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Analyzing acceptance politics: Towards an epistemological shift in the public understanding of science and technology

Daniel Barben

Reviewing the main research approaches on the acceptance of science and technology (S&T) developed in the last decades, I will (1) summarize advances achieved and persisting problems concerning the understanding of both the public and S&T. I will show that the acceptance-centered framework has, at least implicitly, been linked to practical efforts in acceptance politics, i.e., attempts to improve a lack of acceptance. In order to investigate conflicts relating to S&T in a more reflective way, I will (2) suggest an epistemological shift towards the analysis of acceptance politics. Building on the distinction between the relevance and resonance of S&T, the ways in which S&T are valuated and gain legitimacy are investigated from a regime analytical perspective. I will (3) exemplify the advantages of this approach by comparatively analyzing the acceptance politics of three biotechnology applications in the USA and Germany. I will (4) conclude with an outlook on future research.

With science and technology (S&T) at the nanoscale we are witnessing the advent of a powerful field of innovation. But its future prospects are quite uncertain. The success of nanotechnology, like any major innovation, will depend on whether two fundamental challenges can be mastered: first, the ability to translate new knowledge into technological applications and marketable products; and second, the sufficient public acceptance of these applications and products. The latter problem will be the focus of this article.

While nanoscale S&T are just becoming known more generally as a new interdisciplinary and cross-sectoral field, the vast array of research instruments developed in the past four decades on the acceptance of S&T has already brought to bear on nanotechnology-related issues. But given a widespread lack of experiences with and controversies over new products, investigating early perceptions may only provide data of very preliminary significance. We may also remember how much researchers were caught by surprise when seemingly well-founded assumptions about the acceptance of agricultural and food biotechnology in various countries suddenly crumbled because public perception took an unexpected turn.

In this article, I will elaborate on achievements and limitations of the research on acceptance theoretically and empirically and propose an epistemological shift. I will argue that “acceptance politics” provides a more appropriate focus than “acceptance,” showing that such a framing of problems related to the introduction of new technologies into society helps highlight otherwise neglected aspects. The proposed shift goes beyond a simple exchange of words because it opens
up new—and in part complementary—perspectives. To achieve a more complex sociological understanding, acceptance politics itself needs to be analyzed within a framework concerned with the configuration of S&T in society. Regime analysis may provide such a framework since it allows for emphasizing the distinction between the relevance and resonance of S&T. This distinction is conceptually richer than the notion of (different degrees of) acceptance and provides focal points for analyzing acceptance politics.

In section one, I will review the main research approaches on the acceptance of S&T, summarizing advances achieved and persisting problems. I will show that this framework has generally been linked to practical efforts in acceptance politics, i.e., attempts to improve lacking acceptance. In section two I will outline elements of a regime analytic framework which reflects on the dynamics of acceptance politics without supporting from the outset one of the parties in a conflict. In section three I will empirically analyze cases from biotechnology, i.e., the field of S&T that has faced the most significant problems of acceptance in the past 30 years. Showing how and why the public perception of biotechnology applications varied or changed in different countries, I will emphasize the fundamental importance of acceptance politics for the configuration of S&T. I will conclude with a brief outlook on future research.

1. Research on the acceptance of S&T

The public acceptance of S&T became a lasting concern among the promoters of major innovations following the controversies over, and resistance to, nuclear energy in many countries since the mid-1960s. A multidisciplinary research field was developed in order to better understand the causes of unfavorable perceptions, together with an extensive infrastructure of conferences, institutes, and journals. One mission of this research was (implicitly if not explicitly) to advise the actors who fund, generate, or apply new S&T on how to overcome lacking acceptance—through efforts of what I call acceptance politics. In my brief review, I will pay particular attention to both analytical and practical concerns, without being able to do justice to the state of research in its entire complexity. I distinguish roughly between three stages, referring to designations used in the respective research traditions: (1) “risk perception,” (2) “risk communication,” and (3) “public understanding of S&T.”

Risk perception

Protest against nuclear energy mainly addressed safety issues related to nuclear power plants and ultimate waste disposal. The centrality of environmental and health risks was reflected in the risk perception approach. Its basic analytical and political assumption was that the ways in which risks are perceived determine whether positive or negative acceptance is the outcome. Scientific traditions focusing on human rationality contributed to the research, in particular psychometric studies, rational choice, and opinion surveys (Golding, 1992; Renn, 1992a; Slovic, 1992). On the other hand, experts in scientific risk analysis commonly claimed that they were able to assess the risks of nuclear energy in objective, unambiguous terms. The notion of risk here applied defined risk as the relationship between the probability of a hazard and the scale of harm it would cause—a definition historically developed by insurance companies. While such calculations provided some practical guidance for assessing technological risks, they also expressed a fundamental uncertainty about the probability and scale of hazardous events (Luhmann, 1993; Perrow, 1984).

The lasting public controversies over nuclear energy brought up the issues of a divide between experts and laymen and public distrust of expert knowledge (Otway, 1992).
emergence of counter-experts casts further doubt about the objectivity of expert knowledge. The expert position dominant at that time nevertheless presented calculations about the risks of nuclear energy as if they were both definite and highly unlikely—which contrasts with the basic definition of technological risk as dealing with the uncertainties and indeterminacies of hazardous events. The risk perception approach thus assisted the dominant expert position whenever it lent support to the claims that people should perceive risks in scientifically appropriate ways and that they would do so if adequate information enabled them. The practical solution for tackling and overcoming lacking acceptance was therefore seen in providing the public with more or better information—an approach to acceptance politics I like to call public information. After initially disseminating information to the public in general, public relations were increasingly targeted to special audiences based on insights into how public perceptions are shaped according to a variety of social indicators such as education, gender, and age. But the information campaigns about nuclear energy were not as successful as had been hoped, inspiring more research into how people perceive risks differently.

New research indicated that people’s perceptions correlated with divergent attitudes that were described as risk-taking and risk-avoidance. In addition, it was observed that risks were evaluated according to patterns of risk amplification (Jungermann and Slovic, 1993; Kasperson, 1992). In other words, the perception of technological risks—i.e., their probability and scale—would depend on the extent to which they are attributed to one of the following dimensions: old vs. new, controllable vs. uncontrollable, voluntary vs. inflicted, benefits vs. costs, common vs. spectacular. Consequently, the degree to which risks are accepted was considered to result from their cumulative attribution to either side of these oppositions. Accordingly, peculiar effects were highlighted such as the favorable evaluation of the risks of driving cars as opposed to those of living near a nuclear power plant. This line of research acknowledged that risk perceptions, rather than following reputed objective criteria, are subject to individual and social evaluations. It contributed insights into the limits of supposedly rational actors, although generally expressing an epistemological preference for a rational actor framework (Krimsky, 1992; Renn, 1992a).

Despite some compelling explanations of why, oddly enough, certain minimal risks are perceived in exaggerated ways or estimated higher than more severe risks, the risk perception approach presupposed for the most part the objectivity of risks, in effect demanding actors perceive and behave pursuant to the best available knowledge. Correspondingly, this approach supported the claim that elevated risk aversion resulted from a serious lack of knowledge or an inability or unwillingness to acknowledge superior knowledge—key assumptions in what has been discussed as the “deficit model” (Irwin and Wynne, 1996).

Risk communication

The lack of political success of the public information efforts cast doubt about the epistemic appropriateness of this approach. It was criticized as a mere one-way relationship following the technical model of media communication between sender and recipients. Instead, it was suggested that the relationship between experts and the public should be understood as a social, i.e., reciprocal, relationship. Consequently, a shift towards risk communication was undertaken in the 1980s which brought about improvements in both the analytical framework and acceptance politics (Jungermann et al., 1991). While risk issues were again a central concern, the overall question was no longer how risks are perceived, but how they are communicated. Thus conceived as communication, the interactions between the relevant actors from science and engineering, government, industry, public interest groups, and the wider public came into focus (Renn, 1992b). Following the earlier focus on characteristics of risk perception, the peculiarities of risk communication now became the primary concern. Problems of acceptance were thus
understood as communicative problems, and the solution for overcoming these problems was seen in better communication with the public. Unlike previously, risk-related information was no longer supposed to be definite and unambiguous, and the process of informing the public was not understood any more as a clear and undisturbed transmission of lacking knowledge.

It was hoped that research would provide insights for improving political risk communication and, with it, the acceptance of controversial S&T. It was not only considered important what information was presented to which audience, but also by whom and in what ways (NRC, 1989). Acknowledging the basic self-will and obstinacy of the other side in the communicative relationship, it was important for those interested in promoting a certain technology to take into account the varying degrees of trust and legitimacy attributed to particular actors, sources of information, channels of communication, and ways of presenting controversial issues. Consequently, the analytical and political assumptions underlying the risk perception and public information approach seemed illusionary, i.e., the belief that higher acceptance could be simply effected through providing appropriate information to the badly informed. Instead, risk communication sought to increase acceptance by reflecting more on which information to communicate, which communicators and channels to make recourse to, and how to address particular understandings among recipient audiences.

All in all, communication scientists, psychologists, and sociologists contributed to a more complex approach and improved knowledge about how meanings of controversial S&T are produced, distributed, and received. However, risk communication, too, tended to take the standpoint of those actors primarily concerned with developing new technologies. The attempt to more effectively communicate with the public is therefore an approach that by and large only modifies the approach of public information—by employing more differentiated means of information on the basis of a more realistic view of the social relations between the various actors (Otway and Wynne, 1989; Plough and Krimsky, 1987).

Public understanding of S&T

With negative perceptions and attitudes continuing, attempts to better understand the public understanding of S&T (PUST) were inspired in the 1990s (Dierkes and Grote, 2000; Wynne, 1995). The risk communication approach was criticized for the epistemic and practical limitations of mainly focusing on risks; for insufficiently analyzing how perceptions and attitudes are actually built; and for not really communicating with the public. It was proposed instead to take into account all aspects relevant for people’s perceptions of S&T (e.g., socio-economic and ethical concerns), to analytically acknowledge that they result from complex evaluations, and to engage people in real dialogue with experts. In addition to the common demographic criteria used in research, the experiences and cultural orientations of people were also considered important—otherwise their ways of understanding would remain largely unexplored. PUST offers the most advanced approach to date for analyzing the perceptions of, and communicating S&T with, the public.

In order to both approach the various understandings and facilitate public engagement, a variety of participatory procedures have been developed. The most prominent among them are round tables, citizens’ panels, scenario workshops, and consensus conferences (Abels and Bora, 2004; Joss and Durant, 1995). Such experiments expose the ways in which particular views are substantiated and allow for various kinds of interactions. While they also provide opportunities for increasing the acceptance of controversial S&T, from a counter-perspective they might help reveal lacking acceptability. Although efforts to enhance citizen engagement are not necessarily oriented toward increasing (or decreasing) acceptance, this criticism is sometimes asserted. Participatory procedures are further challenged by arguments such as that
only a small faction of the public is involved; that citizens lack the capability to make valuable contributions to controversies requiring scientific expertise; or that representative democracy already provides citizen participation through its political institutions. Counter-arguments point out that citizen engagement may have an effect beyond those participating (depending on how such experiences are communicated); that citizens may well be able to expand their scientific literacy (not least through participatory experiences); or that the far-reaching challenges associated with some technologies indeed require a renewal of democratic participation and citizenship (Fischer, 2000). In light of these arguments, creative critiques of PUST have lately been translated into endeavors to shape the development of S&T through new modes of “upstream engagement” (Macnaghten et al., 2005; Wilsdon and Willis, 2004).

I have tried to show that in each stage advances have been achieved while blind spots and problems have persisted (of course, none of the approaches has been homogeneous and there have been overlaps among them). Overall, the continuing attempts to overcome problems of acceptance through more adequate understandings—along with more efficient acceptance politics—brought about scientific as well as political learning. Clearly, the shifts in focus from perception to communication and understanding, from opinions and attitudes to experience, from risks to an ever broader spectrum of relevant aspects of S&T, and from information to communication and participation mark epistemic—and practical—progress. These conceptual extensions and differentiations have been driven as much by requirements inherent to research as by persisting political problems of insufficient acceptance. On the other hand, lasting shortcomings have concerned the conceptualization of the public, e.g., when explaining continually negative or skeptical views by peculiar national traditions of risk aversion (such as romanticism toward nature), the bad influence of public interest groups, or the inadequate reporting of the mass media (particularly television), thereby amplifying public concerns in unbalanced ways. Another set of shortcomings has concerned the conceptualization of S&T, e.g., through treating unfavorable perceptions and attitudes as the preeminent problem, leaving the objects of controversy mainly outside the focus and thus portraying S&T as generally beneficial for all of society.

2. Acceptance politics from a regime analytical perspective

While the connections with acceptance politics have for the most part not been systematically reflected upon by the different research approaches, I aim for a social science framework that focuses on S&T-related conflicts in an analytically more distanced way. To this end, I will (1) present a critique of the very notion of acceptance. I will (2) show that some of the points raised within the acceptance-centered framework outlined above are well worth being acknowledged as valuable contributions but might be better placed within an expanded social science framework. Building on the distinction between the resonance and relevance of social phenomena, in the main part of this section I will (3) outline key elements of a regime analytical framework that helps better understand S&T in society, including acceptance politics.

Critique of the notion of acceptance

From a broader sociological perspective, the notion of acceptance itself seems very limited. “Acceptance” characterizes a state in which certain social phenomena, for example technologies, are by and large taken for granted. This notion emphasizes a problematic aspect of a social relationship, i.e., when a phenomenon meets some kind of refusal, resistance, or protest. It is a concern closely related to particular interests and stakes. Acceptance tends to become a
lasting point of reference for actors only if their projects, practices, or products continually encounter lacking appreciation. What sufficient or lacking acceptance actually means depends on an actor’s expectation and the social domain concerned. For example, it makes a difference whether an actor is seeking consent, or does not mind operating without consent; whether or not acting in a social domain requires the backing of people’s hearts and minds; whether protest is articulated in the public or confined to the private sphere; and whether there are opportunities to express preferences by ballots or decisions in the marketplace.

Acceptance only highlights a very narrow aspect of how individuals or groups evaluate phenomena relevant to them: acceptance does not express affirmation, approval, or conviction; and it presupposes a passive rather than an active relationship (the latter emphasizing that people make sense of things themselves). This is not to say that people’s beliefs and behaviors are free of contradictions or are not—from an opponent’s or an observer’s perspective—of limited rationality. As a result of the predominant interest in sufficient acceptance, the notion of acceptance is ultimately disinterested in people’s actual motivations and reasonings. Accordingly, in a strict sense, acceptance politics, too, only attempts to change the level of acceptance but not the underlying conditions that contribute to critical or negative evaluations. As regards S&T, acceptance politics primarily aims at a frictionless development—it is about improving the state of acceptance, not the technologies or the modes of their development and application. For all these reasons, acceptance marks a sociologically awkward notion. However, despite lacking sophistication, it reflects real-world concerns that are of practical significance (the epistemological status of such a concept is best called Realabstraktion).

It is more fruitful to think of the ways in which S&T are used and appropriated as enculturation (similar notions are cultural appropriation or domestication, see Sørensen et al., 2000). Elaborated particularly in anthropology, psychology, and sociology, “enculturation” generally refers to how social phenomena become embedded in people’s lives and in society, thus constituting a much richer—and sociologically more appropriate—notion than acceptance.

Complementary perspectives

Some of the advances made in the research on the acceptance of S&T do, however, represent insights that transcend its narrow epistemic confines and can thus build elements of a broader social science approach. An important lesson learned concerns the expert–lay relationship and the concept of the public. While laypeople first were expected to submit to the supreme authority of expert risk calculations, later it was acknowledged that they may have good reasons to take into account other or additional criteria for evaluating S&T—i.e., criteria that matter in various contexts of everyday (including professional) life, such as socio-economic impacts for consumers or producers. These criteria are obviously different from the institutionally specialized criteria of expert knowledge, such as the scientific justification of technological risks (Fischer, 2000; Wynne, 1996). And further, the controversies over S&T time and again also revealed deep disagreement among experts based on divergent epistemic or political cultures (Otway, 1992; Smith and Wynne, 1989). Accordingly, some contributions to PUST criticized the prevalent ways of deeming the public’s understandings as misunderstandings, demanding instead that we approach people’s understandings in terms of their own frames of reference (Douglas, 1985; Rayner, 1992; Wynne, 1992). Thus, the different knowledge structures of experts and laypeople as well as publics have more generally gained increasing attention, together with the ways and institutional contexts in which knowledge claims are presented, legitimized, or contested. Consequently, these arguments call for analyzing knowledge disputes within the relevant social context, as well as for cross-national or cross-institutional comparisons.
Another important lesson learned relates directly to the problem of technology acceptance. After the initial crude claim that technologies with low risks should be accepted, the risk amplification research suggested distinctions linking social with technological aspects that help explain diverging perceptions of technological risks. Next, the distinction between the acceptance and acceptability of technologies was introduced, emphasizing that technological properties influence the ways in which their potential positive and negative consequences are evaluated (see section 3 for a further elaboration). Generally, this shift in emphasis opened up possibilities for adopting concepts from the social studies of S&T that have explored manifold interdependencies between technology and society, such as the ways in which technologies are constructed and stabilized cognitively and institutionally (see for example Bijker et al., 1987; MacKenzie and Wajcman, 1985). While contributions such as these provide elements of an alternative framework of conceptualizing the meaning of S&T, the regime analytic framework proposed here incorporates a more elaborate critique of the research on acceptance and its connections to acceptance politics.

**Key elements of a regime analytical perspective**

Against the background of this differentiated review, I hope it has become evident that I do not want to establish a clear-cut divide with the acceptance-centered framework, but rather to integrate findings from the research on the acceptance of S&T (for other recent approaches that combine “deficit” and “contextualist” perspectives see Einsiedel, 2000; Sturgis and Allum, 2004). While some profound critiques of the “deficit model” have been transformed into practice-oriented models of “upstream engagement” with S&T (Macnaghten et al., 2005; Wilsdon and Willis, 2004), here I rather intend to present a more reflective social science approach to analyzing S&T-related conflicts (in another venue I have contributed to an approach to “anticipatory governance” of S&T that incorporates the analysis of acceptance politics, see Barben et al., 2008). I will continue from here by further outlining an analytical framework, approaching the envisioned epistemic shift from acceptance to acceptance politics by elaborating on a set of distinctions that allow for the conceptual expansions needed. These distinctions relate to the relevance and resonance of phenomena, the relationship between social structures and agency, the configuration of innovation regimes, the forms of interest articulation, and asymmetries among opposing strategies of acceptance politics.

Since the research on the acceptance of S&T focuses on the public resonance, important factors involved in shaping the views and attitudes of groups or individuals are neglected—namely much of what is specifically at stake for them. This is why I suggest taking into account more broadly the dimensions in which the relevance of S&T is structured. For, in addition to perceptions and communications, the significance of S&T is shaped by particular characteristics of S&T and their embedding in institutions and practices. For example, fields of S&T embody different combinations of ends and means; distinct sets of research and development (R&D) practices; various institutions and organizations that take part in generating, regulating, and implementing S&T; and divergent ways of using particular applications of S&T. Distinguishing between the resonance and relevance of social phenomena will enable us to examine the ways in which S&T are valuated by and gain legitimacy among actors as they are engaged in various societal (e.g., economic, political, legal, or everyday life) contexts. These institutional contexts—as well as the organizations characteristic for them (e.g., companies, parties, or courts)—embody particular values and norms that articulate specific criteria of relevance.

Investigating the resonance and relevance of social phenomena thus concerns the shaping of significance at two “levels,” i.e., actors and social structures. Social structures and agency are not conceptualized as opposites but as relating to each other in mutually constitutive ways.
While institutional or organizational contexts do not determine completely the behavior of actors, they nevertheless mark a range of options for decision-making and acting. On the other hand, people’s work, lives and identities are shaped by their participation in contexts that determine what is relevant to them—processes that imply sense-making. Accordingly, people take part in shaping the contexts and contents of their existence depending on the competences that are available to them (i.e., positional capacities and individual capabilities). Looking at how the significance of S&T is constituted will enable us to put actors’ behavior and attitudes in wider societal contexts, as well as to combine micro and macro analyses. It is this kind of mutual shaping of actors and structures that the notion of regime emphasizes, expressing the general sociological idea of “structuration” (Giddens, 1984). A regime analytical perspective allows us to investigate social phenomena with regard to the ways in which they have emerged, been stabilized, and modified; to integrate the various—material, institutional, practical, and discursive—dimensions in which they are constituted; to draw on a variety of social science research traditions that cover different domains of interest, such as regime analyses of governance at local, national, and international levels; and, maybe most importantly here, to capture the changing configurations of S&T in society (Barben, 2007a).

As to the last point, innovation represents a highly significant concern for societies that depend on economic growth and competition, providing the foremost rationale for generating and applying new S&T. Particularly radical innovations often lead to considerable economic, political, legal, and cultural change, bringing about major challenges to the established ways of regulating and enculturating S&T. The configuration of innovation regimes represents the wider societal context in which I suggest analyzing acceptance politics. To be acknowledged as innovations, inventions generally require not only the creation of new or improved knowledge, processes or products but also successful introduction onto the marketplace. On the way from laboratory R&D to markets of various kinds, inventions may have to overcome regulatory hurdles relating to health and environmental safety or national security; may become subject to intellectual property management; may need to undergo ethical review or regulation as regards their creation or application; may be challenged on moral grounds once exposed to users; or, last but not least, may be subjected to attempts to either increase or undermine their public acceptance. Therefore, S&T regimes encompass institutions, discourses and practices relating to safety and security risks, intellectual property rights, ethical issues, and acceptance politics.

While perceptions and communications are crucial elements of politics, rather than mapping their differences, my emphasis is on how particular perceptions, attitudes, and understandings are shaped by—and also shape—political processes. In addition to the constellation of actors pursuing diverging S&T-related interests and values, the societal forms in which these interests and values are articulated and organized may play a significant role in how controversies unfold, and should thus be investigated from comparative perspectives. Societies provide different institutional sites within which interests and values can be fought for or contested, translated into legitimate agendas and protests, and put forth as predominant or subordinate concerns. The institutions of nation-states—particularly the legislative, executive, and judicial branches of government—have the capacity to enable or constrain political mobilization and actions. Besides policy making, acceptance politics also relates to decision making across society, for example in companies, in the marketplace, or in civil society organizations. Interestingly enough, conflicts surrounding S&T may contribute to the creation or reconfiguration of institutional sites—the conflicts may even affect the constitutional dimension if the most fundamental principles and norms of a society are concerned, such as liberty, privacy, and human dignity.

The numerous aspects that characterize the relevance of innovations—e.g., new capabilities to know and do things; economic impacts in various sectors; safety, security, and ethical issues; political, religious, or socio-cultural concerns—present many potential objects
for shaping the public resonance of S&T. Since efforts to improve lacking or to impair given acceptance are intricately linked with each other, “acceptance politics” constitutes a field of interacting opposing strategies, where certain actors align with particular actors against others. As such strategies attempt to successfully contradict, and thus de-legitimize, the knowledge claims of the other side, S&T become a battleground for articulating issues from diverging perspectives. However, there are asymmetries among these strategies as regards their epistemic, material, and practical resources and capacities. While acceptance strategies can claim the superior rationality of science and engineering, their counterparts must make a legitimate case for differing arguments in order to find acknowledgement. Acceptance strategies profit from their basis in established infrastructures and practices, while oppositional strategies have to gain institutional legitimacy. Acceptance strategies achieve their main goal by improving acceptance, while counter-strategies cannot be satisfied with impairing acceptance because this effect alone does not automatically bring about change in public discourse or public affairs. Such changes require altering the attitudes and agendas of actors in civil society and, respectively, in government, industry, and academia.

To conclude, within the analytical framework I am proposing here the blind spots and major problems of the acceptance-centered approaches mentioned above can be explored and eventually overcome. The public no longer serves as the conceptual mirror onto which questionable assumptions about public perceptions and attitudes are projected. S&T are no longer conceptualized simply as objects of opposing perceptions and discourses, but rather as subjects around which actors organize and shape divergent or competing expectations and practices, hereby mediating their social relationships through S&T—a view similar to the one articulated by “co-productionist” perspectives (Jasanoff, 2004). S&T are also no longer considered unquestionable carriers of progress that only lack appropriate appreciation when confronted with criticism or refusal. Instead, the public as well as S&T are seen as embedded within the complex fabric of society. From a sociological perspective, such a framework facilitates a more reflective standpoint—which does not, however, imply support for one or the other position in a given conflict, but rather enables critical observation of the controversies themselves.

3. Acceptance politics of biotechnology

A decade or two ago, surveys on public perceptions often put forth rather strong assumptions about national publics, for example that the USA, the UK, or France were quite uncritical of, or even enthusiastic about, new technologies. In contrast, the publics in countries such as Germany or Denmark were considered overly skeptical about, if not hostile to, the same technologies. But sometimes the constellation in some countries would suddenly change. While the previously fiercely fought debate about the risks of genetic engineering seemed to die out in Germany in the late 1990s, such risks became intensely disputed in Britain and France. It would be misleading to assume that the German public had eagerly learned all the lessons taught by public information campaigns and the like, or that those who were formerly unconcerned had been led into hostility toward S&T by public interest groups. In any case, developments such as these flew in the face of the research on the public perception of S&T—at the same time creating opportunities for comparative controversy studies. These contributed to a better understanding of previously neglected dynamics, but did not initiate an epistemological critique of the acceptance-centered framework (Gaskell and Bauer, 2001).

In the following, I will analyze some selected aspects of the acceptance politics of biotechnology, without aiming for comprehensiveness. My ambition is to further demonstrate through empirical arguments that acceptance politics provides an innovative focus for understanding the
conflicts surrounding emerging S&T. I will (1) portray characteristic elements of the discourses articulating acceptance and oppositional strategies as they have typically shaped the resonance of biotechnology in times of intense contestation. To more fully approach the relevance of biotechnology, as outlined above, the analysis of discourses must be complemented with that of technologies and institutions. I will (2) examine the acceptability of biotechnology, building on a distinction of acceptability dimensions developed in the PUST tradition but arguing that a better understanding requires consideration of acceptance politics. I will (3) elaborate on some distinctive features of national publics and institutions involved in shaping acceptance politics. The latter two sections will be comparative, focusing on the acceptance politics of exemplary applications of biotechnology in the USA and in Germany.

Opposing discourses on biotechnology

Whenever biotechnology became subject to opposing strategies of acceptance politics, polarized claims would result, thus producing conflicted resonance about its relevance. It was assumed there was “a” biotechnology—either good or bad—contributing to economic growth and solving global problems of health, food, and the environment, or, alternatively, increasing these problems and creating new ones. Thus the potentials of biotechnology were articulated with either generalized promises of its usefulness or generalized fears of its hazards. However, there is a common assumption in both arguments, i.e., that the potentials and effects of biotechnology are revolutionary. While the promoters claimed that the translation of potentials into outcomes was under control and did not pose particularly new challenges, their opponents contended a basic lack of controllability because of the fundamentally new quality of genetic engineering. At the same time, the ends biotechnology was asserted to serve were presented as undoubtedly good, which was countered by the claim that the prevalent motive of profits could have no noble end. Hence, good social ends associated with good technological means are juxtaposed to bad social ends associated with bad technological means. With analytical distance, such arguments seem odd and unable to withstand a critical test. Rather than merely criticizing the one-sided claims, reflective social science helps understand the nature of the conflict itself (Luhmann, 1993, 1998), with regime analysis comprehending those claims as strategic interventions in acceptance politics.

Since acceptance politics is about gaining and defending ground against competing claims, its dynamics require the various parties time and again to adapt to new situations and to shift or differentiate arguments. For example, in the 1970s and 1980s scientists often portrayed biotechnology as the third “synthetic” technology after chemistry and nuclear technology. In turn, opponents tried to establish the equation between “splicing genes” and “splitting atoms,” thereby rejecting both genetic and nuclear engineering on the grounds that they are equally dangerous (Gill, 1996; Howard and Rifkin, 1977). According to this metonymy, it seemed reason enough to object to the basic idea of recombining life at the molecular level—whatever the particular ends and means. However, once products had become available that clearly seemed both useful and harmless, opponents came under increasing pressure to concede the potential benefits of biotechnology (see also below). On the other hand, whenever arguments framing the immense biotechnological potentials in a negative light had gained increasing public resonance, the promoters’ discourse was pressured to be significantly rearticulated. For example, in the 1990s, its promoters began presenting biotechnology as an evolutionary rather than a revolutionary technology, merely executing with refined means what had always already occurred in nature. However, this move could not overcome the objection that biotechnology had allowed humans to cross the boundaries between species and radically intervene into the building blocks of life.
Not least because of their highly generalized nature, one-sided arguments were criticized on both sides again and again internally but—because of intense acceptance politics—seldom publicly (a fact that in-depth expert interviews I conducted revealed). Polarized claims have been part of the arsenal of acceptance politics in several countries, although they gained significance in different ways and at different times. Such divergent dynamics have been outside the focus of public opinion surveys but have affected their results. It is only from a sympathetic political standpoint that the generalized assumptions about biotechnology or its stakeholders—likewise presenting each other as ruthless or ignorant—may seem appropriate. From a reflective social science standpoint, it is essential to critically analyze discourses with respect to how they are structured and take part in sense-making. With regard to the evaluation of how appropriately or plausibly discourses represent their subjects (e.g., S&T), as suggested in section 2, discourses should be related to additional dimensions in which a subject’s materiality is constituted. I will further elaborate on this in the following.

Comparative acceptance politics and acceptability

How a technology is evaluated depends, among other things, on the actual significance of its characteristics—an aspect that goes beyond the cognitive, affective, and communicative, concerning rather the practical relevance of a technology in a particular social context. As argued above, I suggest distinguishing between the relevance of S&T and their resonance among actors and across societies. Following the distinction between acceptance and acceptability, three dimensions have been commonly distinguished in the PUST tradition to understand why, and to what degree, technologies meet with acceptance or not: risks, usefulness, and cultural or ethical values. Accordingly, a technology should be accepted most when perceived as being useful, not risky, and culturally or morally acceptable. Complex technological fields, such as biotechnology, encompass a multitude of applications that may be evaluated quite differently in those three dimensions (and in other dimensions as well). Instead of investigating the acceptance of biotechnology as such, it makes much more sense to turn to particular applications—a difference in perspective that has been called the “microscope” view in contrast to the “helicopter” view (Hamstra, 2000).

Against this background, I will start with two early examples of biotechnology as received in the USA and in Germany: human insulin and the so-called Flavr Savr tomato. Insulin was the first recombinant drug for human use, approved by the Food and Drug Administration (FDA) in 1982. Genetically modified (GM) microorganisms were engineered to produce human insulin in unlimited quantity, in contrast to the previous conventional method of extracting insulin from the pancreases of cows or pigs. Human insulin also had the advantage that the chances of inducing an allergic reaction were lower because it is not a foreign protein. Whereas the usefulness seems evident, the risks or moral concerns are not. What may thus count as a strong case for the acceptability of a biotech product was only perceived accordingly in the USA, but not in Germany. In the latter country in the 1980s, opponents of genetic engineering claimed that there were fundamentally unpredictable risks, referring to cases of death because of contaminations during the production of an unrelated GM drug in Japan, the amino acid L-tryptophan, and the possibility that symptoms of hypoglycemia could be missed because of the identical protein structure of human insulin. Moral concerns were loudly raised, too, since the genetic modification of microorganisms was considered sacrilege. However, after the opponents’ attempt to make human insulin a test case to stop the industrial application of genetic engineering ultimately failed—after protracted controversy and legal entanglements—biotech drugs now enjoy the reputation of generally useful and unproblematic products in Germany, too.
The *Flavr Savr tomato* was planned to become the first GM food plant on the market. Its main purpose was a delayed ripening process that would provide better product quality in terms of taste, packaging and transport, and longer availability for consumption before decay. The biotech company Calgene asked the FDA for voluntary regulatory guidance in 1989. After an extensive risk assessment of the new tomato, five years later the FDA declared all risk issues had been comprehensively evaluated. US consumer and environmental groups raised their opposition to the coming marketing of the Flavr Savr tomato, criticizing the voluntary character of the regulatory procedure, possibly still unknown risks, and the general lack of product labeling, which would prevent consumers from making a choice for or against genetic engineering in the marketplace. Introduced in test markets in 1995, the tomato initially cost double the price and the statements (both published and by people I talked to) about its taste ranged from “excellent” to “not even as good as a conventional green-house tomato.” But unexpectedly, the Flavr Savr failed because of technical problems in the harvesting and packaging process, as its skin turned out to be so delicate that new machines had to be built for these purposes. There was also a perceived lack of usefulness for the wider public, since the new tomato was generally acknowledged as beneficial for those who transport and sell foods but not for the consumers. Considering the noncompetitive price, this problem may have been the deciding factor in Calgene’s decision to withdraw the product from the market.

These two examples show that the distinction between the three dimensions of acceptability allows for evaluations of, and predictions about, the public acceptance of biotechnology, although only with some limitations. The first example makes clear that although the actual properties of human insulin looked generally beneficial, they were denied for strategic reasons of oppositional politics. In Germany at that time, there were intense controversies over whether and how to promote and regulate biotechnology. Although the resistance against recombinant human insulin was not successful in building a barrier against the further development of biotechnology in general, this case had gained additional relevance because it changed the attitude of industry representatives who had long opposed a federal bill that would specifically be dedicated to genetic engineering. Crucial for their new support of such a law was a higher court decision in the state of Hesse denying the pharmaceutical company Hoechst the approval to set up human insulin production facilities there. Consequently, a federal regulatory framework that would prevent uneven legal conditions between the states (*Bundesländer*) became a strategic task for industry. On the other hand, the fact that the risks and the moral concerns had been exaggerated against the usefulness of human insulin fundamentally undermined, in the longer term, the public credibility of worst-case scenario arguments.

The second example stresses the importance of mass-market products being generally useful. In the USA (and in Germany) the Flavr Savr tomato was publicly perceived as benefiting mainly those who market it. Thus generalized claims of usefulness turned out to be socially limited. Finally, and oddly enough, the immense effort of assessing the health risks of the new plant still left room for unexpected technical failure. In sum, both examples make it evident that the fate of biotechnological applications is dependent on their particular relevance and resonance among various actors as well as in different societies. In some instances, the relevance and resonance of biotechnology was also shaped by institutional, in particular regulatory, concerns.

**Comparative acceptance politics and publics**

In addition to differentiating biotechnological applications, it is important to differentiate *national publics and institutions*. Assumptions about “the” American or German public are not appropriate, as a closer look will show. For example, in the aftermath of various intense conflicts, Germans were accused of being “hostile to technology”—a notion so prominent that it
was even investigated in a study by the German Office of Technology Assessment (Hennen, 1994)—while Americans were generally considered open to exploring new technologies.

To start with, both above-mentioned polarized positions can be found empirically in Germany and in the USA. Of those advocating a thoroughly positive view of biotechnology in the USA, interest and lobby group organizations such as the Biotechnology Industry Organization (BIO) have been most active in working on public perceptions. On the other hand, the Foundation on Economic Trends (FET; founded in 1977) has launched many lawsuits and media campaigns against biotechnology. They targeted in particular those developments that had the potential of being scandalized, such as interventions into the human germ-line, or that were of strategic importance, such as intellectual property rights. Unlike FET, more moderate and pragmatic approaches have been pursued by the Union of Concerned Scientists (UCS; founded in 1969 at MIT) and the Council on Responsible Genetics (CRG; founded in 1983). Both organizations have been critical on a wide variety of issues, usually by addressing scientific and technological as well as social aspects. They also have not opposed biotechnology in general but rather tried to differentiate between problematic and favorable applications that would fulfill social or environmental needs. Providing information—for instance through their journals *Gene Exchange* and *Gene Watch*—has been crucial for their attempt to address the public. FET as well as UCS and CRG are typical for public interest groups in the USA. While Jeremy Rifkin’s FET is expert in coping with the American litigation and media culture, UCS and CRG are connected to a strand of academic life that has engaged in liberal policy tasks (“liberal” in the American sense). The expertise provided by UCS and CRG has also been taken into account by big mainstream environmental and consumer organizations such as Friends of the Earth, the Environmental Defense Fund, or the Sierra Club.

In Germany, those organizations that have expressed the most pronounced criticism of biotechnology also represent particular cultural and political tendencies in German society. The Gen-ethisches Netzwerk (Gene-ethical Network; founded in 1986) has launched campaigns on a wide variety of issues, partly in cooperation with the Gen-ethischer Informationsdienst (Gene-ethical Information Service). The information service was intended to be broad and critical, but not to serve at the disposition of campaign tasks. The network’s campaigns have addressed interested individuals as well as local initiatives. For instance, the campaign against the deliberate release of GM organisms provided information about the operators, places, plants, and their modifications to the interested public, but at the same time local initiatives were supported and in part coordinated. These local initiatives in turn often operated in stealth, for example clandestinely destroying again and again the fields where the GM crops had been sown. The Genarchiv Essen (Gene Archive, Essen) targeted the complex of reproductive and genetic engineering. Besides feminist groups, groups of disabled people also provided and used information. They have been particularly engaged against new eugenic threats, which still gain a lot of public resonance in Germany because of the Nazi past of medical experimenting and extermination of human life. The Öko-Institut (Eco-Institute) in Freiburg grew out of the environmental movement of the 1970s, specializing in risk-related counter-expertise that was linked with proposals calling for either a moratorium for certain R&D activities or a stronger implementation of the precautionary principle. Finally, the working group on genetic engineering of the Green Party (Bundesarbeitsgemeinschaft Gentechnologie; founded in 1984) served as an important critical forum close to the realm of institutional politics. Up until the mid-1990s, these organizations were engaged quite unambiguously against biotechnology. With the progress of biotechnology, however, they increasingly had to concede the possibility of useful and unproblematic applications.

These observations provide evidence for the existence of similar, yet distinct, tendencies in the American and German publics regarding biotechnology. If we extend the picture beyond
interest groups, additional determinants and foundations of the general public’s attitudes toward biotechnology come into view. In more general terms, the USA has been characterized by social scientists as an individualistic, business and venture-oriented society, and Germany as a collectivist society oriented towards social integration and security. Furthermore, distinct institutional configurations and traditions such as pluralist vs. corporatist modes of interest articulation characterize each society respectively. Accordingly, the concepts of “liberal market” as opposed to “negotiated market” societies were coined (Hollingsworth and Boyer, 1997). This background helps better explain why emerging commercial opportunities in biotechnology have for the most part been welcomed enthusiastically in the USA, but met with a widespread reluctance or even refusal in Germany. For example, unlike in Germany, academic-industrial collaborations have evolved rapidly in the USA, and the patenting of organisms has been allowed earlier and practiced more vigorously. However, in the USA, the exploration of new frontiers of science has been hindered in the case of embryonic stem cell (ESC) research because of the strong influence of Christian fundamentalism, especially among Republicans.

**ESC research** provides an interesting comparative example about the significance of specific institutional configurations. The conflicts over whether and how to regulate human ESC research demonstrate how political controversies have shaped the understanding of its usefulness, risks, and moral implications. These conflicts also highlight the fact that they are shaped by characteristics of national publics. For instance, there is an institutional separation between public and private in the USA so that federal regulations of bioethical matters only apply to the public sector—unless they specifically impose legal prohibitions—whereas in Germany a law generally applies to all of society. In the USA, the deep political divide set by the abortion debate has largely structured the debate about ESCs, although the two debates have not been congruent or without tensions. Religious arguments have played a role in Germany, too, yet without being predominant. Other grounds have formed the basis of opposition to ESC research there, in particular notions of human rights and dignity. The high importance of these values must be understood as specific to the German context, especially the Nazi past of cruel and inhuman medical experiments. Although the regulatory compromises established in the USA and in Germany to mediate between various social interests regarding ESC research seem similar, their significance is quite different. On the one hand, both regulations attempt to prevent further destruction of embryos by establishing a deadline that determines which cell lines may be used in federally funded research (9 August 2001 in the USA) or be imported (1 January 2002 in Germany, recently amended to 1 May 2007). On the other hand, in the USA, the private sector is exempt from any federal restrictions as are the states—thus not only industry but also research universities and some states fund large ESC R&D programs—while in Germany the production of ESC remains completely prohibited. While the ESC-related regulations were implemented in the USA, based on presidential decisions (by Bill Clinton and later George W. Bush), in Germany the legal decision resulted from an intense parliamentary debate. Accordingly, the legal situation can change easily in the USA with a newly elected government (it is thus not surprising that Barack Obama reversed some of his predecessor’s restrictions on ESC research soon after taking office), whereas that is not the case in Germany, because the parliamentary decision was based on a compromise found across the various parties and in conjunction with a long public debate.

While moral issues have prevailed in the public controversies over ESC research, the issues of risks, usefulness, and research alternatives (particularly adult stem cell research) have also played a role. In sum, this example shows that the public debates in the two countries have dealt with a number of common or similar issues but have been structured culturally, institutionally, politically, and legally in very different ways. A striking difference between the acceptance politics in the USA and Germany surrounding ESC research is that in the USA, party politics
has been dominant—with Democrats being clearly in favor of and Republicans overwhelmingly against ESC research (although there has been an interesting debate within the pro-life camp concerning the conflict between destroying life for research purposes vs. saving life thanks to eventual cures based on ESC research). But in Germany, unlike most issues debated in Parliament, this one has not been split along party lines. Here the compromise was agreed upon by a majority of representatives from almost all parties, which means that a minority across the party spectrum opposed the parliamentary decision in favor of either a more restrictive or a more liberal position (with the exception of the Free Democrats, who were unanimously in favor of a “free market” solution without limitations). The multi-partisan approach to ESC research in Germany may be explained by the fact that the various issues have been perceived as affecting the very constitutionality and identity of postwar Germany—not least because the Basic Law protects the “inviolability of human dignity.”

4. Conclusions and outlook

With respect to the introduction into society of new and potentially contested technologies, I have discussed two different analytical frameworks. While the research on acceptance is primarily interested in mapping the perceptions and attitudes toward S&T, the research on acceptance politics is primarily interested in understanding the ways in which opposing strategies attempt to shape the cultural embedding of S&T. I have shown how the research on acceptance may contribute to acceptance politics, but I have not been able here to elaborate on how analyzing acceptance politics may open up opportunities for reflexive engagement in the configuration of S&T (Barben et al., 2008).

Although the acceptance-centered research tradition has managed to overcome many of the limitations evident in its initial approach to the public and S&T acceptance, broader social science perspectives—such as regime analysis—are needed to better understand the problems related to the generation, regulation, and enculturation of S&T. Quantitative surveys are particularly fit to provide data on S&T-related perceptions and attitudes and on divisions in the public based on social indicators such as economic status, education, gender, religion, and locality. But statistical evidence is not sufficient for explaining—or predicting—how people actually appropriate and behave toward S&T. Therefore, qualitative social studies are needed to historically, politically, and culturally contextualize available data, as well as to provide different kinds of reasoning. I have aimed at establishing an epistemological shift—though not a rupture—with the distinction between the relevance and resonance of social phenomena (such as S&T) becoming the key analytical concern (instead of “acceptance”). The focus on acceptance politics has also rendered the notion of the public more complex, comprising—in addition to public perceptions and media—public interest articulation, party politics, public policy, and state institutions.

Against this background, I would like to point to two important issues the proposed framework is able to consider that eluded the research on acceptance: transnational and temporal dynamics. Recent emerging technologies have evolved transnationally, thus affecting public perceptions and acceptance politics in distant places. Since major problems concerning S&T are communicated across borders (e.g., by news media and interest groups), they may have effects on various actors or S&T regimes more broadly. For example, the strong resistance in Europe to the import of GM soybeans in the mid-1990s led to transnational repercussions in the USA and even a change in the set-up of the (agricultural) biotechnology industry (Mitsch and Mitchell, 1999). Or, in mobilizing for or against certain stakes, governmental agencies have coordinated their efforts in acceptance politics (see as an example US–EC Workshop,
1992) and nongovernmental organizations have launched transnational campaigns, such as “No Patents on Life!” And S&T of potentially high moral significance, such as ESC R&D, have revealed striking differences among countries with divergent religious and philosophical traditions, impacting manifold aspects of their generation, regulation, and enculturation (Holland et al., 2001).

Temporal dynamics in the emergence of S&T is crucial—and, correspondingly, so is the timing of analyses. For example, the controversies over emerging technologies are often much more intense at early stages than during their large-scale introduction into society, which is in part because of cultural change effected by S&T. In addition, issues experience upswings and downswings that, in different countries, often take place in diachronic and uneven ways. Furthermore, controversial issues may influence each other, causing unexpected interferences, as was the case with the turnaround in the acceptance of agricultural and food biotechnology in the UK (which was fuelled in particular by the BSE crisis and led to a subsequent loss of trust in experts); in France, such a turnaround gained momentum through the anti-globalization movement, a faction of which mobilized against the global icon McDonalds and the Americanization of food production and consumption at the expense of rural traditions of craftsmanship and gourmet foods. Finally, the sensitive domain of ethics, too, can show slow or sudden changes in public perception that may be caused by advances in a field of S&T—and, conversely, such changes may encourage attempts to revise previously instituted compromises between R&D and morals, like those concerning ESC. All these aspects indicate again how important it is to analyze the dynamics in the shaping of the relevance and resonance of S&T.

To conclude, further study of acceptance politics would be particularly fruitful in three regards. First, there is a lack of comprehensive case studies on the acceptance politics of particular fields of S&T, showing how these fields and their respective publics have been mutually shaped such that neither the relevance nor the public resonance of S&T can be taken for granted. Cross-national or cross-technological comparisons would be especially insightful as regards empirical variation and further conceptual differentiation. Second, since acceptance politics is far from being an isolated concern related to gaining or losing public acceptance but is instead part of the complex relationships between the generation, regulation, and enculturation of S&T, investigating innovation regimes accordingly would be both challenging and rewarding. It would provide us with insights into the patterns and interdependencies through which S&T emerge and become embedded in society (for biotechnology see Barben, 2007b; Jasanoff, 2004). Third, as S&T regimes are themselves changing—as regards particular regime areas and their overall configuration—emerging potential new sites of acceptance politics should be investigated. For example, while the “big science” project of biotechnology, the Human Genome Project, eventually gave rise to the systematic implementation of research on ethical, legal, and social issues into R&D funding, high-powered initiatives to take societal aspects of nanotechnology into consideration have been launched early on in the USA and Europe—not least to help avoid significant resistance or lack of acceptance (CEC, 2004; NSTC, 2004; Royal Society and Royal Academy of Engineering, 2004). Subsequently, endeavors have been launched to create novel forms of integrating both social science research and public engagement into nanotechnology programs. Such experiments provide valuable new opportunities for the reflexive engagement of researchers at the interface of science and society—as well as potential new sites of acceptance politics that might be worth further exploration.

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Notes

1 The issue of allowing the import of ESC only came up because of a gap in the Embryo Protection Law of 1990, which was passed to anticipatorily govern human reproductive technologies at a time when the cultivation of ESCs was not yet a reality.

References


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