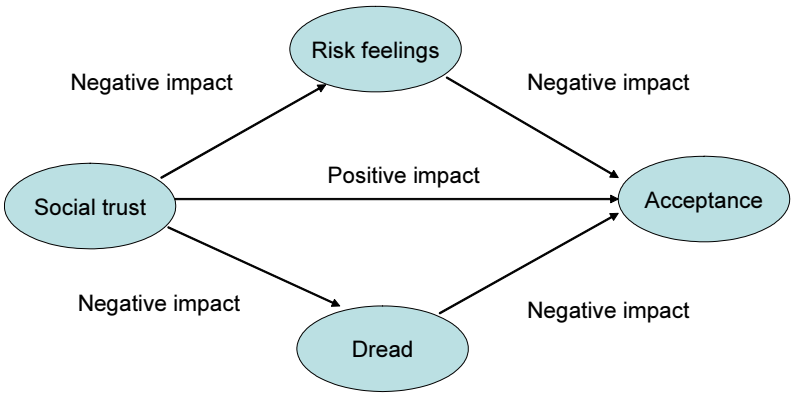

Fig. 1. The received psychometric model/paradigm of trust and risk acceptance.

The psychometric paradigm also considers the difference between experts and the public. It is well known that experts' risk assessments often diverge dramatically from the risk perceived by members of the public. A small group of risk assessment experts was studied within the psychometric paradigm and it was found that their risk assessments were in good agreement with the facts, and different from those of members of the public (Slovic, Fischhoff, & Lichtenstein, 1979).

The results within the psychometric paradigm appeared to be very much common sense and were readily accepted as giving a correct analysis of perceived risk and related attitudes. Another reason for their acceptance was probably the very high correlations reported between perceived risk and the psychometric factors (dread and novelty) - in the neighborhood of 0.8 when calculated for mean ratings. It was probably not generally realized that means, when estimated across a large sample of individuals, have much less random error than individual values and therefore can be expected to be more readily accounted for than individual values[4].

[4] . This fact is well known in social science, and has been termed the "ecological error" (Robinson, 1950).

When the latter were analyzed, the correlation level dropped from 0.8 to about 0.2[5] (Gardner & Gould, 1989; Sjöberg, 2002b).

However, later work has not supported the basic tenets of the psychometric paradigm. In the present paper, I develop a critical analysis of the psychometric paradigm and illustrate some of my points with new results from an ongoing survey study of risk perceptions and attitudes to a nuclear waste repository. These data were obtained in 2005-2006 from random samples in three Swedish municipalities, as well as a national sample, using a mailed survey. About 2000 respondents took part in the study. The response rate was about 51 percent. The three municipalities were Östhammar and Oskarshamn, where there is currently a study of feasibility for siting a repository, and Finspång, which was used as a control community. They are all small communities, population about 25 000 each, situated in the middle and south of Sweden

Critical analysis of the psychometric paradigm

Several points should be stressed.

1. It is not obvious that *risk* is the most powerful explanatory concept when it comes to accounting for policy attitudes[6]. Risk has two facets: probability and consequences. The probability of a negative event is closely related to perceived risk, but policy attitude, such as demand for mitigation, is mostly related to the severity of consequences (Sjöberg, 1999a). This finding is related to Sunstein's concept of probability neglect (Sunstein, 2002, 2003) and to the currently commonly applied and much debated precautionary principle. One of the primary aspects of severity of consequences if that of substitutability. An important technology, which cannot easily be substituted, tends to be accepted, given that risk is at a low level (Sjöberg, 2002c). Current debates about nuclear power show, in many countries, how this works: nuclear power is being reinstated because it has been managed well and without accidents, and because substitutes are expensive or environmentally harmful.

2. Furthermore, there are risks and risks. We found very early in our empirical work that people make a very clear distinction between risks to themselves (personal risks) and to others (general risks) (Sjöberg & Drottz, 1987). Weinstein had discovered this earlier, of course, and wrote about unrealistic optimism (Weinstein, 1980). We found that personal risk was as important as general risk with regard to policy attitudes toward the environment and technology related hazards. For life-style risks, general risk was more important (Sjöberg, 2003a) We also found that non-specified risk, i. e. when no target for the risk is explicitly stated, as practiced in the psychometric paradigm, was judged in very much the same way as general risk (Sjöberg, 2003a). Hence, the psychometric tradition got a wrong start by studying the type of risk least relevant for policy issues.

[5] . One of the more surprising twitches of the debate about risk perception models is the argument that correlations are inadequate to measure the strength of a relationship, see my discussion in Sjöberg (Sjöberg, 2003b). Correlations are of course suitable in all ordinary applications where it is desired to test how well one or several independent variables account for a dependent variable – the typical application in testing models and theories.

[6] . Attitudes to policy issues, such as siting a waste repository in one's municipality.

3. The two basic Psychometric Model dimensions of novelty and dread fail to account for much of the variance of perceived risk. In particular, there is no solid evidence that novelty is a factor in risk policy attitudes or even in perceived risk. Dread may, or may not, be of some importance but a close look at the definition of dread shows that it is measured wholly, or mostly, with non-emotional components which can be best summarized as measuring the perceived severity of consequences (Sjöberg, 2003d). The dread variable, by itself, is not a powerful explanatory concept. This finding does not imply that emotions are not important in risk perception, only that the evidence for their importance is lacking in the psychometric paradigm. More about this later.

4. Social trust is a rather weak factor in risk perception and related attitudes (Sjöberg, 1999b). Two other dimensions have turned out to be more important: epistemological trust and antagonism (Sjöberg, 2001, 2004a; Sjöberg & Herber, in press). People are suspicious about a technology when they doubt that the scientific basis of risk assessments of that technology is not solid enough. They are also suspicious when they believe that it is being implemented in the interests of others who do not care about their welfare or are even hostile to it.

   Trust in science, or epistemic trust, is more important than social trust (Sjöberg & Herber, in press). This conclusion is based on regression analysis. Simple frequency data tell the same story. As much as 28 percent in my recent nuclear waste study answered that a repository could have negative effects unknown today (to a large or a very large extent). Only 7 percent believed that it could have positive effects unknown today.

   Perceptions of antagonistic interests in society are common. Risk communicators have at times been naive in assuming, more or less implicitly, that people share the goals and values of industry and/or politicians in power. The question about antagonistic interest was posed in the present study. For nuclear industry, 26 percent stated that it was rather, much or completely antagonistic to the interests of the respondent. The value was lower for regulatory authorities (about 18 percent) but still large.

   A related aspect of importance is the very common feeling among members of the public that they have no influence on policy (Sjöberg, 1996b, 1997). Such a feeling leads to alienation and rejection of proposed policies. In the national sample, 40 percent stated that they had rather or very small possibilities to influence policy on nuclear waste in their municipality. The number was about 10 percent lower in Oskarshamn and Östhammar, but still large enough to form a cause for concern.

5. Experts have risk perceptions, too. These risk perceptions are not very different *in structure* from those entertained by the public. Experts are people, and though their risk assessments are the best we have, they need to be taken with a grain of salt. In our work we have found that experts make much lower risk judgments of a technology whenever their professional role involves a responsibility for handling that very technology, but not otherwise (Sjöberg, 2002a). For example, a group of experts on nuclear waste and ionizing radiation made very low risk judgments of all matters related to nuclear technology but judged radon gas (another radiation risk, and a natural hazard) to be as dangerous as the public judged it (Sjöberg & Drottz-Sjöberg, 1994). Another example comes from our work on food related risks (Sjöberg, 2003b). Experts distinguished very clearly between risks, which were the responsibility of

individual consumers, and risks with which they had some professional connection. Only the latter risks were judged as very much smaller than the public did (Sjöberg, Oskarsson, Bruce, & Darnerud, 1997). Hence, experts' risk judgments are probably different from those of the public not only due to their knowledge. Experts may have become experts because of a self-selection process involving low perceived risk to begin with. We found high-school students to exhibit risk perception strongly correlated with line of study (Drottz-Sjöberg & Sjöberg, 1991). Once the process of advanced study and later socialization in a work environment sets in, these tendencies can be expected to increase in strength. After all, who can and wants to survive in an environment, which you see as destructive to your fellow human beings?

The role of emotions re-assessed

Traditional arguments within the psychometric paradigm for the importance of emotions are misleading for two reasons. First, the "dread" factor mostly measures non-emotional items and the emotion word used (dread) has by itself only weak explanatory power. Second, work on "affect" has been cited in an overly simplistic manner (Loewenstein et al., 2001); see a discussion of the ambiguous use of the word affect (Sjöberg, 2006). Attitude toward a technology does correlate with perceived risk, but that does not mean that emotions in the proper sense of the word have thereby been demonstrated to be of importance. Attitude is essentially a matter of evaluation in contemporary psychology (Alabarracín, Johnson, & Zanna, 2005). The importance of emotions is quite a different matter.

The typical "dread" item of the psychometric paradigm asks for a judgment of *one* emotional reaction, dread. There is no specification of the current emotional reaction of the respondent, nor about *whose* emotional reaction is to be judged (Fischhoff et al., 1978). These conditions may partly explain why the item lacks explanatory power. In current work, I measured emotional reactions by the following instruction:

"Make a fast and spontaneous assessment of your feeling about a nuclear waste repository in your municipality".

A number of emotional reactions were assessed, *viz*.

Anger
Contempt
Fear
Interest[7]
Sorrow
Satisfaction[8]
Guilt
Shame
Worry
Pessimism
Optimism

Note that most of these terms are negative, in accordance with emotion theory (Izard, 1977). The emotion ratings were used to form two indices, one of positive and one of negative

[7] . There is good evidence that interest is an emotion (Silvia, 2006).
[8] . Used to measure the basic hedonic mood and emotion dimension (Sjöberg, Svensson, & Persson, 1979).

emotions. The means (standardized) of the rated emotional reactions to a local repository are given in Fig. 2 for the four samples.

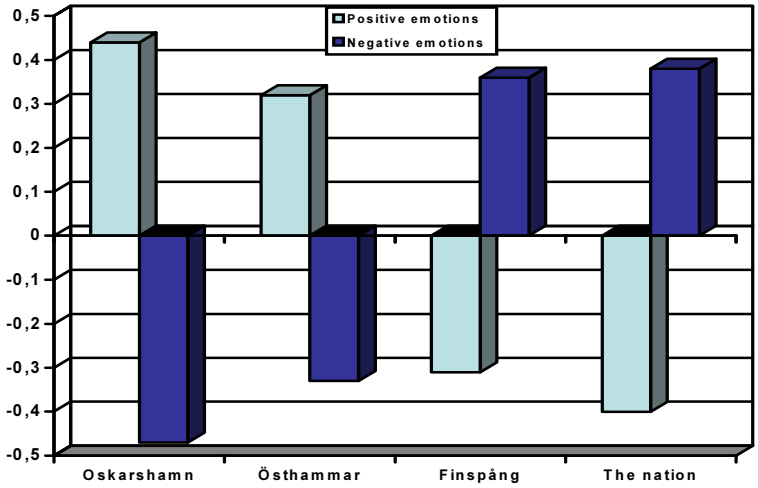

Figure 2. Mean rated emotions in four samples. Standardized values.

Note the large, indeed dramatic, differences between the two municipalities where siting work is under way, and the rest of the country. Inserting emotion factors in a model of attitude to the repository, together with some other variables, gave the results illustrated in Fig. 3.

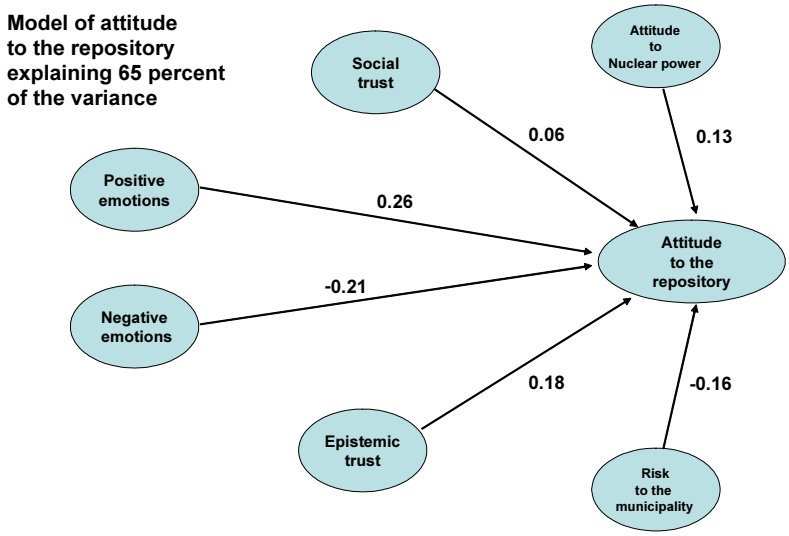

Figure 3. Model of the attitude to a repository. The numbers are standardized regression coefficients.

Note that emotion factors were the most important ones, followed by epistemic trust, perceived risk and attitude to nuclear power, in that order. Social trust carries very little explanatory power in the model. Additional analyses showed that novelty and dread added nothing or very little to the model. Note also that attitude to nuclear power is an important explanatory variable. It is a frequent finding that attitudes reflect a common underlying image, which finds its expressions in diverse response modes, such as beliefs and values (Sjöberg & Biel, 1983).

A closer look at all 11 emotion factors showed that the most important[9] emotion factor was anger, not fear. Fear and satisfaction (hedonic response) were about equally important, and clearly less so than anger. The total set of 11 emotion factors accounted for 63 percent of the variance of attitude to a local repository. A few simple questions about emotional reactions were thus sufficient to model attitude. Adding the traditional "dread" item increased explanatory power by only 1 percent. Anger was found to be important also in a study of reactions to the attack on the WTC in 2001 (Lerner, Gonzalez, Small, & Fischhoff, 2003), but in that study positive emotions were not investigated, for obvious reasons. The prominence of anger is in line with Sandman's "outrage" model.

The importance of the target (*who* is having the emotional reactions) was further clarified in a follow-up study where the respondents were asked to rate their own emotional reaction to the concept of nuclear power, as well as the reactions of others to the same concept. The correlations between emotional reactions and attitude to nuclear power are given in Table 1. It is seen that correlations are quite strong with one's own emotional reaction, about zero with the emotional reaction expected from others.

Table 1. Correlations between emotional reactions and the attitude to nuclear power.

Emotion	Own emotional reaction to nuclear power	The anticipated emotional reaction of others to nuclear power
Anger	-0.62	-0.08
Contempt	-0.55	-0.10
Fear	-0.65	-0.06
Interest	0.28	0.17
Sadness	-0.58	-0.12
Satisfaction	0.57	0.21
Guilt	-0.25	0.03
Shame	-0.29	0.04
Worry	-0.61	-0.12

The systematic difference between one's own emotional reaction and that attributed to others is also illustrated in Fig. 4, where mean the two sets of mean rated emotional reactions are plotted. The emotional reactions of others are rated as much stronger than one's own, a finding, which resembles, to some extent, the common finding that personal risk is rated as lower than general risk. It may also throw some light on the common notion that the public will "panic", often argued by representatives of authorities who tend to refrain from providing information to the public for that reason.

[9] . Important in the sense of being strongly correlated with attitude.

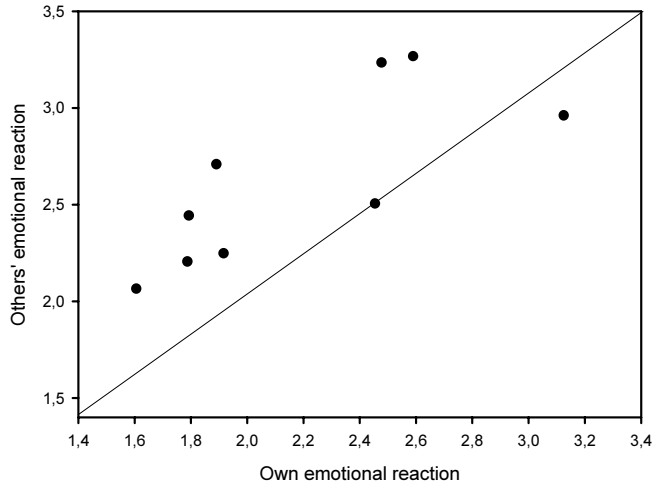

Figure 4. Mean emotional reactions attributed to others vs. own reactions.

Summing up, emotions can be powerful explanatory factors of attitudes and risk perception, but how they are measured is crucially important. The fact that there is a moderately strong and consistent relationship between emotional reactions and risk perception is documented in our work as reported elsewhere (Drottz-Sjöberg & Sjöberg, 1990; Sjöberg, 1998b).

The psychometric paradigm: conclusions

Several shortcomings of the psychometric paradigm are fairly obvious (Sjöberg, 1996a, 2003c). When data are analyzed in an appropriate manner, it is clear that the model accounts for, at the most, 20-25% of the variance of perceived risk and risk tolerance[10]. The strong explanatory power claimed for the model is based on misleading data analysis using means.

The data on experts (Slovic et al., 1979), cited so frequently, has turned out, on closer examination, to be very weak as evidence (Rowe & Wright, 2001). Only 15 experts were studied, and their claim to expertise is very dubious. When real experts in a chosen field were analyzed, as I recently did for the case of nuclear waste (Sjöberg, 2002a) and genetic engineering (Sjöberg, 2004b), they turned out to give risk ratings which were explicable by the psychometric model dimensions in a manner similar to those of other respondents. Experts' risk perception was correlated with risk characteristics in a similar manner as in the case of the publiuc's risk perception.

Social trust is a fairly weak explanatory variable with regard to perceived risk. The present results support that statement and suggest that epistemic trust is more important than social trust.

The psychometric paradigm neglects important distinctions and variables. People make quite different judgments of personal and general risk, see for example Drottz-Sjöberg (Drottz-Sjöberg, 1993). Personal and general risk differ both in level (personal risk is usually judged as much lower than general risk) and in correlates. General risk is a better predictor of policy attitudes for lifestyle risks such as alcohol, while personal risk is more or equally important

[10] . Occasionally, higher values are obtained, especially for nuclear technology.

for technology and environment risks perceived as being outside of our individual control, such as nuclear power (Sjöberg, 2000a).

The model does not take into account the powerful dimension we have called tampering, or interfering, with nature (Sjöberg, 2000b), nor does it treat vested economic interest. It also does not account for the weak relationship between rated "risk" and policy attitudes, such as demand for risk mitigation. The latter dimension is hard to explain with risk data but so far it has been found to be most strongly related to expected *consequences* rather than probabilities or risks (Sjöberg, 1993, 1998a, 1999a). The latter finding is true whether hazards are defined as activities or consequences, as shown in the present paper and elsewhere (Sjöberg, 1999c). The psychometric paradigm is founded on the presumption that *activities* are important for risk policy attitudes. The present data, and data in the cited references, strongly support the notion that *consequences* are much more important.

In the present study, 24 attributes of risks were used, some of them not considered in any version of the Psychometric Model known to me. The most important attributes, emerging from a regression analysis of attitude to a local repository, were, in that order:

Harm to children and future generations
Decreasing real estate prices
Negative effects unknown today
Effects which will increase over time

The fit of a model is of course not the same thing as practical value of attributes in a risk communication situation. Yet, it seems likely that attributes which carry most weight in models also are quite important in communication situations.

Despite its important shortcomings, the psychometric paradigm has become an attractive basis for most current work on risk perception, both research and consulting. The question I pose here is why. A few suggestions are offered as answers:

- *The model is very simple.* It is very easy to understand and is close to "common sense".

- *The model provides answers which are politically desirable.* The public is depicted as emotional and ignorant, just as policy makers have always suspected. In contrast, experts are said to make the objectively correct risk judgments.

- *The model seems to supply a final answer.* As we have seen above, the model has been popularized with the help of a kind of data analysis which can hardly fail to provide the impression that risk perception is explained. Furthermore, it gives replicable data, probably because it benefits from common semantics of risk and related concepts in various groups and even nations or cultures. Similar semantic overlap has been noted before, e.g. with Osgood's semantic differential (Osgood, Suci, & Tannenbaum, 1957).

Other aspects may also be involved, but those mentioned above carry the Psychometric paradigm a long way.

Implications for risk communication

There seems to be consensus on risk communication being difficult and frequently a failure (Bier, 2001). Let me suggest reasons why this should be the case, to the extent that risk communication relies on the received message from the psychometric paradigm:

1. *Emphasis on probability.* Probabilities are usually of little concern to the public who finds them hard to understand, based on questionable assumptions, and irrelevant. *Consequences* are what should addressed, not probabilities. Compare the current concerns with the precautionary principle. In my recent project on nuclear waste, there were several questions about precaution. Consider the following one:

"A technical solution to the disposal of spent nuclear fuel which maybe can have serious risks should be avoided if it can not be proven that it is risk free".

A large majority agreed, 81 percent, only 6 percent rejected the statement. Several other results of the study likewise supported the precautionary principle. People do not like the idea of a trade-off between risk and benefit. The statement

"A technical solution to the disposal of spent nuclear fuel which maybe can have serious risks should be should be accepted if it is found that the benefits are larger than the risks".

It was accepted by only 26 percent of the respondents.

A closer look at precaution was obtained by pooling the 15 items into a composite score (after reversing 4 of them). The score had a skewed distributions; many more gave extreme high responses than extreme low responses: 20.2 percent endorsed precautionary values strongly while only 1.3 percent rejected them strongly.

The data thus show that there was a prevalence of precautionary attitudes in the studied samples. This does not mean, of course, that people always are in favor of precaution - there must surely be some small hazards we are ready to simply dismiss. Apparently the hazards of a repository for spent nuclear fuel is not an example of such a hazard.

2. *Trust.* Social trust, the kind of trust usually discussed in the literature, is a relatively weak factor compared to epistemic trust. People say that they may well trust experts and organizations, still do not accept the policy they recommend because they are not convinced that scientific knowledge can be trusted - they feel it may be changed in the near future when new results are obtained. Epistemic trust may be called for when people use central processing of information, as should be expected with important issues. With less important issues, social trust may be more important because people use peripheral processing. The central vs peripheral aspect is extensively discussed in the literature on attitude change (Petty & Cacioppo, 1986).

3. *Neglected dimensions.* The Psychometric Model neglected to study the dimension "Interfering with Nature" and the related notions about "God's intentions". Many people believe that it is immoral and dangerous to change Nature, as given to us by

God. The model also neglects economics; many people have personal economic interests *pro* or *con* a siting issue.

4. *The role of emotions.* Emotions are important, but not only fear. Anger is more important, and positive emotions also enter the picture. Emotions as experienced by the person him- or herself are more important than emotions believed to be true of others, which is the type of emotions studied in the psychometric paradigm.

5. *Ideologies*. People have similar reactions to a number of social policies. In Sweden, there is endless controversy regarding nuclear power, membership in the European Union and genetically modified food. Preferences and attitudes regarding such matters are closely related to political preferences - which are usually not studied in the Psychometric Paradigm. Fig. 5 shows the variation in attitude to a local repository across preferences for the 7 political parties currently represented in Swedish Parliament. The difference between the two extremes amounts to almost 1 standard deviation, a "very large" difference in Cohen's standard terminology[11] (Cohen, Cohen, West, & Aiken, 2003).

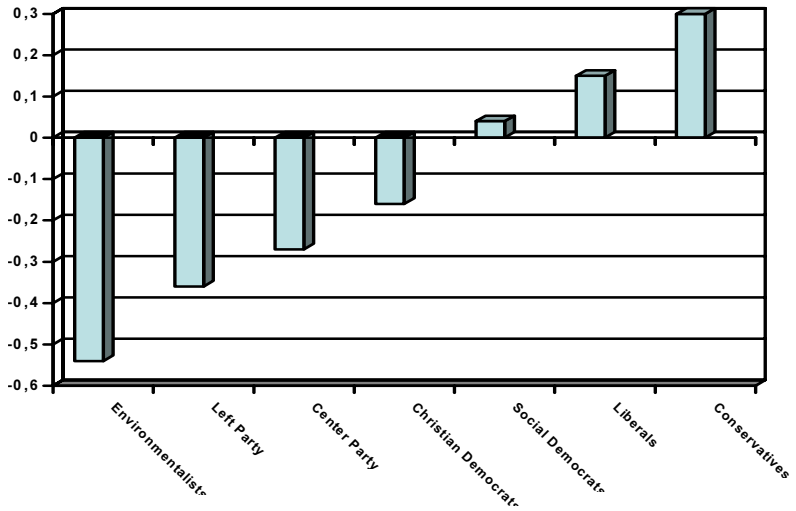

Figure 5. Attitude to a local repository as a function of political preference. Standardized values.

It should be noted that the ordering of the parties is only partially coinciding with the traditional left-right dimension, or socialist versus non-socialist. Both the Center Party and the Christian Democrats are non-socialist parties, yet found here to the left of the Social Democrats. It is interesting to note that Cultural Theory's notion of an egalitarian type (Douglas & Wildavsky, 1982) fits badly to the Swedish situation because egalitarians often support technology, including nuclear technology which was indeed first introduced by the Swedish Social Democrats, a party which is certainly egalitarian. Two other, and much smaller, egalitarian parties are skeptical of technology (the Left Party and the

[11] . The differences across parties according to a one-way ANOVA is highly statistically significant, $p<0.0005$.

Environmentalists). It seems likely that ideology is important to risk policy and attitudes generally and not only in Sweden, but the details may differ depending on unique characteristics of any society.

6. *Morality.* Morality has seldom been explored in the risk perception literature, although it was one of the first powerful factors we discovered in our initial risk research work which started in the middle of the 1970's (Sjöberg, in press, 1987) In an extensive empirical study of several different groups of people, morality was found to be a strong determinant of risk acceptance (Sjöberg & Winroth, 1986). "Outrage" arises especially if people perceive that an actor is imposing a risk on them for his or her own profit. In the present data, the judgment that the repository risk is immoral and unjust accounted for 35 percent of the variance in attitude, adding novelty and dread increased that number by 12 percent, significant but not very much. With risk to the municipality as dependent variable, morality accounted for 30 percent of the variance, novelty and dread added only 7 percent. Of course, other factors are also of importance but the present simple analyses do illustrate that the Psychometric Model's core dimensions are of secondary importance, at best.

7. *Experts.* Experts' risk assessments are not objective and never constitute a final truth. Too much trust in experts sets the stage for difficult risk communication because many people do not agree that science has the final answers in matters of risk. In addition, experts may well speak in favor of values, which differ from those of the public, but in veiled terms, and claim that they propose the "rational" solution to risk management problems.

Summing up, risk perceptions are influenced by other factors than those specified by the psychometric model; risk and probability are not crucial for understanding demand for risk mitigation; experts are also influenced by the same factors as the public and do not simply convey the truth, and emotions are important but in ways not anticipated in the psychometric paradigm.

Epilogue: How about risk communication?

The received message and it implications are well summarized by Ropeik as follows:

> "Risk communication is more effective when it sets a modest goal: to accept that feelings are an important part of why people react to risks the way they do and to provide information about any given risk based on the psychological and emotional factors at work, in language relevant to and respectful of people's feelings so that audiences are more trusting and receptive to the communicator's message, thereby increasing its impact." (p. 5).

The model implicit in such statements is depicted in Fig. 1. How well does risk communication based on the received model actually work? Narrative reviews, in themselves excellent [e. g. Bostrom and Lofstedt (Bostrom & Lofstedt, 2003)] give no information about the size of effects to expect. Sometimes there seems even to be negative or quite complex effects, since people value not only the process but also the outcomes (Arvai, 2003; Santos & Chess, 2003). Yet, according to Ropeik, there are "countless examples" of success (Ropeik, In press), a surprising statement in view of the less

enthusiastic assessment of the success with campaign designed to promote more healthy behavior (Noar, 2006). The complexity of risk communication is enormous, and many factors enter the picture. In spite of this, risk communication as a discipline seems to be assuming a rather constrained and limited view of the actors. The importance of epistemic as opposed to social trust stresses the need to take peoples' concern seriously, not only establish good social relations. The finding that antagonistic attitudes are common and important suggests that being "respectful of people's feelings" will not be sufficient to establish trust.

A search of the literature reveals a bewildering number of inputs from an extremely wide range of disciplines. Interdisciplinary research is often held to be a good in itself, but the chance to find a powerful and yet simple theory, which could account for the major findings, seems slight, at the present time. Closer attention to empirical bases and conceptual clarity could still be of use.

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