PUBLIC RESPONSES TO TECHNOLOGICAL RISKS: Toward a Sociological Perspective

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One of the most serious challenges facing "advanced" industrial societies is the management of technological risks. Recently, a number of sociologists have called attention to the topic, noting the significant contributions sociologists can offer to the ongoing risk debate. This article takes a complementary approach, suggesting that it is important to ask not just what sociology can do for the study of risk, but what the study of risk can do for sociology. Particular promise is evident in studies that go beyond a focus on individuals' risk perceptions, dealing with the behaviors and interests of societal institutions entrusted with the management of risks. Still lacking, however, is a more explicit and coherent conceptual framework, one that can help guide future research toward the testing of sociologically important questions, not just the questions and issues that technologists and policymakers define as important. Working from an explicitly sociological orientation, this article outlines a conceptual perspective that focuses on the "framing" of risk debates by institutional actors. This approach suggests that, given the profound growth of technological efficacy, in the face of modest if any growth in the efficacy of social control mechanisms, the management of technological risk is likely to become increasingly problematic for sociology as well as for society.

INTRODUCTION

Risk is a concept coming of age. Barely existing as a discipline 15 years ago, risk analysis has become a hallmark of modern society (Lave 1987; Short 1987). Risk now commands its own research program at the National Science Foundation, and risk analysis has a professional organization and several new journals. The assessment and management of risks grew quickly to be a multibillion-dollar industry (Nelkin 1982).

The field's phenomenal growth has occurred amidst a storm of controversy, both within and without. Within the field, some insist on the viability of purely quantitative estimates of risk and risk analysis as "a scientific process . . . , an important tool for making

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The Sociological Quarterly, Volume 33, Number 3, pages 389-412.

ISSN: 0038-0253.

logical business and scientific decisions" (Cox, O'Leary, and Strickland 1985); others see the field as offering so many opportunities for manipulation and subterfuge as to call into question its very validity (Sterling and Arundel 1985; more broadly, see Wynne 1982, or Johnson and Covello 1987). Debate also rages over the levels of risk posed by technologies such as energy production (see B. Cohen 1985, 1989; Otway 1985, 1989; Munera 1989). In the broader society, meanwhile, regulators struggle to set and enforce safety standards for a plethora of hazardous and toxic substances, trying to cope with citizen groups who challenge official risk assessments in the courts, in the legislatures, and on picket lines. Industry complains of being shackled by citizens' paranoia about risks to health and safety (see Passell 1989a, 1989b; Cox, O'Leary, and Strickland 1985); citizens complain of being poisoned by industry and ignored or discouraged by government when they take action (see Krauss 1989; Couto 1986; Freudenberg 1984).

The increasing societal importance of risk issues has not gone unnoticed by sociologists. As Dietz and Rycroft (1987) noted, for example, the rapid growth of the "risk establishment" reflects government and industry concern over the social cleavage created by differing approaches to the societal management of risk and safety. This social cleavage is manifested in a variety of social institutions and forms; all offer promise for sociological exploration, and the growing base of social science knowledge about risk has been summarized in a number of reviews (see especially Short 1984, 1987; Christenson 1988; Freudenburg 1988a; Dietz, Stern, and Rycroft 1989; Dietz, Frey, and Rosa forthcoming; Heimer 1988; see also Fiorino 1989; Johnson and Covello 1987; Perrow 1984).

In general, however, both the reviews and the research efforts to date have emphasized the contributions that sociologists (and other social scientists) can make to the study of risk. That approach, while valuable, accepts the field of risk as nonsociologists conceived it. While building on the existing work, we take the complementary approach. Rather than bringing sociology to the field of risk, we attempt to bring risk to sociology, asking how a focus on risk can further our understanding of society.

Sociologists have done important work in dealing with increasing numbers and types of risks, as in financial markets (e.g., Reichman 1983), desired/recreational risks (Machlis and Rosa 1990), or medical risks (e.g., Bosk 1979; Rothman 1986). Our major focus, however, is on technological risks, specifically on cases where the planned or actual implementation of technological development produces benefits for some, or even for society at large, but does so while imposing a burden of risks on others.

While there has long been an association between "technology" and "development," recent years have seen growing disagreement about the desirability of particular forms of development (cf. LaPorte and Metlay 1975). The potential for conflict is present, for example, when a tourism-dependent region is asked to accept offshore oil development (Freudenburg and Gramling 1991, In Press), or a poor, rural area is asked to accept toxic waste disposal facilities that are apparently seen as too dangerous for areas that are more heavily populated or more affluent (Peck 1989). "Development issues" become "technological risk conflicts" when an individual or group becomes concerned about potential risk and mobilizes to stop or change the path of development.

Popular as well as sociological writers (e.g., Glaberson 1988; Dietz, Stern, and Rycroft 1989), emphasize that the outcomes of current technological risk conflicts are likely to have profound implications for society. In addition, conflicts offer a particularly important context for examining both the institutional forms taken by risk analysis and the influence of risk analyses on social actors. To date, however, "Little knowledge exists concerning

such social dimensions of risk as the institutional forms taken by risk analyses, how these forms take shape and perform, or concerning the relationship between scientific knowledge, law, policy and practice, or how risk analysis and risk analyses influence individual lives, corporate or community life" (Short 1987, p. 168).

The implications of technological risk conflicts, moreover, differ from the issues raised by other types of risk, such as financial or recreational risk. Questions of power, social control, and the trustworthiness of specialized experts are embedded in decisions about technological risks in different ways than they are in decisions about other types of risk. When individuals decide whether to trust their funds to a financial institution, for example, they often have a degree of control, including the option to invest elsewhere or not at all. By contrast, when a farm family learns that a toxic waste incinerator will be built nearby, they may have no real choice but to accept or protest the decisions that have already been made by others.

On closer examination, moreover, the imposition of risk on one group by another is often exactly what is at issue in technological risk conflicts (cf. Perrow 1984). The struggle is thus not just technological, but also political (who has the power to decide?) and discursive (how is "benefit" or "progress" defined?). The political/discursive struggles, however, have more often than not been hidden by the way in which questions about technological risk conflicts have been framed to date.

Perhaps because risk debates often tend to have been defined by others before sociologists become involved, even carefully designed sociological research, to date, has tended to focus on questions policymakers and industry spokespersons emphasize. Perhaps not surprisingly, those spokespersons show little evidence of sociological insight and focus primarily on "establishment" concerns, ignoring questions arising from perspectives that are more critical—as well as being more structural and sociological in their implications. While it would not be appropriate to conclude that critical perspectives will ultimately prove either superior or inferior to the implicitly functionalist perspectives reflected in many risk debates, what is needed is the kind of systematic and balanced research that will ultimately allow such a determination to be based on solid, empirical evidence. Our analysis, accordingly, strikes a balance—first, by building on the growing body of relevant social science work, and second, by offering the preliminary outlines of an alternative conceptualization that deserves sociological attention as well.

Attempts to bring technological risk conflicts to sociological light can be partly informed by work in several areas: individual attitudes and perceptions about risk; political sociology/social movements; and community- and media-influence dynamics. We begin with a review organized along these lines, suggesting ways these areas might develop. Later, we turn to recent work that may assist in reconceptualizing technological risk conflicts as political and discursive struggles.

PREVIOUS RESEARCH

Individual Perceptions and Attitudes

Perhaps the best-known of the existing approaches to perceptions of technological risks focuses on the "objective" characteristics of risks and on individuals' risk perceptions. Starr's influential article (1969), for example, notes that risks accepted voluntarily, such as cigarette smoking, tend to inspire significantly less opposition than do otherwise equiv-

alent risks that are seen as being imposed by others. Other authors modify this formulation, stressing factors such as the lack of control (Slovic, Fischhoff, Lichtenstein 1980; Fiorino 1989) and the equity with which technology's risks and benefits are distributed (Kasperson 1983; Rayner and Cantor 1987). In perhaps the most developed body of work on individual risk perceptions, Slovic, Fischhoff, and colleagues (Fischhoff, Slovic, Lichtenstein, Read, and Combs 1978; Slovic, Fischhoff, and Lichtenstein 1980, 1985) use factor analysis to identify a pair of considerations that appear particularly significant in shaping the perceived risk of a technology—(1) the degree to which it seems new, unfamiliar, or unknown to science, and (2) the degree of "dread" inspired by the potential for catastrophic accidents. Related research finds concern to be linked to highly complex technologies, those perceived to be unnecessary (Covello 1983), and those where institutional safeguards are inadequate (Vlek and Stallen 1980).

Much of this area's literature focuses on what supporters of technology see as a gap between "real" risks and public perceptions. In the first well-known use of formally probabilistic risk assessment, for example, the U.S. Nuclear Regulatory Commission (1975) concludes that the average citizen has a lower chance of being killed by a nuclear power plant than by a falling meteorite. The Commission later withdrew its endorsement of the report's forcefully written executive summary, and subsequent analysis of actual operating experience shows that even the detailed technical analyses suffer from such pervasive overconfidence that "*all* the values from operating experience fell outside the 90 percent confidence bands" of the original report (Shrader-Frechette 1990, p. 29; emphasis in original). Nevertheless, the risk-assessment community widely interpreted the report as showing that public concerns over nuclear power safety had little or nothing to do with actual risks, being influenced instead by the biases of individual perceivers (see, e.g., B. Cohen 1985).

This orientation meshes nicely with the work of psychologists (N.B., Tversky and Kahneman 1974) who compare probabilistic assessments against experimental subjects' risk estimates and conclude that most people are not probabilistically rational utility-maximizers. Over the period of roughly a decade, work within what is sometimes called the psychometric paradigm has developed a substantial literature on "heuristics," or the common-sense rules of thumb that people apply to risk questions, particularly to probability estimation. Common examples of heuristics include the tendency to judge probabilities according to "availability" (roughly, the ease with which one can imagine or recall examples), "representativeness" (the degree to which an event looks like its parent distribution or displays the characteristics of the process generating it), and "anchoring and adjustment" (the process of estimating upward or downward from a value that the problem statement suggests). Judgments are also susceptible to "framing" bias; the acceptability of risks varies, for example, depending on whether a probability is presented as negative, as in a 50% chance of dying, or positive, as in a 50% chance of being "saved" (see, e.g., Tversky and Kahneman 1974, 1981; Slovic, Fischhoff, and Lichtenstein 1984). Such tendencies can be valid and even helpful in some circumstances, but at times, they can lead to "large and persistent biases, with serious implications for risk assessment" (Slovic 1987).

While these two bodies of literature have been interpreted as depicting a public that irrationally fears science and technology, sociological work paints a different picture. Studies of attitudes toward science and scientists, for example, tend to find persistent and strongly favorable orientations toward science within the American public (see Marrett

1984; Marshall 1979). Greater concerns appear to be raised by some of the specific applications of science (LaPorte and Metlay 1975), but even research on the opponents of specific technological installations does not tend to support the view of an emotional, hysterical, and anti-science public that some proponents of formal risk models portray. Contrary to claims such as those by Cox and colleagues (1985), who discuss the public's "basic fear of science and technology," opponents of specific facilities and technologies work with scientists often and find these experts helpful (Freudenberg 1984).

Public attitudes toward nuclear power, for example, often denounced by physical scientists as irrational (see, e.g., B. Cohen 1985), have undergone considerable analysis by sociologists (Freudenburg and Rosa 1984; Freudenburg and Baxter 1985; Gamson and Modigliani 1989). Multivariate studies tend to challenge the common belief that higher education levels foster greater support (Mitchell 1984; see also Dunlap and Olsen 1984). In addition, research indicates that earlier levels of strong support have largely disappeared, even among certain previously supportive segments of the public, as in the case of "host communities" for nuclear power plants (Freudenburg and Baxter 1984).

Despite scientists' calls for more "public education" on science and technology in general, sociological evidence also calls into question the assumption that public concerns are due to insufficient or inaccurate information and that attitudes will thus grow more favorable as people become "educated" or better-informed (see Otway and Thomas 1982). The public that turned against nuclear power had been subjected to a decades-long, multimillion-dollar public-relations campaign on the benefits of nuclear technology; the U.S. Atomic Energy Commission's *Annual Report to Congress* (1968) notes that nearly five million people saw its exhibits and demonstrations in 1967 alone. On the other hand, the increasing skepticism may reflect the potential for what technological proponents might consider "the wrong kind of education." Some of the most dramatic declines in public support for nuclear power, for example, took place after headlines featured new information, such as the accident at Three Mile Island (Freudenburg and Baxter 1984, 1985). Recent findings suggest that so-called "public education" campaigns, focused on overcoming "irrational" public concerns over controversial facilities such as nuclear waste repositories, appear, if anything, to be associated with *increasing* levels of public opposition—not just in the U.S. (Slovic, Layman, and Flynn 1990; Flynn 1992), but also in nations commonly described as more compliant with the desires of technological elites, such as Japan (Budd, Fort, and Rosenman 1990), Taiwan (Liu and Smith 1990), and Korea (United Press International 1990).

Perhaps in response to these problems, the literature on risk communication suggests a movement toward establishing a dialogue with citizens and away from arguments that people simply need to be convinced (see National Research Council 1989; Fiorino 1989). Still, sociological research indicates the human side of the technological risk conflict equation is more complex than even the newer versions of the risk communication literature suggest. To date, relatively little of the needed work has been done, but research on attitudes toward environmental preservation suggests one promising direction (for reviews, see Van Liere and Dunlap 1980; Dunlap 1987; Heberlein 1981; Freudenburg 1991c), pointing to the potential significance of broader worldviews or "paradigms" (Dunlap and Van Liere 1978). This literature suggests that attitudes toward science and technology may be tied to some of people's most deeply held beliefs (cf. Freudenburg and Rosa 1984). Clearly, however, the "nonscientific" components of beliefs and attitudes (values, personal priorities, etc.) can influence the views of technological proponents and

opponents alike; to date, relatively little attention has been paid to the "nonscientific" components of *scientists'* beliefs and attitudes—a point that receives further discussion below.

Political Sociology/Social Movements

Sociologists have also contributed case studies of communities embroiled in conflicts about a variety of risks (see, e.g., Nelkin 1985; Levine 1982; see also Nelkin 1979; Tichenor, Donohue, and Olien 1980; Kamieniecki, O'Brien, and Clarke 1986; Kroll-Smith and Couch 1990) as well as work on the dynamics of technological controversies more generally. Mazur, for example, explores ideology, belief and partisanship, and the growth and "attention cycles" of protest movements (Mazur 1981, 1984; see also Jasper 1988).

In general, however, studies have made only limited use of the fact that technological risk conflicts are essentially problems in political sociology. When battle lines are drawn between citizen groups and the state or industry, concepts of power, collective action, resource mobilization, and ideology would seem useful. In addition, every conflict has its alignment of forces, and many twists are possible; scientists may work on either side of the picket line, for example, as they do in Adeline Levine's case study of Love Canal (1982). State, local, and federal government bodies may also work in concert or opposition. To the extent to which risk debates could be said to reflect the political sociology literature, moreover, what has been reflected is primarily the dominant tradition of the 1960s, focusing on characteristics of the individuals who join a social movement, including their motivations for participation and family backgrounds (see Kenniston 1968; Snow, Rochford, Worden, and Benford 1986). In this paradigm, social discontent is expected to underlie the inception and life cycle of any movement, and movement participants are expected to be motivated by grievances (for a recent discussion, see Zald and McCarthy 1987; see also Opp 1988). Participants in the so-called "Not In My Back Yard" or "NIMBY" groups are often characterized as motivated largely by discontent (e.g., Keeney and von Winterfeldt 1986), and in informal discussions, scientists and policymakers often express the view that "NIMBY types are malcontents—the kinds of people who complain about things," or who "get a kick out of stirring things up." This view corresponds to articles in the popular press that worry about "technological gridlock" (e.g., Glaberson 1988) and to the Douglas/Wildavsky claim that such groups reflect "sectarian cosmology" (1982, p. 127), all of which appear to reinforce the "public irrationality" perspective.

Such views bear little resemblance, however, to the characteristics that empirical case studies reveal, more often involving angry but rational activists who emerge from relatively conservative private lives to challenge the state or industry (P. Brown 1987; Kroll-Smith and Couch 1990; Edelstein 1988; Finsterbusch 1989; Fowlkes and Miller 1987; Freudenberg 1984; Gerlach 1987; Levine 1982; Sterling and Arundel 1985; Walsh 1987; see also Krauss 1989, 1991; Staub 1983). Studies suggest that citizen groups in technological risk conflicts are better characterized by the more recent work on resource mobilization, which addresses the difficulties faced by organizations that are based on volunteer participation. This literature emphasizes other variables, such as competition for volunteer time and financial resources, organizational strategies, the ability to draw resources from the surrounding population (e.g., Snow et al. 1986; Oliver 1984; Walsh 1981), and in particular the problem of the "free rider" (Walsh and Warland 1983; Oliver

1984). Unlike the psychological approach to social movements, resource-mobilization work often focuses on the rationality of participants: Given that any individual's influence on the actual provision of a public good (or prevention of a "public bad") is likely to be negligible, the rational action may be simply to "ride along" rather than seeking a leadership role or even carrying a fair share of the burden (Olson 1965). One study finds that organizations with paid staffs tend to have hard-to-get, sought-after leadership positions, while in all-volunteer organizations, such positions tend to be easy to get, but avoided (Pearce 1980). In the case of risk-related protests more specifically, studies of opponent organizations such as those at Three Mile Island find substantial free riding (Walsh 1981; Walsh and Warland 1983).

Still, some individuals do organize, participate, and persist, in spite of free riding, lack of resources, and other resource-mobilization problems. While such efforts may not appear rational from an economic point of view, they may be quite rational from other perspectives. At least informal observations, for example, support Oliver's (1984) finding that activists expect more of themselves than of others, devoting their energies to organizations because of higher-than-average beliefs that "if I don't do it, nobody else will" (p. 602). Rather than participating out of rationally or irrationally *individualistic* motivations, in other words, the active participants in neighborhood-style groups may tend to harbor higher-than-average concerns for the *collective* good (McKenzie 1981; Uzzell 1980; Nanetti 1980; Parkum and Parkum 1980; Oliver 1984).

Technological risk conflicts also present a broader opportunity to explore the impact of ideological variables and the connection between ideology and experience. Given that controversial facilities are often associated with declining property values as well as with concerns over family health, technological risk conflicts often mobilize homeowners, perhaps even more frequently than they mobilize left-wing students or transient community members (for reviews, see Edelstein 1988; Levine 1982). This suggests that for many citizens involved in technological controversies, to challenge the status quo may be to challenge their own ideological beliefs. The association of property-owning with conservatism thus means homeowners present interesting cases for sociological thinking about social movement challenges to the status quo. Empirical work on the experience of citizens who confront environmental problems suggests that the process of dealing with "locally unwanted land uses" or LULUs (Popper 1981, 1983) is often radicalizing (see Finsterbusch 1988; Krauss 1989; Staub 1983; Edelstein 1988). Recent work on social movements (e.g., Offe 1985) suggests one possible reason for radicalization is that the operation of government bureaucracies will often fail to match the usual assumptions about the ways in which a representative democracy "ought to" work. While most citizens have relatively little contact with bureaucratic evasiveness or agency capture, the citizens who do become involved in some conflicts are often surprised when they meet indifference or even hostility from bureaucracies that are supported by their tax dollars and that exist "to serve the public." It can be a matter of considerable dismay, in fact, to discover that agencies sometimes seem less interested in protecting the public from industries than vice versa.

Media Influences/Community Dynamics

Scientists and policymakers alike have long assumed the mass media are major sources of risk information for nonscientists. Conferences dealing with risk and the public tend to include frequent and forceful proclamations that the media "blow things out of propor-

tion." As scientists often see it, "Bad news sells papers" (see Starr 1985; Public's Right to Information Task Force 1979; Rothman and Lichter 1987; B. Cohen 1985). Most observers appear to feel that media reporting is predominantly anti-technology in content and consequences, and that the reporting is the major source of risk information for affected individuals. It is not clear, however, that the available evidence supports either of these common beliefs.

Some evidence, such as the experience at Love Canal, provides at least indirect support for the media-bias charge, suggesting that the media can be an important ally of activist groups (Levine 1982; Gibbs and M. Levine 1982). While the *Niagara Gazette* tried to tone down Michael Brown's reporting in the early days of the Love Canal story, for example, the paper ran one of the largest banner headlines in its history to announce that the canal was a threat to public health (Brown 1981).

On the other hand, Molotch (1979), among others, concludes that mainstream media representatives are much more likely to be supportive of growth than of the oppositional groups' concerns. When citizens organized to force the city of Middlesboro, Kentucky, to clean up a stream that even the state acknowledged to have been polluted by the local tannery, for example, the daily newspaper ran an editorial urging the citizens to be objective and rational instead (Staub 1983). Similarly, at the national level, outlets such as the *New York Times* have carried any number of articles complaining that progress is being stifled by Not-In-My-Back-Yard protests (Glaberson 1988) and by a purported epidemic of chemophobia (Passell 1989a, 1989b; Brody 1989). In more systematic studies, at least the initial media coverage of technological problems, such as those at the Three Mile Island or Fermi nuclear reactors (Flynn 1984; Fuller 1975), often appears designed to lower rather than raise public concerns (see also Raymond 1985). Perhaps Mazur (1979, 1984, 1989) offers the closest approximation to systematic support for the expectation of an anti-technology bias. He suggests that although media coverage is often "even-handed"—activists on both sides of an issue are contacted and quoted with reasonable accuracy—this approach tends to convey the message that experts disagree and to inspire a "better safe than sorry" reaction.

A growing body of research outside the technological controversies literature also suggests it is wrong to suppose people rely primarily on the media for information. A long tradition of research on elections, for example (cf. Verba and Nie 1972), indicates most individuals gain information from a variety of sources—importantly including other individuals, as well as governmental organizations and advocacy groups. This may be one reason why public information campaigns no longer tend to focus strictly on the mass media (Rice and Paisley 1981). More specifically, a recent study of young adults' perceptions of AIDS (Dunwoody and Neuwirth 1988) finds that discussions with friends correlate more highly with attitudes about AIDS and with stated changes in sexual behaviors than does exposure or attention to mass media messages. Other studies suggest the importance of associational networks and broader economic forces in shaping attitudes. Employees of polluting industries often defend their employers (e.g., Staub 1983), for example, and a similar phenomenon can be found in communities that depend heavily on extractive industries (Freudenburg and Gramling 1991; see also Gramling and Freudenburg 1990).

Neither does it appear reasonable simply to accept what technologists see as a common-sense assumption that, as communities gain experience with a technology, they will become more supportive; evidence supports both this contention and the converse. Off-

shore oil drilling does appear widely accepted in areas where it has a long history, such as Louisiana and Texas, while inspiring protests in regions having little or no prior experience with it, such as Florida and Northern California (Freudenburg 1988b; Freudenburg and Gramling 1991). Similarly, studies of the proposed high-level nuclear waste repository in Nevada find the lowest levels of opposition in communities closest to the site, which have had experience with atomic weapons testing and other nuclear materials (Krannich, Little, Mushkatel, Pijawka, and Jones 1991), with Nevada as a whole showing less opposition to a nuclear waste repository than do samples from the national population (Kunreuther, Desvousges, and Slovic 1988). "Host communities" for nuclear power plants also have a long history of being more supportive of "local" nuclear facilities than the public at large (Rankin, Nealey, and Melber 1984).

In the case of nuclear "host communities," however, the disproportionately high levels of support for nuclear power appear to have ended after the Three Mile Island accident (Wisniewski and Freudenburg 1981; Freudenburg and Baxter 1984, 1985). In a more recent comparison of two outwardly similar communities in Michigan, Stoffle and colleagues (1988) conclude that one reason for a relatively low level of support for a proposed superconducting super-collider site in one community was the "risk perception shadow" cast by the community's prior experience with a nuclear power facility. Levine's (1982) detailed study of Love Canal also clearly shows that prior experience with technology can heighten opposition, as do reviews of cases where industrial representatives have understated known risks (Clarke 1988a, 1988b; see also Perrow 1986). Finsterbusch (1988, 1989) provides a summary of toxic waste contamination cases: In 19 of these cases, concerned citizens first pointed out problems to officials, rather than vice versa, and in all but one of the 19 cases, the citizens judged the officials' reactions to be inadequate. Such experiences would scarcely be expected to increase the likelihood of support for future developments of the same technologies.

Controversies over technological risks require attention to community social structures as well. As one example, Coleman's classic (1957) analysis of community conflicts finds similar sets of conditions in cases where controversy reaches high levels: Relatively specific issues tend to give way to general ones, fostering new and different issues and a change from "disagreement" to "antagonism." In addition, community social patterns tend to change, social relations polarize, partisan organizations form, new leaders emerge, and word-of-mouth (as opposed to formal) communication increases (pp. 9–14). More recently, Carroll's analysis (1988) notes the difficulties created by the clash between the relatively formal or "technical" culture of federal agencies and the very different culture of rural communities, and more broadly, Fortmann (1988) finds that natural resource "micro-protests" are best predicted by a combination of characteristics of affected individuals (e.g., affluence), communities (degree of urbanism), and organizations (e.g., presence of an environmental organization in a rural area).

AN ALTERNATIVE FRAMEWORK: THE SOCIAL CONSTRUCTION OF RISK CONFLICTS

While it would be possible to expand the study of risk and technological conflicts within the psychometric paradigm, research in all three areas reviewed here suggests that different approaches might prove more fruitful. In particular, the many contributions from studies in risk characteristics and perceptions, political sociology, and media and commu-

nity-level effects are perhaps better understood in a light other than the public irrationality/rationality debate. What appears to be needed is a framework that brings risk to sociology, rather than the converse, highlighting instead of hiding the political and discursive struggles embedded in technological risks.

An important start is provided by the growing number of sociologists who show that insights can be derived from treating local concerns as legitimate (e.g., Erikson 1976; Levine 1982; Couch and Kroll-Smith 1985; Freudenburg and Jones 1991). Others' important work focuses on differential access to (expensive) scientific and technical expertise (Dietz, Frey, and Rosa forthcoming), the influence of lack of control over one's own employment status on the willingness to work under unsafe conditions (Heimer 1988), the accuracy of claims that environmental and other regulations actually diminish economic performance (Freudenburg 1991a), and even the issue of societal trust more broadly (Barber 1983; Shapiro 1987, 1990; Walsh 1987).

At the same time, there has been a growing tendency to subject official pronouncements and assessments to sociological investigation, as well as to consider the institutional arrangements through which risk is managed. Clarke (1988a) explores the historical and institutional context in which probabilistic risk assessments evolved, noting that institutions can have a vested interest in "proving" the safety of their own technologies; this interest can influence risk estimates as much as does the science itself. In a subsequent paper, he points out that governmental and private-industry contingency plans may prove in practice to have more in common with science fiction than with science, as illustrated by the *Exxon Valdez* (Clarke 1990). The plans, officially approved and technically acceptable, had a value that was almost entirely symbolic (cf. Wynne 1982), serving more to assure observers that safeguards were "in place" than to provide a real level of safety (see also Vaughan 1990 on safeguards that failed to anticipate the *Challenger* disaster).

This empirical work suggests that safety plans and risk assessments should be treated as data for sociological study, not as unquestioned representations of organizational and technological reality. The rich literature from the sociology and anthropology of science also validates the need for skepticism. Researchers in these areas (e.g., Latour 1987) show that even in presumably apolitical laboratory settings, facts are "constructed" as much as "discovered." It would be surprising indeed if debates in the more overtly political realm of technological risk conflicts were not similarly susceptible to the tendency for "facts" and frames of reference to result in part from complicated social processes of negotiation. From this perspective, the move to probabilistic risk assessments in the early 1970s, rather than having been inevitable, represents a *choice* of how to interpret risk.

While leaders and technical experts often do simply strive to do what they deem best for society at large, they may also resemble most mortals, responding to what Freudenburg and Keating (1985) call the principle of differential interests—the tendency for persons who occupy specific positions within a social structure to behave in accordance with what they see as being in their own best interests. As Olson (1965) points out, moreover, their own interests can be expected at times to differ from those that would be optimal for the larger collectivity. Lest we be misinterpreted, we stress that this in no way implies that political and scientific elites never (or even "rarely") desire to better society—only that official spokespersons from industry and even government, like most human beings, may be tempted to speak for their *interests*, as well as for "truth."

As Raymond (1985) notes, the "mainstream" press implicitly operates from a social consensus model of reality, but because this underlying assumption goes unstated, official pronouncements take on the status of fact, rather than of mere statements. The "advocacy" press practices greater skepticism, but as the name itself implies, these media outlets are often seen as being more interested in advocacy than objectivity (although Raymond concludes that the advocacy biases may simply be more openly acknowledged than those in the mainstream or "consensus" press). Stallings' (1988, 1990) careful analysis of media coverage, for example, illustrates the importance of "keynoting"—official spokespersons' efforts to "place an issue into perspective" or to interpret the implications of an accident. Certain interpretations place a "spin" on the news that will reflect far more favorably on such spokespersons and their interests than will others; it would actually be surprising if keynoters would not respond to that fact. As Stallings notes, moreover, the realities of media coverage mean "official" viewpoints have significantly greater media access than do the views of critics or of community residents at large (see also Galanter 1974 for a broader discussion of the importance of institutionalized or regularized patterns of access).

When official pronouncements and risk estimates are themselves subjected to sociological analysis, moreover, different insights emerge. *Even claims about public irrationality* can be ways to "frame" risk issues, and it is at least possible that, in making such claims, relevant social actors will emphasize the framings that encourage outcomes they consider most desirable. Calls for "educating the public," for example, may involve no (conscious) motivations other than a desire for an enlightened citizenry, but such calls could also prove effective in re-framing or reshaping, rather than responding to, "the will of the governed."

Rather than being "natural," in short, the currently prevailing view of technological risk conflicts is a *social* construction. While it is possible and even likely that many participants in ongoing risk debates are largely unaware of the choices involved, the prevailing construction reflects at least an implicit choice to treat ordinary citizens' behaviors as problematic, without extending the same scrutiny to behaviors of scientists and officials, or to the characteristics of the controversial technologies themselves. If installations such as nuclear waste facilities inspire hostility wherever proposed, this suggests the underlying problem is one of the *facilities* as much as of the citizens, such that the appropriate acronym is not so much NIMBY as LULU, in reference to locally unwanted land uses (Popper 1981, 1983). To date, however, research tends to ask what about people leads them to reject certain technological developments, not what about industry leads it to develop technologies people reject. Both questions are legitimate; failure to address the latter one has meant that the institutional factors influencing technological and regulatory decisions have often been hidden.

To say important factors are "hidden" is not to imply that an overt conspiracy exists, nor even that agencies tend to accept risks that are (clearly) "excessive." On the contrary, one of the ways in which the study of risk can contribute to sociology is to draw attention to a more subtle problem—but arguably, one that will become increasingly important, particularly as the growth of knowledge leads to growing recognition of the irreducible uncertainties of our probabilistic world. In fact, the "adequate" protection of public health and safety may prove to be especially problematic *when the meaning of "safety" is subject to ambiguity and debate.*

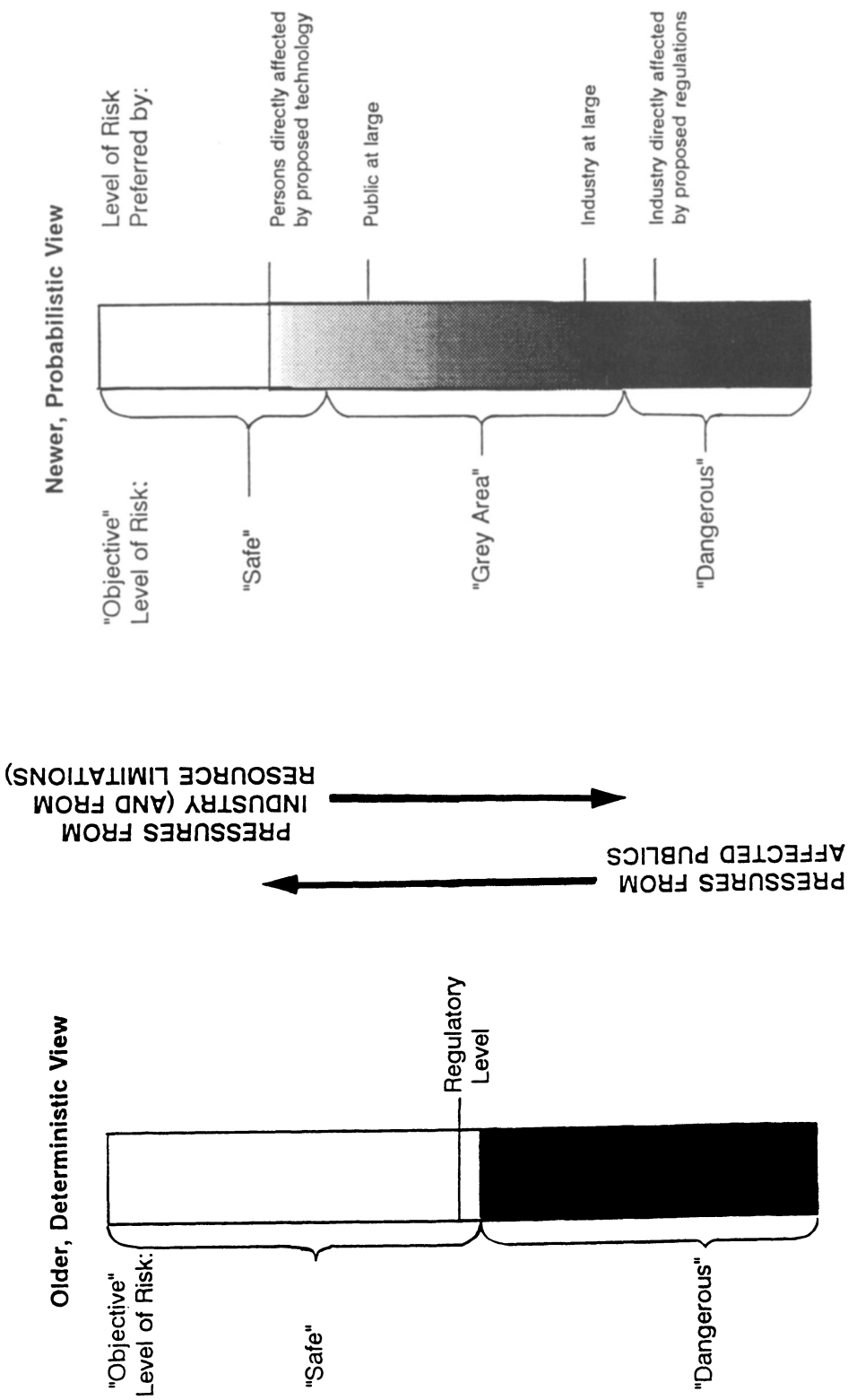

Figure 1. Two Views of Regulating "Risk" and "Safety"

Figure 1 illustrates this point. The traditional logic, represented by the left side of the figure, is essentially black-and-white; either a facility is safe or it is not, and the agency's job is to establish regulations at the point of demarcation, perhaps adding a small safety margin. As the field of risk analysis is increasingly pointing out, however, reality involves a broad "grey area." Almost all health and safety regulations are made and enforced in the context of *irreducible* uncertainties and ambiguities—situations that yield no single "best answer" or optimum enforcement level, one that simultaneously meets all objectives a regulatory agency is expected to satisfy. At the same time, regulated industries may press for regulators to demonstrate that a "regulatory burden" is *unambiguously* justified. Even where an agency is not fully "captured" by a regulated industry (Kaufman 1960), in short, the right side of Figure 1 suggests that the ultimate regulations may be significantly weaker than the neighbors of controversial facilities would desire. At least for health and safety regulations, this approach suggests, it is likely that for every case of clear "agency capture," there are dozens of others where an agency gives a more ambiguous benefit of doubt to economic interests (including its own, or those of another branch of government—see, e.g., Lawless 1991), rather than providing a safety margin for public health and welfare.

While regulatory agencies are likely to be subject to complex and often contradictory pressures, the arrows in the center of Figure 1 summarize two primary forms of pressure. On the one hand, a higher level of scrutiny from the public can increase pressures toward relatively tough regulations and vigorous enforcement: While concerns over potential job loss can lead to pressures for weakened health/environmental enforcement in some cases, most studies in the U.S. find overwhelming public preferences for enforcement practices that are stronger, rather than weaker (see, e.g., Dunlap 1992; Freudenburg 1991c). At the same time, agencies can also experience intense lobbying from *industry* groups and others for the weakening of environmental, health, and safety regulations. In addition, the ever-present concerns of limited time, budget, and enforcement personnel tend to reduce agencies' ability or willingness to display the degree of vigor in enforcement that unlimited resources would permit. Thus if effective public scrutiny is reduced, Figure 1 would imply, other pressure on agencies would tend to encourage less vigorous regulation and enforcement (cf. Stone 1980).

An additional consideration is relevant: Particularly when the benefit of doubt does *not* go to the protection of public safety (or alternatively, to the imposition of "unjustified regulations"), life is easier for the regulatory agency if its decisions and actions nevertheless enjoy widespread public deference. Credible challenges from the broader public, as from regulated industries, can impose substantial costs on the agency; examples include political scrutiny, potential challenges to agency funding, or the need to invest available resources such as personnel and time in responding to public complaints and concerns that are simply not present when agency decisions inspire support or mere indifference.

While public criticism can create difficulties, however, agencies tend not to be expected to respond to "illegitimate" concerns—a category that presumably includes any concerns based on ignorance, misunderstanding, narrow self-interest, and/or misplaced emotionalism. Under the circumstances, it would actually be surprising if an agency were *not* tempted to characterize criticisms as emotional, ill-informed, and selfish outbursts from a small, unrepresentative slice of the population that will never be satisfied by any reasonable course of action. These, of course, are precisely the kinds of characterizations of public views that have been given repeated attention in the risk literature to date—and as noted above, that have generally been found to be lacking in factual support.

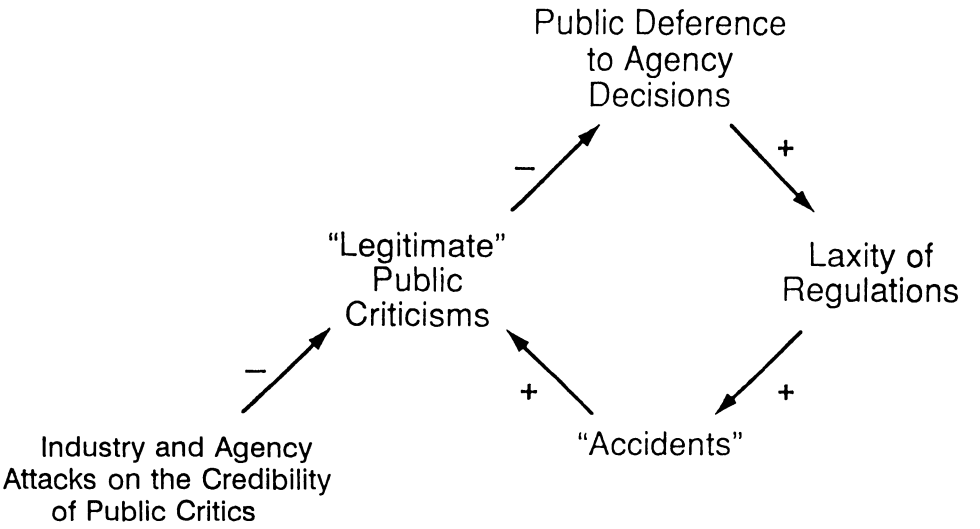

Figure 2. The Laxity-Legitimacy Loop

Figure 2 provides a schematic representation of the overall logic suggested here. The arrow from the left side to the top of the figure suggests that "legitimate" criticism is likely to reduce public deference to agency decisions. Given the foregoing discussion, however, deference from the broader public could be expected to increase the influence of pressure from regulated industries and from agency resource limitations, leading to reductions in the agency's level of vigilance and to an increased laxity of regulations (Stone 1980; cf. Freudenburg 1992).

While regulatory relaxation may of course lead to improved safety levels, the very existence of a regulatory agency indicates that, at least at some point in the past, the *absence* of regulation was the condition that had undesirable implications for public health and safety. Following Molotch, it follows that a lowered vigor of enforcement increases the likelihood of an "accident"—that is, "an occasion in which miscalculation leads to the breakdown of customary order" (1970, p. 143). As the bottom of Figure 2 suggests, such accidents may lead to significantly increased criticisms of the agencies—particularly in the case of large and well-publicized incidents such as the nuclear reactor malfunction at Three Mile Island or the *Exxon Valdez* oil spill, but perhaps increasingly, also in the case of incidents that, while less major or dramatic in themselves, nevertheless send a "signal" that the agency is failing to perform as vigorously as would normally be desired (Slovic 1987; Freudenburg 1991b). Such accidents can also increase the credibility of persons and groups who already had been critical of the agency.

What this logic suggests is that, at least in the absence of efforts to re-frame the discussions, one of the unanticipated consequences of political pressure can be a problem of a laxity-legitimacy "loop." Agency legitimacy can lead to laxity, increasing the likelihood of accidents and thus of subsequent criticisms—challenging the very deference and legitimacy that made it easier for the regulatory agencies to reach congenial accommodations with the regulated industries. A number of options are available for maintaining the stability of what might otherwise become a self-negating feedback system, including not

just a real toughening of regulations, but also increased attention to *symbols* of regulation and concern for public welfare. Importantly, however, as the lower left corner of Figure 2 suggests, this negative feedback loop may also encourage agency or industry spokespersons to intervene, attacking the legitimacy of public criticisms and concerns. In short, whatever their other characteristics, claims about public irrationality may involve efforts to shape the agenda of public discourse on technological risk, perhaps even to the point of diverting attention away from other issues that deserve scrutiny as well.

A perspective that takes risk conflicts as socially constructed would also point to more subtle aspects of credibility and legitimacy. Assumptions about the dispassionate neutrality of scientists lie at the core of scientific credibility, but these assumptions are becoming increasingly shaky in light of the growing pattern of findings, particularly in the sociology and anthropology of science, that scientific facts are socially constructed as much as they are "discovered" (see, e.g., Latour 1987), and that the facts put forth by more authoritative and powerful scientists carry more weight regardless of the care with which they are developed.

Perrow contends that often, "the issue is not risk, but power" (1984, p. 306), and the social construction approach suggests it may be fruitful to devote more attention to the other variables sociologists have found to be associated with power. In particular, authority and power have been connected to gender, but the connection may need greater scrutiny in the case of risk conflicts. As Levine (1982) notes, citizens at Love Canal were led by housewives, and the scientists and officials they confronted were all men. This pattern may prove not to have been unique to Love Canal (see Krauss 1991); although systematic studies are lacking, in the technological conflicts we have observed to date, the vast majority of "scientific spokesmen" have in fact been men, while at least the key informal citizen leaders have generally been women. Following Connell (1987), it makes sense to ask whether differential gender status would contribute to the effectiveness of "public irrationality" claims as a form of agenda control. It is entirely possible that some of the hostility directed at Lois Gibbs and other women in local citizen groups could be related to their status *as women* and to women's lack of power and authority in public life (Pastor 1989b).

DISCUSSION

While agency claims about public risk perceptions may be taken as "official" pronouncements, and while the literature often grants enough legitimacy to such pronouncements to treat them as testable hypotheses, the consistent failure of research to support the official pronouncements should perhaps suggest something more than the need to retest the same statements in different ways. Rather, it may be that the statements themselves can be seen as efforts to shape or "frame" the legitimacy of agency critics in the eyes of the broader society.

It is important to remember that regulatory agencies face difficult if not insolvable challenges, and that for some technological controversies, there may be no such thing as a single unambiguously optimal decision. In addition, although this point may emphasize the obvious, it needs to be noted that some public responses to agency decisions undoubtedly *are* unreasonable and ill-informed. In the interest of fairness, however, it also needs to be noted that it would be equally unlikely for *all* public concerns to be groundless.

In short, we most emphatically do not suggest that all public concerns are well-

founded, nor that all agency statements and explanations are specious and self-serving. Such an approach would make as little sense as the current tendency to treat official pronouncements (and "perceptions") as being above question, while public criticisms are taken as reflecting problems of the perceivers.

Instead, what is needed is an additional line of analysis that would be both more sociological and more balanced. The approach needs to be more sociological in beginning to test hypotheses explicitly derived from sociological conceptualizations and analyses, whether the conceptualizations are the ones developed here or by others. The approach needs to be more balanced in treating the views of the broader public, and not merely those of agency spokespersons, as being worthy of empirical consideration; choices could then ultimately be based on empirical evidence, rather than assertions—or on the fact that, *a priori,* only one set of views is being tested. The *need* for greater balance is underscored in that, at present, the views receiving the most attention derive not from explicit sociological conceptualization, but from assertions by persons who, whatever their other characteristics, also happen to be parties to the ongoing debates, and happen as well to have discernible interests in "framing" their critics' views as lacking in legitimacy.

While such tests should provide substantial payoffs, they are likely to be troubling to many observers. To treat public concerns as valid—or at least as being worthy of empirical investigation—is to admit the possibility that official societal institutions may not be fulfilling their obligations. While officials' attacks on critics are often treated with a certain deference, moreover, critics' attacks on officials are more commonly viewed with suspicion. Any suggestion that agency behaviors may reflect something so severe as misconduct—or even the more carefully delimited suggestion that the agencies may exhibit *recreancy,* or the failure to perform specialized duties with the necessary vigor (Freudenburg 1991b)—is likely to inspire defensive or even emotional responses from agencies and their allies. Nor should such defensiveness be seen as completely inappropriate, in that, to repeat, some criticisms undoubtedly *are* lacking in validity. What is required, accordingly, is that the potential for recreancy and self-interested behavior needs to be seen neither as a given nor as an impossibility; instead, such possibilities need to become the focus of empirical investigation. We need empirical tests of the sociologically plausible expectation that risk conflicts result at times from the failings of key persons and institutions that have been entrusted with the safe management of technology. The insights from such studies, while perhaps not always likely to be celebrated by the agencies that have funded much of the risk-related work to date, could have the counterbalancing advantage of contributing to a deeper understanding of the realities of a technologically advanced society.

CONCLUSION

While sociologists have made increasingly important contributions to the study of risk, the time has come for the study of risk to contribute more to sociology. For that to happen, we conclude, sociologists will first need to go beyond testing "hypotheses" suggested by participants in the ongoing debates, and to examine the hypotheses that are suggested by sociological perspectives, as well. These efforts should also prove fruitful in the study of nontechnological risks.

We have suggested that officials' unflattering characterizations of their critics can be seen as "politically rational" responses to the pressures created for agencies by an era of

probabilistic uncertainty; other interpretations are also possible (see especially Dietz, Stern, and Rycroft 1989; Gerlach 1987). Clearly, however, the issue of risk is more complicated, and more dependent on social structural factors, than would be suggested by the ways in which it has generally been considered to date. A willingness to face this complexity is needed if we are to understand the mechanisms behind risk and risk debates—and if we are to learn more about an increasingly technological society in the process. To do so, moreover, we will need to examine more closely, and in some cases to "examine" for the first time, some of the components of the risk debate that have often been accepted uncritically in the past. Scientific authority and technological development are accepted so fully in our society that it is by no means a simple task to think of either as problematic (but see, e.g., Pastor 1989a; Schnaiberg 1980). A fundamental principle of sociology, however, is relativity; there is no *a priori* reason why a society must hold to a given configuration.

The reasons for moving beyond our current thinking, moreover, are compelling. Risk is not merely a "technical" phenomenon, but a societal one. Understood in the context of the new social-movements literature (Offe 1985; J. Cohen 1985), citizen activism on technological risk represents a challenge to the increasing power of government bureaucracies, not simply a response to the particular technological decisions at issue.

Rather than begin with the typical assumption that "the" social problem has to do with public perceptions of risk—or for that matter that "the" problem is corner-cutting, industrial greed, or other concerns that are quite different—a truly sociological analysis needs to examine the profoundly social processes through which the problem definition is negotiated and developed. Such an examination may prove more challenging than would a continued focus on purported public irrationality, but we believe it will prove more rewarding, as well. If we are able to respond adequately to the challenge, in fact, the results will include a contribution not just to the risk debate, but to our understandings of society as a whole.

ACKNOWLEDGMENTS

This article is a revised version of a paper originally prepared for presentation at the annual meeting of the Rural Sociological Society, Seattle, 6 August 1989. The authors wish to thank the *Sociological Quarterly* anonymous reviewers, as well as the editor and copy-editor, for their helpful comments and suggestions.

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