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Beliefs and Values in the Nuclear Debate¹

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A questionnaire was administered to 47 participants attending a workshop on nuclear energy shortly after publication of a report on a proposed nuclear fuel reprocessing plant. Supporters and opponents of the proposed development differed markedly in their estimates of its possible consequences, and of the relative importance of these consequences. They also differed in their endorsement of pro- and anti-nuclear arguments, the evaluative adjectives which they used to label the pro- and anti-nuclear lobbies, and the factors which they felt contributed most to the "quality of life." Overall, pro-nuclear subjects appear to place emphasis on the economic benefits of nuclear energy, while anti-nuclear subjects appeared more concerned with social and political risks, and regarded alternative energy sources as more viable. It is concluded that an analysis of such attitudinal differences requires a consideration not only of differences in beliefs, but also of differences in belief salience.

The economic and political significance of energy supplies has been dramatically underlined in the last few years by events such as extended strikes by coal miners on both sides of the Atlantic, the embargo on oil supplies by Arab states, the discovery and exploitation of North Sea oil, and the attempts at energy conservation in the USA. Yet, while these events may have focussed public attention on fossil fuels, another aspect of energy policy with probably far more important long-term implications—the use of nuclear power for civil purposes—has generally remained, at least in Britain, a point of

¹This study was conducted while the second author was in receipt of a scholarship from the British Council. The advice and assistance of Harry Stopes-Roe, Mary Stopes-Roe, and Michael Billig of the University of Birmingham is gratefully acknowledged. As will be immediately clear, this was written before the Harrisburg accident.

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controversy only between interested and involved minorities. So far, the debate "has centered on largely technical arguments about technical issues" (White, 1977, p. 647). However, other questions, such as the social acceptability of new kinds of environmental risk and of special security measures, have been raised and are less easily resolved without a wider public awareness and involvement.

The debate over civil nuclear power is also particularly challenging from the point of view of social psychological theory. Unlike many of the favorite issues of attitude researchers, it is *both* of profound inherent significance *and* provides an opportunity to see new attitudes in the making. On the one hand, there is the question of how very different kinds of arguments, the technical and the socio-political, can be balanced together—either at the level of governmental action or at the level of the "cognitive algebra" (Anderson, 1974) of individuals. On the other hand, there is the question of the kind of attributions individuals make in order to justify their own attitudes and explain why others disagree with them. There is already evidence that some of those more involved in the debate may characterize their opponents as irrational, ignorant, or cynically self-centered (e.g., Beckmann, 1976; Fuller, 1975).

In spite of all this, there seem to have been very few theoretically based attempts to analyze the structure of people's attitudes towards nuclear power from a social psychological point of view. Two exceptions are the studies by Otway and Fishbein (1976) and by Otway, Maurer, and Thomas (1978). Both are applications of Fishbein's (1963) model of attitude formation, which basically assumes that the more a person believes the attitude object has good rather than bad attributes or consequences, the more favorable will tend to be his attitude.

Otway and Fishbein made a pilot study on 30 members of an American institute for energy-related research. Both pro- and anti-nuclear subjects seemed to agree about the risks of nuclear power, but it was suggested that "differing attitudes towards nuclear power may be primarily determined by strongly differing beliefs about its benefits" (p. 13). Otway et al. report the results of a factor analysis on 39 belief statements about nuclear power using a sample of 224 Austrians. This yielded four factors designated as "psychological risk," "economic and technical benefits," "sociopolitical risk," and "environmental and physical risk." Subgroups of the 50 most pro- and 50 most anti-nuclear respondents were then compared so as to determine the contributions of beliefs and evaluations within each of these factors to respondents' overall attitudes. For the pro-group, the economical and technical benefits factor made the most important contribution, whereas for the anti-group, the risk factors were more important. The anti-group believed environmental and physical risks would be increased by the use of nuclear

power, while the pro-group believed they would not. Otway et al. infer (p. 115) that "Beliefs about the benefits of nuclear power appear to be relatively independent of beliefs about the risks. Further, people differentiate between types of risk."

The finding that separate dimensions of the issue appear differentially salient (in terms of their contributions to the prediction of overall attitude) for the different attitude groups has important practical implications for communication and mutual understanding between the protagonists in the nuclear debate. Also, at a theoretical level, it demands a conception of attitudes which takes such differential salience into account. Another theoretical question concerns how molecular beliefs and evaluations are related to global attitudes. The Fishbein model seems to imply that the direction of causality is from the molecular to the global, but there is also evidence that people will tend to bring their predictions of possible future events more into line with their existing attitudes (Cantril, 1938; Eiser & Eiser, 1975; McGregor, 1938). If this is so, then the understanding of why people hold different attitudes towards nuclear power may require an investigation not only of their specific beliefs but also of their more general systems of values.

Of relevance to both these points may be the language a person will use to describe differing viewpoints on an issue. It has been argued (Eiser, 1971) that people will tend to see as most salient those dimensions of an issue in terms of which they can evaluate their own position positively and opposing positions negatively. Social judgment studies (e.g., Eiser & Mower White, 1974, 1975; Van der Pligt & Van Dijk, 1979) show that individuals with different attitudes towards an issue tend to describe the issue in different terms; thus, it is inferred, they may see different dimensions as more salient, and may seek justification for their position in terms of more basic values. The present study, then, is a preliminary attempt to investigate the relationship between people's attitudes towards the civil use of nuclear power, their specific beliefs and more general values.

The historical context in which this study was conducted is relevant to the specific aspects of the issue and the particular measures employed. On June 14, 1977, a public inquiry opened into an application by the state-owned company, British Nuclear Fuels Ltd., to expand the nuclear establishment at Windscale in N.W. England by building a thermal oxide fuel reprocessing plant (THORP) which would reprocess spent nuclear fuel from both British and foreign nuclear reactors. As a result of this reprocessing, plutonium would be extracted and made available as fuel for reactors (particularly the new "fast breeders"), and could be sold back to the countries from whom the spent fuel had come. Even after reprocessing, there would be highly radioactive waste products in need of careful storage (leading to the allegation that Britain would become the world's "nuclear dustbin"), in addition to less radioactive

effluents to be discharged into the sea. Also the military significance of plutonium raised fears as to the possibility of "nuclear terrorism" and of the international proliferation of nuclear power capability. On March 6, 1978, the report of the inquiry was published (Parker, 1978); it recommended that the development of the plant should be allowed to go ahead. The House of Commons approved the report in a debate on March 22 and approved a development order for the plant, by 224 votes to 80, on May 15.

METHOD

Subjects

Participants attending a one-day open workshop on March 18, 1978 on "The Great Nuclear Debate" at the Department of Extra-Mural Studies, University of Birmingham, served as subjects. They included males and females and were mostly professional people with relatively active interests in the issue. Employees of the nuclear industry were present as well as members of environmentalist groups, such as Friends of the Earth. On arrival, all participants were handed a short questionnaire designed to be completed before the start of the first session. Usable questionnaires were returned by 47 of the 65 participants, the remainder consisting mainly of late arrivals. The (self-selected) sample is in no way claimed to be representative of the general population (cf. White, 1977). Nonetheless, those attending may be considered fairly typical of the kind of people actively involved in the nuclear debate at the time of writing.

The Questionnaire

Rather than attempting to elicit subjects' attitudes towards nuclear power in general (which many would probably have considered an impossible question), we chose to concentrate specifically on their attitudes towards the proposed development at Windscale. The first question, therefore, asked: "Are you for or against the proposed development of the nuclear waste reprocessing plant (THORP) at Windscale?" Subjects responded in terms of five categories ranging from strongly opposed to strongly in favor. The next two questions asked for guesses concerning, first, the percentage of MPs that would support the development order when it was put before Parliament, and second, the number of extra deaths per annum among members of the public due to routine emissions of radioactive waste from Windscale which would occur by the end of the century if the development went ahead. Next, subjects were asked to select from a list of 16 adjectives any they thought best described first the pro-nuclear lobby and then the anti-nuclear lobby. This list contained, in a random order, eight adjectives relatively positive in evaluation

TABLE I

MEAN SCORES FOR PRO- AND ANTI-NUCLEAR SUBJECTS ON POSSIBLE CONSEQUENCES OF EXPANSION OF NUCLEAR INDUSTRY, AND PERCENTAGES OF PRO- AND ANTI-NUCLEAR SUBJECTS CHOOSING EACH ITEM AMONG THE FIVE MOST IMPORTANT

	Mean scores†		<i>t</i> (<i>df</i> = 42)	Percentage††	
	pro Ss (<i>N</i> = 25)	anti Ss (<i>N</i> = 19)		pro Ss (<i>N</i> = 24)	anti Ss (<i>N</i> = 18)
a) Strength of the UK economy	1.2	0.3	4.33**	75	17
b) Risk of nuclear terrorism	0.3	1.3	4.39**	4	72
c) Ordinary UK citizens' influence over political decisions	0.2	-0.9	6.32**	8	50
d) Level of unemployment in the UK over the next 10 years	0.0	-0.1	-4.6	50	6
e) Risk of a serious nuclear accident in the UK	0.2	1.2	4.91**	21	56
f) Restrictions on individual civil liberties in the UK	0.3	1.3	4.37**	17	83
g) UK's ability to meet future energy demands	1.7	0.5	5.19**	92	22
h) Risk of proliferation of military nuclear capability	0.2	1.4	6.48**	8	67
i) Total deaths among worker in UK nuclear, coal, oil and gas industries <i>combined</i> from accidents and occupational diseases	-0.5	0.2	3.53**	42	6
j) Total environmental damage produced by UK nuclear, coal, oil and gas industries <i>combined</i>	-0.4	0.6	3.41*	71	39
k) Total health hazards to members of the public from routine pollution by UK nuclear, coal, oil and gas industries <i>combined</i>	-0.5	0.7	5.80**	67	39

†Possible range of scores from -2 (greatly decreased) to +2 (greatly increased).

††The columns do not add up to 500 because of the inclusion of 4 pros and 4 antis who chose fewer than 5 consequences.

**p* < .005.

***p* < .001.

(rational, safety-conscious, realistic, humanitarian, responsible, moderate, far-sighted, and practical) and eight relatively negative adjectives (complacent, ill-informed, extremist, emotional, materialistic, elitist, selfish, and alarmist). The selection was based on words used in various publications for and against nuclear power.

The next section presented a list of 11 possible consequences (shown in Table 1) and asked subjects to rate how each of these would be affected if THORP went ahead, in terms of five categories from greatly decreased (-2) to greatly increased (+2). They then had to rank the five possible consequences they personally thought were most important. Next, subjects were presented with eight arguments (all actual or slightly modified quotations) which they had to rate in terms of five categories ranging from definitely untrue (-2) to definitely true (+2), as shown in Table 2. Finally, subjects were asked to rank five factors which they felt "would contribute most to an improvement in the overall 'quality of life' as you understand it" from the nine listed in Table 3.

RESULTS

Subjects were clearly divided in their attitudes towards THORP. Only 2 of the 47 were undecided. The remainder were assigned to a pro-group of 25 who were moderately or strongly in favor, and an anti-group of 20 who were moderately or strongly opposed. The mean age of the pros was 48.8, and of the antis 31.8 years ($t = 4.05$, $df = 39$, $p < .0001$), four subjects omitting their age.

Both groups slightly underestimated the percentage of MPs who would vote in favor of the development order (means were 64.3% for the pros, 68.5% for the antis, the difference being nonsignificant). The anti-group estimated that there would be more extra deaths per annum due to routine radioactive pollution from Windscale than did the anti-group. The group means were distorted by a few extreme estimates (e.g., 510 by one anti subject); however, 12 out of 18 pro subjects responding to this question gave estimates of less than 5, as compared with only 3 out of 13 anti subjects ($\chi^2 = 7.21$, $df = 1$, $p < .01$). This result should be interpreted with caution, however, in view of the relatively large number of subjects who declined to give any estimate.

Subjects' selections of adjectives to describe the pro- and anti-nuclear lobbies revealed, as predicted, a strong tendency for them to describe their "own side" positively and the opposition negatively. The three adjectives most frequently chosen by the pro-group to describe the pro-nuclear lobby were (in descending order) realistic, rational, and responsible; and to describe the anti-nuclear lobby, emotional, alarmist, and ill-informed. The most frequent descriptions by the anti-group of the pro-nuclear lobby were materialistic, complacent, and elitist; and of the anti-nuclear lobby, far-sighted, humani-

tarian, and responsible. To analyze these differences, we counted for each subject the number of positive minus the number of negative descriptions of the pro-nuclear lobby and subtracted from this the number of positive minus the number of negative descriptions of the anti-nuclear lobby. This "labelling" score correlated .85 with subjects' expressed favorability towards the THORP development ($p < .0001$).

Table 1 presents the mean ratings by the pro- and anti-group of the 11 possible consequences of the THORP development. Apart from item d, the level of unemployment, which neither group felt would be affected either way, all show significant differences between the two attitude groups, in a direction predictable from a simple consistency notion (e.g., Rosenberg, 1956) as well as from Fishbein's model. The pro-group, as compared with the anti-group, saw THORP as more likely to produce benefits and less likely to lead to adverse consequences. We next computed an "instrumentality" score for each subject by summing the ratings over all 11 items, having multiplied the ratings of the three benefits (a, c, g) by +1 and the eight adverse consequences (b, d, e, f, h, i, j, k) by -1. Omitted items were scored 0. Over all 47 subjects, this "instrumentality" score correlated .75 ($p < .0001$) with the attitude measure.

We next considered which possible consequences were chosen as being among the five most important by the two attitude groups. Table 1 also presents the percentages of pro and anti subjects choosing each of the consequences anywhere among the most important five. As can be seen, there were striking differences between the two groups, with the pro subjects most frequently choosing the strength of the UK economy and the UK's ability to meet future energy demands, and the anti subjects choosing restrictions on civil liberties and the risk of nuclear terrorism. The rank correlation between the two sets of percentages was $-.50$. We then recalculated subjects' "instrumentality" scores for only those items which they individually considered the most important. Subjects who failed to list all five choices were excluded from this analysis. For the reduced sample of 35, the "instrumentality" scores on important items correlated .86 with subjects' attitudes ($p < .0001$). A similar calculation on the six least important items for each subject yielded scores which correlated only .44 ($p < .01$) with subjects' attitudes.

Table 2 shows subjects' acceptance or rejection of arguments on either side of the issue. The differences were in the expected direction, and significantly so on six of the eight statements. The largest difference of opinion concerned whether there was any practical alternative to nuclear energy to succeed oil and gas. Finally, we compared the two groups in terms of which factors they felt contributed most to the overall "quality of life." The percentages of pro and anti subjects choosing each factor anywhere among the most important

TABLE 2
MEAN SCORES FOR PRO- AND ANTI-NUCLEAR SUBJECTS ON INFORMATIONAL BELIEFS^a

	Mean for pro Ss (N = 25)	Mean for anti Ss (N = 20)	t (df = 43)
The UK has an obligation to help other countries develop nuclear energy for peaceful purposes.	0.7	-0.4	2.78**
Plutonium is the most toxic substance known to man.	-0.7	0.3	2.33*
Apart from at Nagasaki in 1945, there is no record of anyone in the world having died as a result of contact with plutonium.	-0.2	-0.7	1.88
Workers who actually handle plutonium are at least 7 times and possibly 20 times more likely to die of leukemia than other workers.	-0.4	0.5	2.96***
There is no practical alternative to nuclear energy as a candidate for the fuel technology to succeed oil and gas.	1.0	-1.4	8.62****
The reprocessing of used oxide fuel is unnecessary; it can be stored safely in the form in which it comes out of the reactors.	-1.0	0.2	3.73****
No reactor can explode with the force of an atomic bomb.	0.6	0.1	1.31
Almost to a man the pro-nuclear lobby has a personal interest of some kind in the development of nuclear energy.	-0.8	0.3	2.99***

^aPossible range of scores from -2 (definitely untrue) to +2 (definitely true).

* $p < .05$.

** $p < .01$.

*** $p < .005$.

**** $p < .001$.

TABLE 3

PERCENTAGES OF PRO- AND ANTI-NUCLEAR SUBJECTS WHO CHOSE EACH FACTOR AMONG THE FIVE THAT CONTRIBUTE MOST TO OVERALL QUALITY OF LIFE

	pro Ss ^a (N = 22)	anti Ss ^a (N = 15)
a) A higher material standard of living	36	0
b) Decreased emphasis on materialistic values	36	100
c) Reduction in scale of industrial, commercial, and governmental units	22	86
d) Industrial modernization	68	6
e) Greater public participation in decision-making	50	66
f) Security of employment	77	40
g) Improved social welfare	31	80
h) Conservation of the natural environment	77	100
i) Advances in science and technology	82	13

^aThe columns do not add up to 500 because of the inclusion of 2 pros and 1 anti who chose fewer than 5 factors.

five are shown in Table 3. The factor most frequently chosen by the pro subjects was "advances in science and technology," whereas "decreased emphasis on materialistic values" and "conservation of the natural environment" were chosen by all anti subjects. The rank correlation between the two sets of percentages was $-.05$.

DISCUSSION

Following publication of the Windscale report, a spokesman for the environmentalist group Friends of the Earth commented that he found "it hard to credit the extent to which Mr. Justice Parker appears to have overlooked or misunderstood key aspects of the argument." What constitute "key aspects" is, of course, the central question in controversies of this kind. In a public inquiry, evidence is heard and conclusions are drawn; yet while such a procedure may lead to a broader base of agreement as to the facts, the relative importance of these facts may remain a matter of contention, less easily resolved by testimony.

This is not only a practical problem for public inquiries. It also presents a challenge to those social psychological theories which treat attitudes as a simple summative function of evaluative beliefs along a common dimension. It is our contention that committed individuals with opposing attitudes will tend to see different dimensions, or aspects of an issue, as salient, and will tend to disagree not only over the truth of certain facts but also over their importance.

This is not to say that analyses which ignore this question of differential salience may not still provide fairly adequate predictions of attitudinal differences in many instances, and indeed provide useful insights into which specific beliefs discriminate between different attitude groups. Our "instrumentality" scores (calculated over all consequences) essentially correspond to Fishbein's $\sum b_i e_i$ scores (strength of beliefs, weighted by evaluation, summed over items) except that we took account only of the presumed sign and not the degree of evaluation. These predicted subjects' attitudes at a level comparable to that reported by Otway and Fishbein (1976). We also found evidence of a consistency between beliefs and attitudes when subjects were asked to guess the number of extra deaths that might result from pollution from Windscale. There was no evidence of "wishfulfilment," however, in subjects' predictions of the Commons vote, which the anti subjects clearly saw as a lost cause. Acceptance of more general factual claims and arguments (Table 2) was also strongly related to subjects' attitudes. These data therefore show that there remained, within our relatively well-informed sample, broad areas of disagreement over factual beliefs, notably relating to availability of practical alternative energy sources, political consequences of expansion of the nuclear industry, and health hazards of routine radioactive pollution.

Over and above these divergences of belief, however, our data reveal other striking differences between the two attitude groups. Firstly, there are the very different "images" each group had of one another, as shown by our "labelling" scores. Encountering others who disagree with one's own committed opinions presents a continuing challenge to one's conception of social reality, and as Heider (1946) recognized, an attributional dilemma. One way of dealing with this dilemma is to use what amount to ad hominem arguments against one's opponents. One looks for a way of discounting one's opponents' opinions through imputations of stupidity, short-sightedness, or bias.

Next are the results relating to subjects' selections of the consequences they regarded as most important. The correlation between subjects' attitudes and the "instrumentality" scores was about twice as high when considering only those consequences selected by each subject as most important, as when considering only the less important consequences. Moreover, the two attitude groups differed considerably in which consequences they saw as most

important.³ These data are consistent with the Otway et al. (1978) finding that items concerning economic and technical benefits made more contributions to the attitudes of pro subjects while the socio-political risk dimension made more contribution in the case of anti subjects. The lesser importance attached by our anti subjects to the environmental/health risks (Table 1, items i, j, k) would not have been predicted from the Otway et al. data, but is almost certainly a function of the items being worded so as to force a comparison between nuclear and fossil fuels in terms of routine hazards. Such comparisons are a favorite theme of pro-nuclear commentators (e.g., Beckmann, 1976), whereas anti-nuclear commentators (e.g., Patterson, 1976) attach greater emphasis to the risks of major nuclear accidents and the need to exploit alternatives to both nuclear and fossil fuels.

A similar picture emerges from subjects' perceptions of the factors contributing to an improvement in the "quality of life." The anti-group appeared far more committed to the philosophy of "small is beautiful," and less convinced of the benefits of technical "advances" and "improvements" in material well-being. The difficulty of assimilating complex technical information would not, therefore, seem the only reason for this suspicion of the expansion of the nuclear industry. At the same time, the antis regard alternative technologies as underexplored. Furthermore, they would not see the pursuit of higher material standards as a sufficient justification for the extra risks, political as well as environmental, which they see to be involved in nuclear energy. Questions of the kind of society in which one wants to live and the amount of power it is desirable to put in the hands of "experts" seem to preoccupy the antis far more than the pros, who seem to see the debate primarily as one concerning the adequacy of safety precautions.

If social psychology is to make a practical contribution in this area, it would seem to be in the context of analyzing people's reasons for the attitudes they hold. It is our contention that the attitudinal differences

³Research on the Fishbein model does not generally suggest that weighting beliefs for perceived importance improves the predictive validity of the $\sum b_i e_i$ since importance ratings may be highly correlated with polarity of evaluation (Fishbein & Ajzen, 1975, p. 221). However, our analysis took account only of the (presumed) sign and not the polarity of e_i . Our results therefore suggest that importance ratings may contribute to prediction when direct estimates of e_i are not obtained. Our use of these data as evidence of "differential salience" also represents a departure from the Fishbein and Ajzen approach. They define salient beliefs as "the primary determinants of attitude" (p. 219), but also state that importance ratings are not to be taken as indices of salience (pp. 221-222). For our subjects, the "primary determinants" were the beliefs they selected as most important, suggesting that the distinction between importance and salience which Fishbein and Ajzen attempt to draw may not be useful unless certain operations (e.g., elicitation procedures) have been performed.

apparent in controversies of this kind require a more sophisticated theoretical conception of attitudes than has so far been applied. At the very least, such a conception must take account of the fact that different aspects of the issue will be salient to the different sides in the debate, and that such differences in salience may be at least as clear-cut and informative as any differences in belief.

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