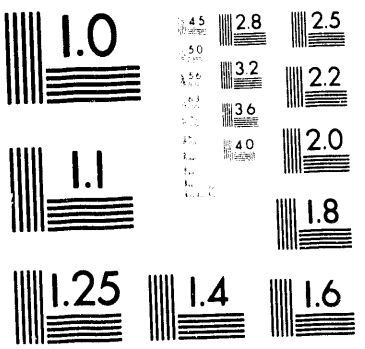
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WORD IMAGES AS POLICY INSTRUMENTS: LESSONS FROM THE YUCCA MOUNTAIN CONTROVERSEY

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INTRODUCTION

One of the failures of the atomic and nuclear testing program, and later the nuclear energy development program, was the lack of foresight in planning for the disposal of spent nuclear fuels. Under the relatively political calm of the post-World War II era, the Atomic Energy Commission missed an opportunity to develop a national storage program for the country's stockpile of high-level nuclear waste which is now in excess of twenty million metric tons and increasing. At this point in time, nearly fifty years after the Manhattan Project that ushered the United States and the world into the nuclear era, the issue of nuclear waste has become a very salient public policy concern. Nowhere is this more evident than in the State of Nevada, which has been declared the "winner" by Congressional consent, in the site selection process for a high-level nuclear waste facility.

The policy process involved in the Department of Energy and Congressional decisions to amend the Nuclear Waste Policy Act of 1982, which led to the sole-site analysis and characterization of Yucca Mountain, Nevada, 100 miles north of Las Vegas, is well documented (Carter, 1987; 1989; Jacob, 1990). The policy process resulted in the selection of Yucca Mountain over sites at Hanford, Washington and Deaf Smith County, Texas. The assessment of the public's perceptions and concerns associated with placing a high-level nuclear waste repository at Yucca Mountain is, however, less well-analyzed. A number of studies (Mountain West,

1989; Mushkatel et al., 1990) of public perceptions of risk and storage relative to storage and transfer of high-level nuclear waste have been conducted since the 1987 passage of the amendments of the 1982 Nuclear Waste Policy Act--cynically known as the "Screw Nevada Bill"--but in general, and unfortunately, they offer little explanation of what underlies these public perceptions associated with the Yucca Mountain site (Carter, 1991; Bisconti, 1991).

The present study is based on the results of a survey conducted during the fall of 1991 in Clark County, Nevada, regarding issues related to the proposed siting of a high-level nuclear waste repository at Yucca Mountain. Specifically, the study explores the word images which have developed about nuclear issues by Nevadans. From a policy perspective, the symbol or image held by an individual, would seemingly suggest how they view issues. In this regard, we investigate word images associated with the nuclear issue arena and attempt to determine what accounts for the foundations of these images among the general public. Secondly, we consider how images are reflected by members of the general public who hold different policy positions or perceptions concerning the risk or consequences associated with the policy area, in this case nuclear activities. These word images are, in part, a consequence of the state's history of involvement in nuclear issues going back to atmospheric testing in the 1950's and even before (Titus, 1986; Rhodes, 1986). During the course of four decades, Nevadans, by some arguments, have become accustomed to living with nuclear programs,

receiving economic benfits by serving as the nuclear testing ground for the nation. To put it another way, is there an absence of a "not in my backyard" attitude instilled among citizens of Clark County, Nevada, in contrast to the NIMBY attitude that is prevalent elsewhere in the country, namely the forty-nine other states who have no interest in a high-level nuclear waste repository? This question is especially salient since Nevada's political leaders consistently denounce the present policy process (Loux, 1989; Malone, 1991: Whaley, 1991; Morrison, 1991; Vogel, 1993a) with the State of Nevada scenario being one of a generally lightly populated, politically weak, and relatively unempowered state, adamantly opposing the nuclear industry and a federal establishment which is decidedly pro-nuclear energy, despite changes in administrations in 1993. In contrast, might the citizens of Clark County accept the consequences associated with nuclear waste in the same way they did with atomic testing, by incorporating it into the economy, lifestyle and communities, as advocated by some supporters of the Yucca Mountain Repository Project (Rodgers, 1991; Vogel, 1993b), and thus, would be seen as a logical extension of Nevada's historic role in the nuclear field that began with President Truman's creation of the Nevada Test Site, just north of Las Vegas, in 1950 (Titus, 1986).

REVIEW OF WORD ASSOCIATION STUDIES

In 1983, an exploratory study was conducted by Fiske, Pratto and Pavelchak to examine the contents of citizens' conceptions of nuclear war and the possible consequences of mental conceptions

or images for political activity. They developed a taxonomy of image content from a stratified random sample of 65 Pittsburgh adults responses to an open-ended question about nuclear war. The content of nuclear war images was primarily abstract and, secondarily, concrete. Abstract images such as death and politics, were defined as general and non-particularistic (Fiske et al., 1983:49). Examples of concrete images, such as injury and survival, are defined as references to events or conditions directly perceptible to the senses or as particularistic. (Fiske et al., 1983:54). Physical destruction, as well as death, disease and injury were included in both abstract and concrete content. The images cut across sex, race, class, ideology and education lines. The age variable showed a consistent pattern of correlation with image content; younger respondents mentioned more abstract and emotional images. Additionally, their findings revealed a significant relationship between the concreteness of people's nuclear war images and anti-nuclear activity.

In a study reported by Slovic, Layman and Flynn (1991) conducted between April 1988 and January 1990, 3,334 individuals were contacted by telephone and requested to respond to the prompt, "Think about an underground nuclear waste repository for a minute. When you think about this underground nuclear waste repository, what is the first thought or image that comes to mind?" Across four telephone surveys, residents of Nevada, as well as individuals from Phoenix, Arizona, and southern California, and nationwide were selected. The respondents were asked to make repeated verbal associations, six in total, to the

same stimulus in order to allow for content evaluation of people's subjective representations or thought patterns in relation to a wide-range of concepts relating to one more specific issues, namely high-level nuclear waste repositories. The responses were categorized into 13 general associations from 92 distinct categories which contained 9,439 word-association images (94.4 percent of total); 561 associations (5.6 percent of total) were uncategorized). The goal of their study "was to provide insight into risk perception by employing mental imagery as a focal point for analysis." Their general findings were "that people do not like nuclear waste," a finding we find far from cutting edge. They reported that the images perceived revealed pervasive feelings of "mistrust, dread, revulsion, and anger" which may be labeled as the "raw materials of stigmatization and political opposition" (Slovic, Layman and Flynn, 1991:11). They conclude that the analysis of these images of "fear" provide an understanding of an individuals' nature in juxtaposition with the permeation, truthfulness and steadfastness of their basic emotions which they contend is essential for resolving the current impasse over risk-associated waste management problems (Slovic, Layman and Flynn, 1991:8).

Framing their research scheme was Szalay and Deese's 1978 psychological comparative study of perceptions, attitudes, and cultural frames of reference shared by groups of people: known as associative group analysis. Their goal was to introduce a research method which offered new kinds of information and made critical aspects of subjective meaning available to empirical

investigation by allowing the respondent's own interpretation of the free-association stimulus to determine the outcome/image (Szalay and Deese, 1978:149). This method requires salience of the issue at hand so an individual may project, in a familiar setting or metaphor, a particular concept or theme. Given that nuclear issues are quite salient in the world today, previous studies have been both timely and appropriate.

Although salient and appropriate, the Slovic and associates (1991) study has some problems. The first problem questions the viability of the four locations where the surveys were conducted. Because Las Vegas has had a long history of nuclear activity, is it fair to compare it to the responses of the other locales in Phoenix, Arizona, southern California and nationwide? Secondly, the study has a longitudinal aspect of two years. A lot happened in this time frame (1988-1990), not only in the nuclear waste issue arena, but in the world in general, such as the end of the cold war and subsequent easing of nuclear tensions. Third, the Yucca Mountain - Las Vegas problem occurs because every other state holds a NIMBY position and is enhanced by juxtaposition to the first problem. The fourth problem is methodological in nature. A "halo effect" could emerge as a result of the same question being asked six times. Fifth, there is no unwrapping of the response data. For example, "war" might be an image of either a conservative or a liberal, and the same problem may exist between any image of any sort. Thus, we argue that drawing policy conclusions requires going further into the response data.

THE STUDY

This study is based on results of a random-digit-dial survey conducted in the fall of 1991 by the Las Vegas Poll,at the University of Nevada-Las Vegas; a faculty development program not funded by any agency or program associated with the Yucca Mountain project. Las Vegas. Responses were gathered for 406 adult residents of Clark county, resulting in an estimated margin of error of ± 4.0 percent at the 95 percent confidence level.

Word Images

The key component of this study is assessing the word images, which come to mind, among the general public when they hear the word "nuclear." As discussed above, Las Vegas, Nevada, is a unique locale for this study because of the nearly three decades of nuclear testing including atmospheric testing, in Clark County. Because of this activity it is useful to compare the responses they provide to those of earlier studies that included a broader geographical perspective. In total, ninety-nine different responses were obtained,[1] which because of similarities, were placed into fourteen categories, including a miscellaneous response category. Table 1 reports these responses across the fourteen general categories. Overall, these general categories are only slightly different than those proposed by Slovic, Layman and Flynn in their study.[2] The most frequent set of responses fell into the category of "unfavorable descriptions", accounting for 24 percent of the responses.[3] The second most frequent set were categorized under the label "war", and obtained over fourteen percent of the responses. "Fear"

received slightly over ten percent of the responses as did direct references to "storage", the latter not particularly unusual in an area where one of the salient public policy issues is the storage of high-level nuclear waste.

The least recorded word images were related to "nuclear facilities" (2.3%), "scientific aspects" (1.3%), and "political aspects" (1.3%). The low responses in the "scientific" and "political aspects" categories are interesting. First, in consideration of "political aspects", since these results were collected after the ending of the cold war, might it be that there is less concern about nuclear advantages in global geopolitics. Second, with regard to the "scientific aspects" in a town where a significant portion of the working population is somehow directly related to the nuclear issue area (ie., testing or storage) complete with all the science involved; it is interesting that it invoked few science images overall.

Beyond these initial findings, however, we are led to ask what might lie behind the images which individuals have about the "nuclear" arena? Earlier research in this same vein, unfortunately, was content to stop at this point while sometimes drawing conclusions that may not necessarily hold true. For example, might it not be the case that those on both sides of the political spectrum draw an image of "war." Why? Moreover, even if someone supports nuclear energy, overall, do they have to have a positive image? In this regard, we move forward by looking at sources of variation proposed by the extant literature of the social sciences which suggests that various positions about

issues are bsed on a number of situational an trans-situational factors. The first is dynamic in nature, conceivably changing from issue to issue, such as one's policy stance on defense, versus environmental issues, versus health issues. The second is fixed and relatively consistent across policy issues, such as age, income and other personal and socioeconomic characteristics.

Sources of Variation

We propose, in addition to the initial images about the nuclear issue area, that other factors should be explored in order to determine to what extent they may impact on the images drawn among the general public. These include: (1) Personal or socioeconomic characteristics; (2) policy preferences; (3) levels of knowledge and information holding; and, (4) perceptions of risk. Each of these is considered in turn. In the analyses, gamma (a measure of ordinal association) is employed to consider the linkage between potential sources of variation and word images. Gamma is employed for a number of reasons. First, it is relatively easy to understand. Gamma measures fall within a known range, from -1.0 to +1.0, where -1.0 indicates a perfect negative association, a +1.0 indicates a perfect positive association, and 0 indicates no association. A positive gamma tells you that as one variable increases so does the other; a negative gamma records the reverse, as one increases the other decreases. (Norusis, 1986). Typically, although there are no general rules, gamma measures over .20 draw the attention of social scientists. In this instance gamma assists us by pointing towards direction

or association so that we may know that, given one characteristic, an individual is likely to develop certain types of word images. From another perspective, gamma allows us to use those who do not choose a particular word image in the analysis. For example, by not choosing a particular word image are there particular sources of variation that stand-out among those in the non-choice category? Measures were recoded as necessary to insure that choices of a particular word image tended to lead to gamma in the positive range, while not choosing an image placed them in the negative range.

Socioeconomic and Personal Characteristics

Eight socioeconomic characteristics are considered for their impact on word images in response to the prompt "nuclear." Inasmuch as socioeconomic and personal characteristics dominate the public opinion literature, they are a likely and useful starting point for our analysis. Age,[4] is considered as a reflection of the nuclear era. Are those who have lived during the early part of the nuclear age more apt to respond with word images different than those from the more recent period? Age may also be a factor among those who developed their perceptions during periods of considerable nuclear activity that gained a large amount of media coverage (ie., Three Mile Island, Chernobyl). Age may also be seen as a step towards gaining wisdom: reflecting on the abilities of society to incorporate technological achievements into developing a better lifestyle, or the reverse. Viewed from another perspective, age may be associated with old-fashion or out-dated thinking with a younger

generation more likely to incorporate new images more reflective of their time (Soden et al., 1988).

Income levels[5] and social class standing[6], two additional sources of proposed variation, may bear on images. Clearly those with higher income levels, and those who report upper-middle and upper-class status, are more secure in their lives and capable of focusing on issues differently than those of lower-class and lower income status. Those who have fulfilled basic needs are afforded the chance to consider a broader range of options and may develop in turn a different set of images (Maslow, 1970).

Education is a third source of variation that has proved to be of considerable importance.[7] Inasmuch as education plays a role in increasing the ability of the individual to perceive and process information about a particular issue (Pierce and Lovrich, 1986; Soden and Conary, 1991), it might equally come to bear on processing the wealth of information in the nuclear arena and developing an image. It is suggested that education increases rationality, and plays a role in innate understanding of issues (Goldberg, 1969). It also relates to life-long learning and may be expected to relate to how one formulates their images.

Also, gender, marital status,[8] and length of residency[9] in Clark County can be significant predictors of policy positions. Gender raises the question of whether women and men hold different images about issues. Knowledge of behavior towards some environmental and natural resource concerns suggests that there is a definite gender difference (Kellert and Berry, 1980; 1984). Women tend to score higher on humanistic and moralistic scales,

and show greater proclivities to get involved in policy arenas where they feel threaten (Bammel and Bammel, 1986; Steel, et al., 1990). Martial status also may be of interest if an image is biased by one's own spouse or a sense of closeness to their spouse, especially in a city like Las Vegas where employment by one spouse in some activity related to nuclear issues, is not uncommon. The length of residency in Clark County also draws our attention. Clark County has undergone dramatic growth during the course of the last decade. For many of those who arrived in the last 10 years, knowledge of the extent of nuclear activities in the Las Vegas area was scant and often non-existent. For those who have lived in the area for some time, nuclear testing, a tactical weapons base (Nellis AFB) and more recently a high-level nuclear waste repository proposal, are familiar issues and part of the community. In this case, the images drawn may be very different if one has lived through the period when many Nevadans embraced the testing of nuclear weapons as an economic benefit to the community as opposed to the opposition that has developed over a waste repository since many new residents arrived during the last decade.

Lastly, ideological orientations[10] are reported, in numerous studies, as having an important impact on the way in which individuals perceive policy issues. The values attached to democratic societies and identification with an ideology suggest the extent to which one choice might be preferred over another. Ideology has been found to be strongly linked to support for or opposition to an number of environmental policies (Pierce and

Lovrich, 1980: Kenski and Kenski, 1981; Steel and Soden, 1989). Pierce and Lovrich have found that ideology is linked to attitudes concerning the policy process (Lovrich, et al., 1979), especially in identifying consistently with those of the same ideological bent. Overall, these studies suggest that those on the conservative end of the political spectrum are more likely to support policies that allow for the free-market to direct decisions and are likewise supportive of programs that are supported by public utilities, industry and development prone interests. In this instance, the majority of the support for the Yucca Mountain project comes from those that might identify with these forces and, in turn, it would seem logical that these individuals would have a more favorable image than those on the liberal end of the spectrum who are more supportive of regulation and stricter environmental controls. Yet, more recent studies suggest that some issues related to the environment and science and technology questions are problem-oriented and separate from conventional ideological considerations. The extent these arguments are manifested in images may be of particular importance in determining policy directions among elected political leaders as well.

Several noteworthy associations arise as a result of the consideration of these socioeconomic characteristics and are reported in Table 2. Age associations are made with images that include "favorable comments", "death", "nuclear facilities", and "scientific aspects." Older individuals do not record "favorable comments" or images associated with "nuclear facilities" and

"scientific aspects." They do, record images of "death," suggesting that a distinct image from the actual deployment of nuclear weapons might exist among an older cohort. Higher educated respondents recorded images in the categories of "fear," "undesirable effects," "death" and "nuclear facilities" while lower educated respondents put forward word images in the categories of "storage," "favorable comments," "scientific" or "political aspects." Overall, these suggest that those with higher education levels are likely to hold negative images, however, "nuclear facilities" requires further consideration because it may conjure negative images for one set of actors and positive for another and a gross categorization as negative should be carefully considered. Those of higher income levels and social class record word image associations that are of interest. Those who record images of "accidents," "nuclear facilities" and "undesirable effects" are likely to earn higher incomes, while those of higher social-class standing record similar images, as would be expected, except about "accidents" where a neutral association is recorded, and "death" where upper-class individuals record images. One explanation of this may be that those of blue-collar and middle class standing are less accident-alert or more accepting of them as the cost or way of doing business than their upper-class neighbors; thereby neutralizing the association, while those who perceive death among higher social classes are more oriented towards negative imagery. However, the degree to which this is true remains speculative.

Those with lower incomes and social class do not record "storage" or "energy" word images in their responses. In addition, those of lower-class standing do not provide word images associated with "scientific" or "political aspects". These appear logical if one considers that energy and storage are more complex concerns that those concerned with other, more immediate, needs are likely to conceptualize; and, that political and scientific aspects are, likewise, of little concern when there are other priorities at the lower-rungs of the socioeconomic ladder.

In consideration of gender and marital status, those who are married are likely to see "political" and "scientific aspects" as part of their word associations. Explanation of this is lacking, but in a community where considerable nuclear activity occurs the science and politics of this activity prevails in the family unit and, more than likely, is openly discussed. Gender is more interesting in that men set forth "energy" related, "test site," "favorable comments," "nuclear facilities," "scientific" and "political" word images, while women record images of "fear." These strong associations point out that men see nuclear issues in a generally more applied and favorable setting than females who record less-positive images. In consideration of the time that respondents have lived in Nevada, the argument is often proposed that those who have resided a longer period are more inclined to accept the repository, seeing it as an extension of the Nevada Test Site, than are their more recently arrived neighbors. Surprisingly, those who have moved into the region in

the last decade do not record word images differently than those who have lived in the area for some time, except in the case of "political" and "scientific aspects" responses of those who have recently moved into the area, while those who have resided for some time are likely to record a word image related to "nuclear facilities." Again, this is not unexpected given the existence of these facilities in the community for over thirty years.

Word image associations to ideology should be consistent across images of both positive and negative effects if the literature is correct. With regards to "war" word images, we find that those on the liberal end of the ideological spectrum are also those who would be apt to respond, as well as with "test site" or "scientific" oriented word images. By contrast, those on the conservative end of the spectrum would be apt to chose images associated with "energy," "favorable comments" or "political" aspects. Overall, these image responses appear logical and consistent with the literature, and would lead one to perhaps draw some policy conclusions.

Policy Preferences

Since the proposed high-level nuclear waste facility has become embroiled in the political scenery of Nevada and ranks among the salient issues in the state, the policy preferences about the proposal may be hypothesized to effect word image responses. In their study, Slovic and his associates suggest this, noting that the nuclear waste repository issue in Nevada is a doomed process that reflects a crisis in confidence. If this is the case, then similar word images should reflect

policy preferences among the citizens of Nevada, negative images with opposition to the repository, for example, in support of their conclusions. We undertake this aspect of the study by looking at responses to four questions about the policy process and policy preferences relating to the Yucca Mountain repository.

Many suggest that the choice of Yucca Mountain for sole-site characterization was a logical extension of the state's nuclear activities. In the course of the policy discourse since the passage of the Nuclear Waste Policy Act of 1982, and its subsequent amendments in 1987, many proposals have been put forward about how the State of Nevada should respond. One, supported by a number of elected officials, is that the state should do all it can to stop the federal government from siting the repository in Nevada while upholding its right to challenge the federal process (Vogel, 1993b). Another suggestion is that the state, if it is going to have to receive high-level nuclear waste, should charge as much as possible for accepting waste from other states; a quid pro quo for being the recipient of other states NIMBY, not-in-my-backyard, attitude. Lastly, it may be that the issue of high-level waste is linked to more broader environmental concerns as documented in other studies (Soden, 1990; Steel and Soden, 1988), and that those with a perception of a greater environmental problem respond differently than those who do not see such a problem.

Table 3 shows the association of these policy orientations to word image responses. Among those who believe Nevada should charge other states as much as it can to store their high-level

nuclear waste,[11] word images of "death" and "nuclear facilties were recorded, while those who provided word images in the category of "war", did not believe that Nevada should exact a heavy fee from other states for receiving and storing high-level nuclear waste. This provides us little in the way of initial insight into the policy domain. There is no clear evidence that a policy option to exact fees, as previously done by the state in accepting low-level waste, is related to images. And when associated, two very negative images, "war" and "death" relate two opposite policy preferences. Among those who believe the State of Nevada should get as much from the federal government in exchange for accepting high-level nuclear waste[12] we find that those who are supportive of this position record images including "unfavorable descriptions," "accidents" and "nuclear facilities," while those opposed may record an image of "war," similar in part to the responses noted above. How, we might ask, can those with "war" word images be so different than those with "unfavorable descriptions" or "death"? One perspective, we suggest, is that the word images people put forward may not reflect political realities. Even if one records an undesirable description through their word image, they may be inclined to have the state government get all it can from the federal government in exchange. Among those who believe the state should do everything in its power to stop placing of the repository,[13] another mixed set of images are recorded that further questions the value of using word responses as a policy analytic tool. Those who do not believe the state should try to stop the federal effort record

word images relating to "undesirable effects", as well as "energy", "favorable comments", "nuclear facilities" and "scientific aspects". By contrast, those who support the state's opposition record images of "unfavorable descriptions" and "fear". Again, two aspects, the physical negative effects and the "favorable comments," are the near inverse of each other which suggests a problem in the practical application and utilization word associations. Lastly, in framing the issue within a more general policy orientation, we see that among those who perceive an environmental policy problem in Nevada,[14] images relating to "fear," "storage," "scientific" and "political aspects" are likely, while those who do not see an environmental problem record images of "war," "energy" and "test site." Given the damage done by war, energy development and production, as well as the severe ecological damage done by thirty years of testing at the Nevada test site, those who do not see an environmental problem are the respondents who we believe are most likely to fall into these image categories.

Knowledge Factors

The role of the public in complex technical and scientific decision making has become of great concern to scholars and practitioners alike. Many have addressed the critical question of how to have mandated public involvement when the issues are of great technical and scientific complexity. The gap between the general public, policy elites and activists has been explored with findings suggesting that indeed there is a technical information gap between groups involved in the public policy

process attendant to complex technical issues (Soden, 1990; Pierce and Lovrich, 1986). Other studies have shown that communities are capable of learning and using an extraordinary amount of technical information, and participating in the polciy process when the stakes are high enough (Douglas and Wildavsky,1982; Wildavsky and Dake, 1990). Knowledge may be assessed in a number of ways and each serves its purpose. Two well-accepted approaches include self-assessment of knowledge within a policy domain, and knowledge of technical terms associated with a particular domain. Together, they should provide a valid assessment of word images, with those having self-assessed their individual knowledge as high recording similar images to those with a higher knowledge of technical terms.

Table 4 reports self-assessed level of informedness[15] and knowledge of technical terms[16]. These are in many ways among the more interesting of the findings. We see that those who believe they are well-informed report word images of "unfavorable descriptions," "war," "undesirable effects," "accident," and "nuclear facilities." Those who do not feel that they are well-informed are likely to see "favorable comments," "test site," "scientific aspects" and "political aspects" in their word imagery. When considered with knowledge of technical terms we would expect to see similar word image responses, and in most cases this occurs; thus, consistency is obtained across associations and word images. Those reported as having greater knowledge of technical terms also report images of "undesirable

effects," "fear," "death," and "nuclear facilities," with associations in some cases nearly the same to those obtained by self-assessed knowledge of terms. Those who recorded low knowledge of technical terms picked images of "energy," "favorable comments," "scientific" and "political aspects." These findings would seem to suggest that knowledge and level of information holding may underscore consistent perceptions not obtained in the other associations. If this is the case, enhancing knowledge about the proposed high-level nuclear waste repository would illicit images that may be viewed as less supportive of nuclear activities such as the proposed Yucca Mountain repository, based on the evidence which indicates that those who are viewed as more knowledgeable are less favorable than those who are less knowledgeable and informed.

Knowledge has previously served as a delineater of support for and opposition to particular public policies. Overall, the political process has few means for dealing with the impact of technical complexity and relies heavily on images, as evidenced from political commercials ranging from the famous "Daisy Girl" campaign advertisement suggesting that Barry Goldwater, 1964 republican presidential candidate, would lead us into war, to the more recent Willie Horton revolving prison door used by George Bush against Michael Dukakis in 1988. Among those well-informed, the commercials had little impact, but among those unclear on the arms race of the cold war or the penal system, they provoked dramatic responses. When the public has limited knowledge, either as a result of the inability to access information or

because of a failure to access and utilize the information available to them, they are likely to develop an image based on incomplete knowledge and perceived risk, as opposed to an informed perspective. These findings indicate that word images vary dramatically based on levels of knowledge about the complex and highly technical arena of nuclear issues, a finding which is in fact consistent with the work of Slovic and others in other writings (Slovic et al., 1990). Developing public policy based on these images may be inappropriate if we do not, therefore, know what levels of knowledge exist. The failure to do so degrades the public involvement process of democratic societies, as well as potentially leading to policies that are based on uninformed public perceptions, or comparisons across domains (ie., Phoenix vs. Las Vegas) where knowledge levels differ as a consequence of proximity to the issue.

Risk Perceptions

Perhaps no public policy issue in recent times has been the focus of risk analysis more than the Yucca Mountain project. Since the release of Rachel Carson's best seller SILENT SPRING , concern has grown about past practices which favored industrialization and material desires over environmental and aesthetic concerns. Citizens have consistently exhibited a concern about environmental hazards and, more generally, have come to appreciate the contributions which the environment can make to their quality of life (Milbrath 1984). It also could be argued that risk perceptions of Yucca Mountain's nuclear storage role have been heightened by the Department of Energy's

circumvention of the National Environmental Policy Act requirements for full environmental analysis in favor of a controlled-site characterization program (Clary and Kraft 1988; Kraft 1988; Lemmons and Brown 1990). A process which resulted in the selection of Yucca Mountain, Nevada over sites at Hanford, Washington and Deaf Smith County, Texas.

Social scientists have proposed a number of factors which may account for risk perceptions and variance among public perceptions of risk (Kuklinski et al, 1982; Steel, Soden and Warner, 1990; Pilisuk et al., 1987; Saarinen, 1982: Rothman and Lichter, 1987; Fiorino, 1989, 1990; Solomon and Cameron, 1985; Jasanoff, 1993). The dimension of risk with regard to word images about public policies has only peripherally been eluded to in previous study suggesting, for example, that negative images correspond to negative risks (Slovic, Layman and Flynn, 1991). Such suggestions may, in fact, lead to ecological fallacies when using samples from more than one area to assess policy positions in one locale, units of analysis which do not match. Or conceptual entrapment where one concept, such as word image responses are used to draw conclusions about risks. In order to move beyond these potential methodological flaws word image responses are compared across six risk concerns[17] that are often identified in the debate attendant to the Yucca Mountain controversy.

Table 5 reports the association of word images with risk to new jobs and employment opportunities, to the tourism economy upon which the Las Vegas area is built, and the possibility of

risks from accidents during the transportation of high-level radioactive waste to Yucca Mountain. Concerns about the risk to the water supply, wildlife, and the ecosystem around Yucca Mountain are also addressed, as are risks perceptions associated with accidents to site workers and the spillover effects these might have in adjacent communities. The associations provided in Table 5 record images of "undesirable effects," "destruction" and "political aspects" in strong association with perceived risks to new jobs and employment opportunities. Those who see little risk to jobs and employment opportunities are more prone to record images associated with "storage" and "test site," not surprisingly, two major employers in the region (Yucca Mountain Project and the Nevada Test Site). Perceived risk to tourism elicits images of "energy," "favorable comment," "nuclear facilities" and "scientific aspects," while those who see less risk to the tourism industry hold images of "unfavorable descriptions." These are somewhat confusing in that those images that associate risk with tourism are not the most negative. Thus, might it be that even those holding positive oriented images do see a risk perception among outsiders that might come to bear on Las Vegas if Yucca Mountain is approved. If this is the case, Slovic and his colleagues are correct, and our further inquiries support their conclusions that the image that Las Vegas and Nevada must contend with may have serious repercussions in other areas, like tourism, and this is recognized even by those who hold positive images of nuclear. Further, risk considerations show those who see risk in the transportation of

high-level nuclear waste again record images close to those who saw risk to tourism, and have word images which are in the categories of "energy" and "favorable comments," "political" and "scientific aspects," and "destruction." In this use of risk some inconsistent images emerge, such as "destruction" with "favorable comments," perhaps then deleting the value of the linkage to other findings considered in association with tourism. Risk to water systems, vis-a-vis contamination, also provides some interesting views. Those inclined to see a risk problem in this area are also likely to provide word images of "energy," "favorable comments," "nuclear facilities," "destruction," and "scientific aspects." The issue of water is among the most salient, if not the most salient, issue in Nevada. Concern for water quality, as well as quantity, is broad across a host of political and social dimensions (Soden, Gerlak and Carns, 1993). The degree to which these word images may seem inconsistent must be considered in light of the water problems of the region, and as such, high risk to water may actually be more of a concern than the linkage to the nuclear issue at Yucca Mountain. Risk perception relating to wildlife and ecosystems are nearly identical to those pertaining to water. If these images hold up across two, albeit broad, dimensions of natural/ecological risks, then insight may be gained into how the image of nuclear issues plays itself out in public sentiments towards natural systems. Previous studies, using the same data set, indicate that those in support of protecting the environment are more likely to record higher perceptions of risk across the board except risk to

tourism (Soden, et al., 1992). Further exploration into these concerns clearly is required and suggest, in light of the other findings, that a first-cut may be obtained from word images, but that risk analysis based on images disregards the multi-dimensional aspect of risk. Lastly, those who do not record high levels of risk to site workers and adjacent communities, put forth images of "unfavorable descriptions," "fear," and "storage," while those who perceive high risks hold images of "energy," "favorable comments," "destruction" and "scientific aspects." This mixed set of word images furthers the raising of the caution flag in the policy analysis arena.

IMPLICATIONS AND CONCLUSIONS

Overall, these findings are interesting but not conclusive. While there are recorded consistencies with earlier studies, more inconsistencies and questions are raised. That a number of different images exist in response to a word prompt of "nuclear" is not surprising and, overall, the recorded images received in the Las Vegas area are not dramatically different than those received by Slovic and his associates in a series of surveys conducted over a two year period. The inquiry into these images suggests that several mixed-signals may come from the public, as those who seemingly are supposed to be on opposite sides of the issue, and based on policy statements and pronounced positions are recording similar images or holding parallel policy preferences and risk perceptions. Thus, unlike other studies, we are less willing to support conclusions about what people may

feel or not feel. We further suggest that, in light of the often conflicting evidence, the use of word images in characterizing the policy debate about a highly controversial issue, like the proposed high-level nuclear waste repository at Yucca Mountain, is risky in and of itself. There appears to be much more to the word images respondents provide than an initial analysis, such as that of Slovic, Layman and Flynn, might have us believe. Also, as social scientists we are concerned about the construct validity of ths type of study, especially when policymakers, such as the Governor of Nevada, base their positions on the findings given them. Put simply, the evidence suggests that policy preferences and risks do not necessarily relate consistently with word images. One can not be predicted from the other acurrately enough to use as a policy instrument.

We would also put forth the tentative nature of our own findings. Given the problems of measuring word images, it would be wise to proceed with caution in any policy arena. The image we may see put forth could well be the image opposite of an individual's preferred policy choice, the mirror or inverse image brought about by displeasure from the other point of view, not an unlikely scenario in many cases. Multiple measures brought about by multiple prompts, likewise, has its problems in that the halo effects, so often discussed in methods classes but so often forgotten in conducting studies, can lead to a series of ascending or descending responses from best to worst and vice-a-versa. In that instance it is no wonder that images from multiple prompts might exact more negative imagery. This might

be the case in using any form of prompt in multiple form and policy conclusions would, as a consequence, be biased away from initial images. The "soft" nature of image data, even among survey researchers, combined with measurement problems suggest we look further before going forward with word image studies as a policy instrument. Added to this is the inconsistency among the public and the many correlates or factors that can be used to explore variations, as set forth here, and the picture is even more muddled. While we find that personal characteristics, policy preferences, knowledge and risk perceptions each lends a bit to the overall assessment of word images in this policy domain, except in the area of knowledge holding and risk perceptions, do we see real consistency. Thus, we hold forth on policy direction and prescriptions based on word images and seek to further unravel the puzzle before supporting the adaption of word images as a policy analytical instrument.

ENDNOTES

1. A full listing of these responses is available from the authors on request. Slovic, Layman and Flynn use thirteen categories, by contrast and obtained ninety-two different categories of responses, but did not include energy or transportation as response categories (response rates of 85 and 65, respectively).

2. Slovic, Layman and Flynn report the following fourteen categories: negative consequences, negative concepts, locations, radiation/physical states, safety/security, concerns, societal institutions, ecology, necessary, economics, information/knowledge, positive, miscellaneous, and uncategorized.

3.We use two categories, "Unfavorable descriptions" and "Undesirable effects". The distinction exist in that the latter category includes those responses which directly refer to concrete or physical effects, while the former includes abstract descriptions that do not pertain or relate to physical effects.

4. Age measured in years.

5. Family income measured in dollars.

6. Five choice scale in which respondent self-describes their social class, ranging from: 1) lower class, 2) working class, 3) middle class, 4) upper-middle class, and 5) upper class.

7. Education measured by level completed, across five choices: 1) never finished high school, 2) high school or trade school, 3) some college, 4) completed college, and 5) advanced degree.

8. Measured as: 1) married or 2) not married, including single and divorced.

9. How many years respondent has lived in Nevada.

10. Seven point scale ranging from: 1) very liberal, to 4) middle-of-the-road, through 7) very conservative.

11. Seven point scale ranging from: 1) strongly disagree to 7) strongly agree, in response to the statement, "Nevada should charge other states as much as possible in return for accepting and storing their nuclear waste."

12. Seven-point scale, as above, in response to the statement: "The State should get as much as it can from the federal government in exchange for accepting the nation's high-level nuclear waste."

13. Seven-point scale as above, in response to statement: "The State of Nevada should do everything in its power to stop the federal government from locating a high-level nuclear waste storage facility in Nevada."

14. Seven-point scale ranging from 1) no problem to 7) a serious problem now, to the statement, "Recently, there has been a lot of talk about the quality of the environment in Nevada should growth trends and use of natural resources continue. In your opinion, how much of an environmental problem does Nevada have?"

15. Seven-point scale ranging from 1) not informed at all, to 7) very well-informed, in response to the question, "How informed are you about the proposed Yucca Mountain high-level nuclear storage issue?"

16. Index of high, medium and low self-assessed knowledge of technical terms, based on responses to eleven terms ranging from the least to most difficult, and one bogus term. Based on a prompt respondents noted that they: 1)were familiar with the term, 2) had heard of but did not know the meaning and 3) have not heard of.

17. A seven-point scale was used ranging from: 1) a low degree of risk exist, to 4) uncertain, to 7) a high degree of risk exist. Using this scale respondents were asked to indicate how much risk there will be to each of the following if the nuclear waste repository is located at Yucca Mountain. The categories were: 1) new jobs created in Nevada, 2) tourists will avoid Nevada, 3) serious accidents will occur while transporting nuclear waste, 4 waste contamination of underground water supplies, 5) site workers and surrounding communities are subject to accidents, and 6) wildlife and ecosystems will be threatened.

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Table 1

Word Images In Response To "Nuclear" Prompt

Question: If I say the word "nuclear" what is your one word reaction?

Response Category	Frequency	(%)
Unfavorable Descriptions	92	(24.0)
War	56	(14.6)
Fear	41	(10.7)
Storage	40	(10.4)
Undersirable Effects	32	(8.4)
Accident	30	(7.8)
Energy	21	(5.5)
Favorable Comments	20	(5.2)
Test Site	17	(4.4)
Death	13	(3.4)
Nuclear Facilities	9	(2.3)
Scientific Aspects	5	(1.3)
Political Aspects	5	(1.3)
Misc.	3	(.8)
Total	384	(100%)

Table 2

Association Between Socioeconomic and Personal Characteristics with Word Images:Gamma

Word Images	Characteristics							
	Age	Education	Income	Social Class	Marital Status	Sex	Length of Residency	Ideology
Unfavorable Descriptions	-.022	-.072	-.159	-.068	.073	.024	-.008	.033
War	.069	.189	.160	.060	.198	.133	-.073	.323
Fear	-.024	.325	.187	.108	-.180	.302	.130	-.050
Storage	.023	-.297	-.207	-.239	.047	.145	.136	-.107
Undesirable Effects	.114	.310	.232	.580	-.042	-.043	.014	-.088
Accident	.046	-.060	.200	.066	.105	-.147	.029	-.180
Energy	-.126	-.424	-.320	-.169	.094	-.350	-.029	-.269
Favorable Comments	-.294	-.262	-.045	-.098	.147	-.311	-.063	-.296
Test Site	-.027	-.151	-.168	.059	.189	-.233	-.061	.382
Death	.272	.347	-.092	.493	-.017	.136	-.157	.169
Nuclear Facilities	-.210	.208	.214	.213	-.090	-.216	.209	.187
Scientific Aspects	-.234	-.781	-.190	-.561	.404	-.300	-.341	.477
Political Aspects	-.042	-.277	-.027	-.344	.309	-.300	-.298	.641

Table 3

Association Between Policy Orientations And Word Images: Gamma

Word Images	Policy Orientations			
	Charge	Accept	Stop	Problem
Unfavorable Descriptions	.021	.225	-.382	-.062
War	-.326	-.343	.087	-.216
Fear	-.025	-.021	-.342	.204
Storage	.004	.006	-.040	.200
Undesirable Effects	.186	-.040	.218	.041
Accident	.038	.219	-.058	.013
Energy	-.040	-.142	.519	-.220
Favorable Comments	-.074	-.044	.692	.145
Test Site	.046	-.135	.168	-.322
Death	.215	-.009	-.157	.076
Nuclear Facilities	.304	.253	.369	.084
Scientific Aspects	.093	-.147	.772	.403
Political Aspects	.027	.132	-.056	.266

Table 4

Association Between Knowledge Characteristics and Word Images: Gamma

Word Images	Knowledge Characteristics	
	Level of Information	Knowledge of Terms
Unfavorable Descriptions	.230	.101
War	.235	-.070
Fear	.164	-.217
Storage	-.032	.092
Undesirable Effects	.332	-.309
Accident	.256	-.057
Energy	.134	.240
Favorable Comments	-.542	.611
Test Site	-.209	.110
Death	.054	-.411
Nuclear Facilities	.245	-.256
Scientific Aspects	-.460	.461
Political Aspects	-.285	.534

Table 5

Association Between Risk Perceptions And Word Images: Gamma

Word Images	Risk Perceptions					
	Jobs	Tourism	Transport	Water	Workers	Wildlife
Unfavorable Descriptions	.064	-.237	-.315	-.436	-.375	-.375
War	.060	.130	.166	.185	.190	.155
Fear	-.166	-.135	-.173	-.283	-.311	-.374
Storage	-.203	-.157	-.228	-.126	-.206	-.223
Undesirable Effects	.273	.094	.050	.096	.143	-.042
Accident	-.045	-.144	-.034	-.068	-.003	-.103
Energy	-.050	.442	.385	.520	.417	.699
Favorable Comments	-.009	.289	.650	.559	.673	.627
Test Site	-.217	.005	.132	.117	.176	.155
Death	-.148	-.003	-.186	.083	-.099	-.208
Nuclear Facilities	.182	.375	.132	.328	.183	.333
Scientific Aspects	.199	.352	.566	.597	.518	.702
Political Aspects	.469	-.146	.432	-.218	.109	.105

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