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Pieter Maesele

In characterizing the genetically manipulated (GM) food controversy as a risk conflict between different social groups with competing interests, the research question of this paper is which interpretive frames are found to be employed in the struggle over meaning in this conflict. In so doing, this paper not only answers the recent call to attend to the relationship between framing processes and issues of social and political power, but also proposes an extension to William Gamson's approach in order to differentiate these frames on an ideological level. After integrating this framing concept into a media-sociological perspective to the relation between media and science, a methodological framework is set out for identifying these interpretive frames which combines the analysis of frame sponsorship (of science, industry, and movements) and media representation. As a result, a frame matrix of 10 interpretive frames is presented, which comprises the different positions in the struggle over meaning in the GM food risk conflict.

Keywords: Framing; GM Food; Ideology, Media Sociology; Power

When Monsanto's Roundup Ready Soya was imported into Europe in the fall of 1996, a public controversy on genetically manipulated (GM) food slowly spread out across the continent. This controversy is a prime example of a new type of *social conflict* in today's late modern societies: a "risk conflict." Beck (1992) and Giddens (1990, 2003) refer to this new type of conflict in their "reflexive modernization"-thesis, which argues that the advance of human knowledge and its ensuing intervention into society and nature has created (high-consequence) modernization risks, such as nuclear and genetic engineering risks. These risks are imperceptible unless in terms of physical and chemical formulas. Because the im/materiality and in/visibility of

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modernization risks renders them dependent on the mediation of external knowledge, mass media representation, and the subsequent mediatization of science acquire a decisive role: not only in terms of the social definition and revelation of these risks, but also in terms of social contestation and social criticism (Adam & van Loon, 2000; Allan, Adam, & Carter, 2000; Cottle, 1998). The antagonisms that originate in these processes produce social conflicts that involve contestation concerning different risk definitions, which are based on competing rationality claims, values, and interests. These social conflicts are referred to as *risk conflicts* (Maesele, 2009a, 2009b).

The application of the technology of genetic manipulation for agricultural purposes is a recent example of the enormous techno-scientific advances with which we have increasingly extended the control over our natural environment. The development, promotion, and marketing of GM food is driven by a close collaboration of scientific institutes and multinational or smaller-sized private businesses that are united by powerful economic interests in biotechnology (Bauer & Gaskell, 2002, pp. 379–404). West (2007) has succinctly labeled this evolution toward an ever closer collaboration between science and private business as constituting a “science–industrial complex.” The Dutch-speaking northern part of Belgium (further referred to as Northern Belgium), a region of approximately 6 million inhabitants, is an interesting place to observe this science–industrial complex, as Northern Belgian scientists developed the technique to transfer foreign genes into the plant genome in the 1970s (Van Larebeke, Genetello, & Schell, 1975), and subsequently founded Plant Genetic Systems (PGS) in the 1980s which was the first company to develop genetically engineered plants with insect tolerance. These events further developed into a “Biotech Valley” in the university city of Ghent that today hosts the Flanders Interuniversity Institute for Biotechnology (VIB) and agbiotech multinationals such as BASF Plant Science, Bayer CropScience, and deVGen. It is important to emphasize that these three companies were originally local spin-offs created by VIB-scientists. The FlandersBio association that groups the different biotech companies in Northern Belgium is also a VIB-product. These manifest links between the scientific institute and industry warrant the claim of a “science–industrial complex.” By mid-1999, as elsewhere in Europe and around the world, a broad coalition of new social movements and/or non-governmental organizations (NGOs; in this case environmental, nature, north–south/Third World and farmer movements together with consumer organizations) arose in Northern Belgium to confront industry and VIB with protest actions, company blockades, media campaigns, debate evenings, etc.

Both structural developments, risk conflicts, and the commercialization of science, have important consequences for the relation between science and the public sphere, and as a result, for the relation between science and media. Furthermore, they bring forward the question of the social role of the media in democratic societies and the relationship between media, power, and democracy. For media studies and environmental communication, this context requires a media–sociological perspective to the study of science (or technology or the environment) in the media. A media–sociological perspective refuses an instrumental view of the role of media in which the goal is to promote science and the acceptance of new technologies (such as

GM food) by uncritically reproducing statements from institutional actors (such as the scientific institutes which develop them and the corporate actors that market them) and by de-legitimizing possible objections from non-institutional actors (such as environmental, nature, and farmer movements). Instead, it poses the question of whether and to what extent mass media contribute to a *framing* of socio-scientific debates (such as the introduction of GM food) as involving *political* choices between *alternative* (technological) *futures*, or to the contrary, as matters to be left to technocratic decision-making or market forces. To be able to make these choices on a substantive basis requires not only knowledge of the full range of possible frames with which to interpret the GM issue, but also of their axiological, normative, and political implications, as well as the interests they serve. The contribution of this paper lies in putting forward a methodological framework to identify these interpretive frames and their ideological implications.

Starting from the assumption that any ideological analysis of media coverage should start by identifying the interpretive frames advanced by the involved social groups in competition to influence media coverage, the aim of this paper is to construct a matrix of interpretive frames, which are differentiated on an ideological level, used in the struggle over meaning in the GM food risk conflict. The author of this paper agrees with the critique of recent developments in the (proliferating) research literature on media frames which contends that the relationship between framing processes and broader issues of social and political power is being neglected (Carragee & Roefs, 2004; Gamson, 2003, p. ix). There appears to be an inherent tendency in communication and media studies to approach the framing concept from a reductionist perspective that treats media frames as separated from the power context from which they originate (for recent research on GM food specifically, see Crawley, 2007; Marks, Kalaitzandonakes, & Wilkins, 2007; Matthes & Kohring, 2008). This study aims to remedy this neglect by integrating an explicit attention to frame sponsorship (of science, industry, and NGOs) with the examination of framing processes within the contexts of the distribution of social and political power and the media hegemony thesis. Moreover, it proposes to look at *framing* as a persuasive element in the workings of ideology in maintaining or challenging hegemonic positions. To illustrate how to empirically study these processes, it sets out a methodological framework in which the approach of William Gamson and colleagues to identify interpretive frames (Gamson & Lasch, 1983; Gamson & Modigliani, 1987) is extended by adding a second implicit level of analysis which allows to differentiate these frames on an ideological level: an underlying problem definition (which uncovers the interests at stake in particular frames). Furthermore, this framework is applied, not to a characteristic topic of public and political discourse (such as welfare or affirmative action), but to a socio-scientific debate such as the risk conflict on GM food in Northern Belgium. The research reported in this paper is part of a larger Ph.D. project whose aim was to shed light on the role of news media in the confirmation or erosion of hegemonic positions during risk conflicts, with the press debate on agricultural biotechnology in Northern Belgium for the period 1998–2007 as its case study (Maesele, 2009a).

The following section of this paper develops my conceptualization of the framing concept and integrates it into a media–sociological approach to the relation between media and science. A subsequent section provides a methodological exposition which details the two-staged research process which was developed to empirically assess this conceptualization in the case of the GM food debate in Northern Belgium. This is followed by an extended description of the 10 identified frames which were found to make up the frame matrix of the struggle over meaning in this risk conflict. Finally, this paper concludes by discussing its significance for shedding light on the role of news media in contributing to a broad democratic debate on technological applications such as GM food.

Framing, Ideology and a Media–Sociological Approach

This paper starts from a media–sociological perspective to the relation between media and social institutions in general, or media and science in particular (Gamson, 1988; Maesele, 2009a; Maesele & Schuurman, 2008; Verstraeten, 1996). In this perspective, media representation is interpreted as constituting a main site for the *struggle* over the (de)legitimation of social institutions like science or products like GM food. This implies that in the efforts to control their public meaning and significance, the struggle for their image in the media is of increasing importance. A media–sociological approach therefore considers the relation between media and science as a site of *contestation* over different representations of science and technology. The research questions are aimed at understanding how science is represented in the media and by whom, and how this relates to issues of access to the media and social debate. It characterizes the relation between media and science not as a matter of information and communication, but as a *social* and *political* matter in which the power relations between different actors and the media representations thereof constitute important research objects. For dominant groups in society reproduce their social and political power not only through material but also through intellectual means, by the production and diffusion of ideas that allow them to maintain their ideological hegemony. This implies that the mass media as the dominant cultural system in present societies should be regarded as a primary channel through which this process takes place. The concept of hegemony emphasizes how this is a process of consent rather than coercion, which can only be accomplished through the presentation of dominant social groups of themselves as being “best able to fulfill the interests and aspirations of other [groups], and, by implication, a whole society” (Taylor & Willis, 1999, p. 33). Especially in the case of high-tech science like biotechnology the claim of specialized, technical knowledge and expertise results in the exercise of power as “cultural authority” rather than force, which successfully masks how the ideological power works against the interests of other groups in society. But as the interests at stake are really in opposition, these presentations evoke challenges which subsequently need to be assimilated “within the dominant ideology in order to pacify and appease them” (Taylor & Willis, 1999, p. 33), which implies a continuous re-negotiating and re-establishing of consent.

This paper puts forward the *framing* concept as a particularly fruitful means to investigate and reveal how media content works ideologically to reinforce dominant ideas, beliefs, and interests by legitimizing and naturalizing them through their media representations as natural and unavoidable (or “common sense”). In so doing, it takes up the recent call for media and communication scholars to revalue the relationship between framing processes and the distribution of social and political power in society (Carragee & Roefs, 2004; Entman, 2007; Gamson, 2003, p. ix) while it simultaneously (re)connects to the origin of framing research within media sociology (Gitlin, 1980; Tuchman, 1978). This conceptualization of the framing concept calls for the integration of frame sponsorship with the examination of framing processes within the contexts of the distribution of social and political power and the media hegemony thesis. Furthermore, to account for the dynamic character of hegemonic ideologies, an apt definition of the framing concept should put forward frame packages as “hav[ing] the task of constructing meaning over time, incorporating new events into their interpretive frames” (Gamson & Modigliani, 1989, p. 4). Therefore, it is useful to consider frames as containing a story line, or a scenario. A prime example of this dynamic character is to be found in Gamson and Modigliani’s study on nuclear power, in which the *progress* frame needed to assimilate the Chernobyl accident, and it did this by emphasizing the ingenuity of American nuclear reactors compared to their Soviet counterparts. Gamson and Modigliani (1989, p. 3) have provided us with a most useful definition of the framing concept: frames are central organizing ideas “for making sense of relevant events, suggesting what is at issue,” and Nisbet and Hume (2006) have added how this central organizing idea persuasively packages or “wraps up” a complex message by focusing on certain interpretations over others. Here it is important to make a clear distinction with definitions that reduce (media) frames to story topics or themes (“economy,” “environment,” etc.), attributes (for example, “benefits” or “risks” of GM technology, common in research inspired by the agenda-setting perspective), or issue positions (pro-GM or anti-GM). These latter definitions do not allow to take account of: (1) the power context from which frames originate; or (2) the particular interpretations of an issue which they construct. In short, they neglect the ideological potential and implications of frames by ignoring how particular meanings serve particular interests. Moreover, it should be clear that a single issue position can be supported by multiple interpretations of an issue.

Carvalho’s (2007, p. 225) definition of ideology proves particularly suitable for identifying the ideological implications of particular frames in risk conflicts, provided that “values” are interpreted as “interests”:

I understand ideology as a system of values, norms and political preferences, linked to a program of action vis-à-vis a given social and political order. People relate to each other and to the world on the basis of value judgments, ideas about how things should be, and preferred forms of governance of the world. In other words, ideologies are axiological, normative, and political. Besides government and society, the referents of ideologies may include, for example, the economy and the relations between humans and the environment.

To identify the axiological, normative, and political implications of particular frames, as well as the interests they serve, we need to supplement the approach by Gamson and colleagues (Gamson & Lasch, 1983; Gamson & Modigliani, 1987) with a second implicit level: an underlying problem definition. It is only by tying these interpretive frames, defined as persuasive story lines, to particular problem definitions of an issue that allows distinguishing the interests, values, and aspirations at stake in the case of a particular problem definition and the normative implications for each player in the story line concerned. Van den Berg and Van der Veer (1986, 1989) used a similar procedure in their seminal work *Ideology and Mass Media* in which another characteristic conflict embedded within capitalist society is analyzed: a labor conflict. The authors identified four frames: the *positive retrenchment*-account, the *cooperation and dialog*-account, the *fate*-account, and the *fight*-account. The first three frames share an underlying problem definition which regards the retrenchment as an “inevitable” and “natural” process, therefore any disruption by protest actions damages the general interest. The fourth is grounded in a (“deviant”) problem definition which does not perceive economic developments as inevitable, but as an expression of profit motives—reflecting particular (industry) interests, which are in opposition to the general interest—which workers should oppose. The idea is that when frames share a particular underlying problem definition, they also share the interests and action components of that problem definition. Frames should, therefore, not be equated to single issue positions or associated with multiple problem definitions. It is instructive to consider them as persuasive possibilities, or even opportunities, for supporting, legitimizing, and naturalizing a particular problem definition tied to certain interests and norms of behavior. Framing, then, functions as a persuasive element of ideology in maintaining or challenging hegemonic positions (Maesele, 2009a). This conceptualization might appear rather intangible for the moment, but this should be remediated in the section in which the frame matrix of the GM food debate in Northern Belgium is described.

Furthermore, neglecting frame sponsorship in framing research also implies taking news texts as a given by ignoring the influence of external sources on journalistic discourse. One of the primary means to evaluate the relationship between framing processes and social and political power is to examine the frame sponsorship of social movements. As premier challengers to hegemonic values, they do this primarily by producing collective action frames (Benford & Snow, 2000, p. 615), a process through which they simultaneously highlight their concerns, mobilize support, and validate their existence as political actors (Gamson & Wolfsfeld, 1993). However, it is important that a methodological set-up not only allows an examination of how movements construct frames which challenge hegemonic ideology, but also simultaneously transcends a narrow focus on the counter-hegemonic agency of social movements: by stressing the dynamic character of the interpretive frames of both dominant groups and movements, the counter-mobilizing framing initiatives of the dominant groups who are confronted with these ideological challenges are also accounted for.

Now the issue is how to empirically assess this conceptualization of framing and how to apply it to a case study such as the GM food risk conflict in Northern Belgium. The following section “Methodology” will build on the still very relevant and useful approach of William Gamson and colleagues who have constructed frame matrices on topics such as welfare and affirmative action by linking particular symbolic and reasoning devices to meaning construction (Gamson & Lasch, 1983; Gamson & Modigliani, 1987). However, for adequately capturing the articulation of (and challenges to) hegemonic ideology through framing research, I propose to supplement their approach with adding the level of an underlying problem definition which uncovers the interests at stake in particular frames, while integrating an explicit attention to frame sponsorship.

Methodology

Gamson and colleagues (Gamson & Lasch, 1983; Gamson & Modigliani, 1987) have emphasized how an exclusive reliance on media materials may lead media scholars to overlook interpretive frames which have very low prominence in public (and media) discourse, although being culturally available (which means that there is an organization sponsoring it). Therefore, the initial source should not be media discourse itself but specialized publications by individual and organized sponsors. However, they remain vague about how their frame matrices are constructed: they indicate that the signature elements (through which frames are expressed and recognized in public discourse) have been “gleaned (...) from sponsor materials (...), books, journal articles, and commentary on the (...) issue, supplemented by exemplars from our sample of media materials” (Gamson & Lasch, 1983, p. 402).

Building on this approach, the proposed methodological set-up consists of a two-staged research process. In a first stage, frame sponsorship is charted by analyzing strategic communication documents of advocates and challengers of GM food. This inductive qualitative–interpretive content analysis leads to a tentative identification of frame categories. In a second stage, these frames are further specified by analyzing media representation.

Stage 1: Frame sponsorship

Data collection. The obvious advocates in the case of GM food are science institutes and industry. In Northern Belgium, there is the VIB which unites the research departments of four universities and which was established by the regional government with as its main objective “to turn [its scientific research] into new economic growth” for the region (VIB, 2003). VIB corporate flyers, information brochures, and fact sheets were analyzed for this part of the study. For industry communication, I collected industry manifestoes and campaign leaflets and documents, as well as information from the websites of the industry associations EuropaBio, BelgoBiotech, BIO.be, and FlandersBio. This “science–industrial

complex” was confronted by a very diverse platform of NGOs. For the purposes of this study, the focus was put on those five NGOs which were found to have played the most visible role: Greenpeace, JNM, Velt, Wervel, and BBL. Greenpeace is a well-known international ecological movement with regional and national sections. JNM is the Dutch abbreviation for Youth Organization for Nature and Environment and is a movement for youths until the age of 25. Velt stands for Ecological Living and Cultivation and profiles itself as a(n) (alternative) consumer organization for organic food and agriculture. Wervel is The Working Group for a Just and Responsible Agriculture, and BBL, the League for a Better Environment, is the federation that unites more than 140 environmental and nature movements in Northern Belgium. Six spokespersons for these NGOs were interviewed for another part of the total research project during which they were asked to provide campaign and press folders, press releases, pamphlets, manifestoes, newspaper articles, etc., to allow a look into their input in the debate and into what happens backstage in their centers of cultural production. For it has to be emphasized that it was much harder to find documents from the NGOs than from science or industry, as the former are mostly small-scale organizations with no budget for large-scale communication.

Document analysis. These documents were systematically analyzed using a qualitative–interpretive content analysis to inductively (re)construct the textual elements into frame packages. This happened through a dialectical process whereby frame examples were collected from studies on science-related or other controversies which were subsequently emptied out from their respective content (e.g. Durant, Bauer, & Gaskell, 1998; Gamson, 1992; Gamson & Modigliani, 1989; Nisbet & Huges, 2006; Nisbet & Lewenstein, 2002; Van den Berg & Van der Veer, 1986). These frame titles were considered to figure as possible candidates for the GM controversy in Northern Belgium without necessarily restricting the eventual decision on the frames that would be selected. The *coding* process was characterized by the principles of the grounded-theory approach (Strauss & Corbin, 1998; Van Gorp, 2006): in a simultaneous process of collecting, coding, and analyzing textual information, new ideas were constantly developed and information was searched for that either confirmed or contradicted the preliminary frames. When certain argumentations appeared to belong to one of the possible frame candidates, the textual information was inventoried in an evolving frame matrix, combining elements of previous frame matrices (see Entman, 1993; Gamson & Lasch, 1983; Van Gorp, 2006; as well as insights from Carvalho, 2007; Van den Berg & Van der Veer, 1986). Ten different frame categories were tentatively identified in this process: *scientific progress*, *economic prospects*, *development*, *cost–benefit*, *scientific uncertainty*, *pandora’s box*, *alternative*, *public accountability*, *corporate control*, and *ethical*. At the end of Stage 1, these frames constituted nothing more than basic ideas and ideal–typical descriptive categories, in other words, the frames were not “alive” yet. Their precise make-up was (re)constructed during the analysis of the newspaper articles.

Stage 2: Media representation

Data collection. A diverse set of newspapers was selected from the Dutch-speaking language community: all three “quality” newspapers (*De Tijd*, *De Standaard*, and *De Morgen*) as well as both most read “popular” newspapers (*Het Laatste Nieuws* and *Het Nieuwsblad*). The eventual search string, consisting of 51 key words, was entered in the Belgian digital press databank Mediargus for a time span from 1 January, 1998 to 31 December, 2007 inclusive. This gave a total of 6,087 articles which were all manually scanned. The digital press databank search had to be combined with a manual search in the paper versions for four of the selected newspapers either because these were not included in the database starting from January 1, 1998, or because a deeper look into their results revealed that some months for some newspapers were missing. Eventually, this led to a total population of 1,385 articles (for a more detailed description of these processes, see Maesele, 2009a).

Media analysis. The newspaper articles were analyzed by means of a qualitative–interpretive content analysis in which the coding procedure is considered as a “process”: not as a mechanical task, but as an interpretation of texts, to allow the frame specifications to be changed, enriched, and completed. Eventually, the 10 tentatively identified frames not only turned out to be valid framing categories, but they were also found to be able to capture each and every position in the struggle over meaning in this risk conflict. Therefore, it was fair to conclude that the construction of the tentative frame matrix in Stage 1 was a success. Reliability in terms of intercoder agreement was measured by means of Krippendorff’s alpha on a random sample of 100 articles that were coded by a second person (Neuendorf, 2002, pp. 84–85; 158–159). Reliability was reached that was 0.74 or higher, except for the frame *cost–benefit* (0.66), which means that we have a good agreement among the two coders. The following section provides a detailed description of the 10 identified frames which were found to make up the frame matrix of the Northern Belgium GM food conflict.

Interpretive Frames in the Northern Belgian Genetically Manipulated (GM) Food Debate

Gamson and Lasch (1983) refer to how the frames present in an issue culture belong to a larger political culture consisting of ideologies or belief systems. They propose an interesting heuristic concept of cultural themes that exist in a dialectical relationship with counter-themes. The themes constitute the mainstream hegemonic ideas in society. They are safe and conventional and “one can invoke them as pieties on ceremonial occasions with the assumption of general social approval (Gamson, 1992, p.135).” They are challenged by counter-themes that are adversarial, contentious, and oppositional, and sponsored by challenger groups in society. Two of Gamson’s four dimensions of cultural themes for viewing politics in American society are particularly fit—provide some adaptations—for characterizing

the issue culture of the GM debate in Northern Belgium (see Figure 1). The technology dimension concerns the relationship between society and nature and represents the struggle between mastery over nature and harmony with nature, between technology through progress and (uncontrollable) autonomous technology. *Scientific progress* represents the safe theme, while *scientific uncertainty*, *pandora's box*, and *alternative* are part of the adversarial counter-theme. And second, the power dimension focuses on the relationship between society and economy, and specifically on how to regulate the (knowledge) economy. Here, the frame *economic prospects* represents the conventional theme, whereas *public accountability* and *corporate power* represent the adversarial counter-theme. In the following, I provide an extended description of each of the identified frames (see Table 1). In using a combination of paraphrasing and direct quotes from multiple sources, I rely on the language of advocates and challengers as found either in strategic communication documents or newspaper articles.

1. Scientific progress

The issue here is whether we allow the development of new technologies through scientific progress to provide better products. GM technology is interpreted as the latest step in a long process of improving the speed and precision of plant breeding (see Table 1). It represents the view that there is a technological solution to every issue ("technofix") and presents itself as pragmatic and non-ideological. The application of agricultural biotechnology will lead to improvements on all possible levels: agricultural and pharmaceutical production, food, medicine, environmental issues, climate change, etc. But this package also implies that the authorities, science, and industry have everything under control. We should trust their expertise in ensuring the safety of GM products. The dynamic nature of the framing process is exemplified with the progress

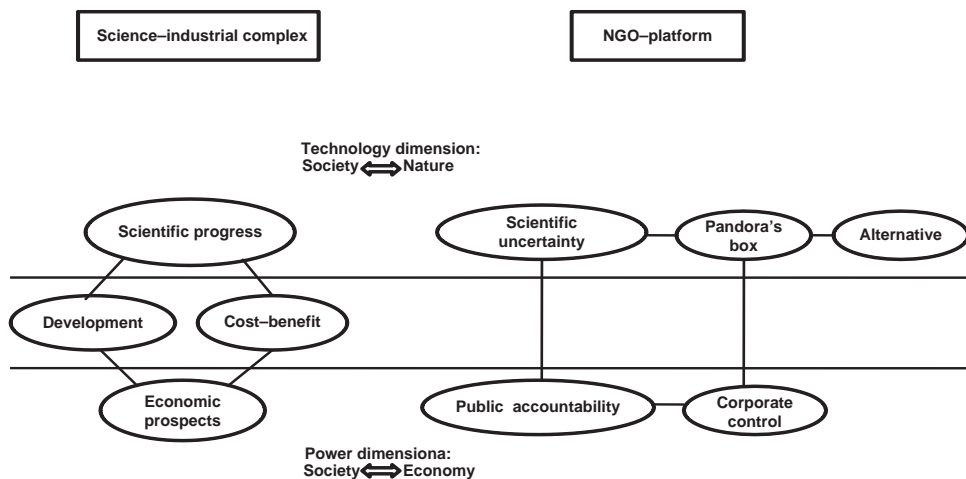


Figure 1. Frame dimensions.

Table 1 Frame matrix.

Core frame	Core position	Problem definition	Interests	Action	Signature elements: GM technology ...
The issue is whether we allow the development of new technologies through <i>scientific progress</i> to provide better products.	The development of GM food is a necessary step to technologically improve the precision of plant breeding, which delivers new varieties with advantageous properties for farmer, consumer, environment, and society.	The introduction of GM food is a normal element of an inevitable natural scientific and economic development.	Whatever serves scientific and economic progress, serves the public interest. The interests of the science–industrial complex are public interests.	The disruption of this natural process by governments or NGOs damages the public interest and is explained by factors external to the technology itself.	... leads to important agricultural, food, environmental, climate, and health improvements. ... is safe and under control. Critical studies are not based on sound science. Media coverage exaggerates the risks. ... is necessary to maintain our standard of living and to feed a growing world population.
The issue is whether we allow the development of new technologies to offer <i>economic prospects</i> .	The development of GM food is necessary to develop our economies and to foster economic growth.	The introduction of GM food is a normal element of an inevitable natural scientific and economic development.	Whatever serves scientific and economic progress, serves the public interest. The interests of the science–industrial complex are public interests.	The disruption of this natural process by governments or NGOs damages the public interest and is explained by factors external to the technology itself.	... is a matter of free trade, economic expansion, venture capital, university spin-offs. ... cost reduction; there is no affordable alternative.

Table 1 (Continued).

Core frame	Core position	Problem definition	Interests	Action	Signature elements: GM technology ...
The issue is whether we allow the development of new technologies to contribute to the <i>development</i> of Third World countries.	The development of GM food is necessary to develop solutions to the problems of developing countries.	The introduction of GM food is a normal element of an inevitable natural scientific and economic development.	Whatever serves scientific and economic progress, serves the public interest. The interests of the science-industrial complex are public interests.	The disruption of this natural process by governments or NGOs damages the public interest and is explained by factors external to the technology itself.	... leads to improved food security and human health for the Third World. ... is a moral obligation for prosperous Western nations to support in developing nations.
The issue is whether the current debate allows for a rational <i>cost-benefit</i> analysis of developing new technologies.	Only a rational debate based on sound science will allow us to move beyond the current emotional debate to discuss the benefits of GM food.	The introduction of GM food is a normal element of an inevitable natural scientific and economic development.	Whatever serves scientific and economic progress, serves the public interest. The interests of the science-industrial complex are public interests.	The disruption of this natural process by governments or NGOs damages the public interest and is explained by factors external to the technology itself.	... suffers from flawed corporate communication in the PR-war with the environmental movement. ... is a matter of ignorant public perceptions.
The issue is whether the level of <i>scientific uncertainty</i> allows the development of new technologies.	The level of uncertainty about the scientifically verifiable risks of GM food is too high for food safety, human health, biodiversity, or the environment.	The current state of GM science is insufficient to allow the development of GM food.	It is in the public interest to prevent damage to food safety, human health, biodiversity, or the environment.	Governments should apply the precautionary principle and suspend the commercialization of GM food.	... is a matter of unknown long-term effects. ... is based on reductionist science. ... needs more testing instead of rushing ahead: better to prevent than to heal.

Table 1 (*Continued*).

Core frame	Core position	Problem definition	Interests	Action	Signature elements: GM technology ...
The issue is how to avoid opening <i>Pandora's box</i> by the development of new technologies.	The current development of GM food is an act of irresponsibility. The survival of man and animal is threatened by the disruption of nature and the environment.	The current state of GM science is insufficient to allow the development of GM food.	It is in the public interest to prevent damage to food safety, human health, biodiversity, or the environment.	Governments should apply the precautionary principle and suspend the commercialization of GM food.	... will be uncontrollable; a genie impossible to put back into its bottle. ... is a threat, a time bomb, will have harmful effects, and catastrophic consequences.
The issue is whether there are <i>alternative</i> soft energy paths available to the development of new technologies.	There are many alternatives to applying GM technology in agriculture that do maintain the ecological balance, such as organic agriculture.	GM food only fits into an increasingly large-scale industrialized capital- and energy-intensive agriculture which is devastating to the environment.	Whatever serves labor-intensive, small-scale and local agriculture is in the public interest.	The government should support ecological alternatives and prohibit or strictly regulate GM agriculture.	... harmony with nature rather than mastery over nature. ... a different mentality: be more economical with energy and food. ... biodiversity versus monocultures.
The issue is whether the level of <i>public accountability</i> allows the development of new technologies.	There is a lack of public accountability and freedom of choice on the issue of GM food because information, control and a social debate built upon democratic participation are lacking.	The current institutional context is insufficiently accountable and democratic to allow the development of GM food.	The GM issue is a case of the people versus the "vested economic interests" of the science-industrial complex.	Governments should apply the precautionary principle until a strict legislation is in place that ensures democratic control and freedom of choice for the public.	... needs control, guarantees, labeling, traceability, liability, etc through a strict regulatory framework to ensure a genuine freedom of choice. ... needs independent research and information. ... needs a social debate built upon democratic participation.

Table 1 (Continued).

Core frame	Core position	Problem definition	Interests	Action	Signature elements: GM technology ...
The issue is whether current economic power relations allow the development of new technologies without increasing <i>corporate control</i> .	The development of GM food is pursued by multinational corporations that defend their private economic interests, only to further increase the dependence of citizens and farmers.	The current institutional context is insufficiently accountable and democratic to allow the development of GM food.	The GM issue is a case of the people versus the “vested economic interests” of the science–industrial complex.	Governments should apply the precautionary principle until a strict legislation is in place that ensures democratic control and freedom of choice for the public.	... puts profit and free trade before security and democracy. ... is about commercialization, privatization, monopolization, and bio-piracy. ... increases global social inequality and our dependence to multinationals for world food security.
The issue is whether it is <i>ethically</i> acceptable to allow the development of new technologies.	The development of GM food raises many ethical issues.	The current institutional context is insufficiently accountable and democratic to allow the development of GM food.	The GM issue is a case of the people versus the “vested economic interests” of the science–industrial complex.	Governments should apply the precautionary principle until a strict legislation is in place that ensures democratic control and freedom of choice for the public.	... is a matter of right and wrong. ... is about setting moral boundaries.

package in disavowing critical scientific reports because they are not based on “sound science” as they are produced by scientific charlatans. The media, always eager for some sensational story, over-publicize these flawed studies. Opponents of the technology are characterized as neo-luddites, traditionalists, anti-science radicals, fundamentalist nature worshippers, and “old” anti-multinational-gauchists led by ayatollahs.

2. Economic prospects

The issue in this package is whether we allow the development of new technologies to offer economic prospects. GM technology in particular is interpreted as necessary to develop our economies and to foster economic growth in the knowledge societies of today and tomorrow. GM products are a matter of cost reduction, free trade, economic expansion, venture capital, joint ventures of successful local university spin-offs with the leading corporations of the world, and double digit annual growth figures that signify their worldwide success. The dynamic nature of the framing process is exemplified with this frame as constantly trying to water down new regulations, while at the same time claiming that since we already have the most stringent regulatory framework in the world, any other barriers to trade for political reasons should be condemned as illegal and unscientific. Any hindrances for the development of GMOs “are setting the sector back in Europe with respect to the rest of the world and are impeding the contribution of agricultural biotech to Europe’s Lisbon goals” (EuropaBio, 2007).

3. Development

The issue is whether we allow the development of new technologies to contribute to the development of Third World countries. We have a moral obligation as prosperous Western nations to support new technologies that could alleviate the numerous problems in the Third World as much as possible. GM crops could increase yields for starving Third World farmers. The ambivalent position of the European Union is hindering the fulfillment of the great potential of biotech crops in helping developing countries meet their own needs. Within this package, GM technology is a matter of public–private partnerships, technology transfers from north to south, and applications like Golden Rice varieties that could prevent blindness and under-nourishment. *Development*, just as *cost–benefit*, belongs to the technology dimension as well as to the power dimension. The core idea is that the problems of developing nations are really technological problems instead of political problems, but it is often Europe’s actions on the power dimension that are blamed for a lack of progress on the contribution of agricultural biotechnology to development goals.

4. Cost–benefit

In this package, the central organizing idea is an evaluation of whether the current level of debate and past and present communication efforts allow for an objective

assessment of the *benefits* of GM technology. The core position is that only a debate based on “sound science” will allow us to move beyond the current polarized and emotional debate which prevents the public to be fully informed about the science and benefits of the technology. These ignorant public perceptions are to blame for hindering its development. This frame reduces the GM issue as well as the notion of a social debate to the adequacy of corporate or scientific PR-efforts, which are said to have been flawed from the start, and which is why GM products are facing the problems of acceptance they are facing today. In this PR-war between David and Goliath, the biotech scientists and biotech industries are the David’s who stand against the huge international campaign efforts of the Goliath’s of the environmental movement who have succeeded in monopolizing the coverage on GM food by playing the emotional card and by arousing fear, leading politicians, and the food industry to follow their fearful voters and consumers, respectively. The *cost–benefit* frame is often characterized by the expression: do not throw out the baby with the bath water.

I have found these four frames to be advocated by science as well as industry (see Figure 1). They are all decidedly pro-GM technology. Delaying the development of agricultural biotechnology will send us back to the stone age (*scientific progress*); will retard the development of our economies (*economic prospects*); will further deteriorate the food security of developing nations (*development*); and means giving in to the ignorance and fear caused by the emotional campaigns of green terrorists (*cost–benefit*). Considering their axiological, normative, and political ideas, these four persuasive “opportunities” for advocating the promotion of GM food appear to originate from a common problem definition: the introduction of GM crops and food is a *normal* element of an *inevitable natural* scientific and economic development that serves the public interest (see Table 1). This implies that the interests of scientific biotech institutes and the biotech industries are public interests. This ideological position is structured by a central opposition between the axis of science–technology–economy (GM technology as part of the knowledge economy) as representing the rational, healthy, natural, and social in society on the one hand, and the political as representing the irrational, unhealthy, unnatural, and anti-social on the other. From this follows that the disruption of this “natural” process by governments or NGOs damages the public interest and is explained by factors external to the technology itself. “Excessive” regulation or collective actions disturb scientific and economic progress and thus serve nobody’s interests.

I will discuss the frames used by challengers to oppose the development of GM food by characterizing the symbolic struggle on the respective technology and power dimensions (see Figure 1).

5. Scientific uncertainty

Moving up the technology dimension, we find a frame package questioning the scientific assurances of the science–industrial complex about their alleged mastery

over nature through GM technology. The technology is blamed for being based on a reductionist epistemology that discards the many scientific uncertainties surrounding the development of GMOs. The long-term effects on food safety and the environment are still unknown and the technology needs more testing in laboratory settings instead of the current rush to commercialization. After all, it takes new medicines 10–15 years of testing before they are put onto the market. In the case of GM products, unknowing consumers are used as guinea pigs and their release into the environment represents one global laboratory experiment *in vivo*. Is it not better to prevent than to heal? It is first and foremost in the public interest to prevent damage to food safety, human health, biodiversity, or the environment. Therefore, governments should apply the precautionary principle—which implies that technological innovations should not be commercialized before the risks and dangers are sufficiently known—and suspend the commercialization of GMOs.

6. Pandora's box

Originating from the same problem definition as scientific uncertainty, the Pandora's box package represents the stronger version of the two in expressing the harmful effects and catastrophic consequences of a technology that will be impossible to control, once the genie is out of its bottle. The inherent dangers of the technique are materialized into innumerable scenarios of a technology that will become autonomous and make us all obey its laws, instead of us using it to control nature in the name of "progress." Therefore, the current development of GMOs is an act of irresponsibility that threatens the survival of man and animal because of its disruptive consequences for nature and the environment.

7. Alternative

The alternative package is skeptical of technology and calls for alternatives to agricultural biotechnology that do maintain the ecological balance, such as organic agriculture. It originates from a problem definition that considers GM technology to continue on the road to an increasingly large-scale, industrialized, capital-, and energy-intensive agriculture which has already been devastating to the environment in general and biodiversity in particular without the use of GM techniques. We need to embark on a different road, where harmony with nature is emphasized instead of mastery over nature. Only a labor-intensive small-scale and local agriculture is in the public interest. Therefore, the government should support ecological alternatives and prohibit or strictly regulate GM agriculture.

8. Public accountability

Along the power dimension we find two packages that represent different options to regulate the economy when it comes to new technologies. Both originate from a

problem definition that emphasizes how the current institutional context is insufficiently accountable and democratic to allow the commercialization of GM products. The GM issue is considered as a case of the people—as citizens, consumers, and small farmers—versus the “vested economic interests” of the science–industrial complex, which are not common interests. Therefore, governments should apply the precautionary principle until a strict regulatory framework is in place that ensures democratic control and freedom of choice for the public. In the *public accountability* frame, we find the complaint of a lack of public accountability and freedom of choice because information, control, and a social debate built upon democratic participation are lacking. More information and control could be ensured by mandatory labeling, imposing a system of traceability, and implementing liability and insurance systems to hold the real culprit responsible instead of making the wider society suffer should anything go wrong. Consensus conferences, citizen juries, local public consultations for field test requests, etc., constitute the elements for a thorough public debate which stimulates the empowerment of the public. Whereas in the *cost–benefit* frame package, the idea of a social debate is reduced to convincing people through information as to why they should be pro-GM (top-down approach aimed at disciplining the unwilling), in the *public accountability* package information and a social debate function as tools for empowerment and democratic citizenship. The symbolic struggle between the *economic prospects* and *public accountability* frame is situated on the ideological nexus of trusting freedom of choice into the hands of free market forces versus ensuring freedom of choice through political intervention in the economy, or the difference between an economic and democratic freedom of choice, respectively. A regular characterization of the *public accountability* frame is “eating GM without knowing it.” Nonetheless, this frame is still a liberal demand in which the public is being addressed as a producer or consumer. For instance, how good is a label on regular food products that nobody understands or that is almost impossible to see? Is it reasonable to expect consumers to always check every label on food products? Does this imply that food producers are allowed to put onto the market whatever suits their interests as long as they put some label on their products? This is where the *public accountability* frame stops and the *corporate control* frame takes over as the stronger version of the two.

9. *Corporate control*

This package questions the economic power relations in which GM products are developed. The core position is that their development is pursued by multinational corporations that defend their private economic interests, only to further increase the dependence of citizens and farmers to corporate control, thereby denying the claim that these (potentially risky) technologies are developed “for the good of mankind.” Originating from the same problem definition as its weaker *public accountability* counterpart, the insufficiently accountable institutional context in the corporate control package refers to unequal power relations in neo-liberalizing capitalist economies and questions whether this economic structure of society should be

allowed to develop such far-reaching technologies. GM technology in the *corporate control* package is characterized as putting profit and free trade first, before security and democracy. It is really only a matter of commercialization, privatization, monopolization, and bio-piracy. Agricultural biotechnology in the current global economic structure will increase global social inequality and our dependence to multinationals for world food security (see, for instance, the Terminator technology). It locates a clear conflict of interest between science and industry in promoting biotechnology as a solution to all of the world's problems, as if these are only technological problems ready to be fixed by conglomerates such as Monsanto, BASF, Bayer, Syngenta, Pioneer Hi-Bred, etc., which in reality are only interested in the bundling of a resistant seed with their associated brand of insecticide or herbicide. The question is: who will we allow to own our genes?

These *challenger* frames clearly originate from problem definitions which do not regard scientific and economic development to be inevitable, to the contrary, they have in common that they consider technological and economic development as a *contested* object of which the direction is steered by certain *agents*, thereby allowing the power structure from which a technology originates to be questioned, as well as to be strictly regulated.

10. Ethical

This package is not to be found in Figure 1 as it does not belong to either the technology or power dimension. It questions whether it is ethically acceptable to allow the development of GM products which are characterized as modifying or manipulating the building blocks of life, thereby entering into God's realm. Although on a latent level, each one of the above nine frames ethically evaluates the technology, it was impossible to ignore the manifest call for an *ethical* debate that sets the moral boundaries for intervening in the genetic structures of plants or animals. Even though there is no ideological positioning to be discerned without motivating the call for an ethical debate on one of the previous nine frames, this characterization of the GM debate could not have aspired to be as comprehensive as possible without including this (although limited) package.

Discussion

The significance of this study lies in the method it proposes to analyze socio-scientific debates in terms of the relationship between the production of meaning and power. A first significant observation is that the scientific institutes which develop GM food products and the companies that market them advocate exactly the same interpretive frames: *scientific progress*, *economic prospects*, *development*, and *cost-benefit*. Furthermore, these four persuasive "opportunities" for promoting GM food originate from an underlying idea that its introduction and development follow from an *inevitable*, *natural* scientific and economic development, serving the public interest. Not only does this legitimize the direct interests of the promoters of GM food as public

interests, but it also simultaneously de-legitimizes any role for political intervention or democratic debate about these developments as not being in the public interest. As a result, its primary goal and consequence is a fundamental *de-politicization* effect. This confirms several authors (Goven, 2006; Kinchy, Kleinman, & Autry, 2008; Kleinman & Kinchy, 2007; Krimsky, 2005) who have related the de-politicization of biotechnology to the successful linking of a *neo-liberal* discourse with a discourse of *scientism* (and I would add: under the justifying cloak of *technological progressivism*). An important element of this de-politicization process is to deny the existence of a social conflict based on competing—but legitimate—rationality claims, values, and interests, i.e., to deny the existence of a *risk conflict*. This is achieved by (1) attributing any resistance to factors external to the technology; and (2) de-legitimizing challenger groups. Regarding the former, we find *scientific progress* to attribute critical scientific questions or reports to a combination of flawed science and sensational media, while *cost-benefit* attributes these to a combination of flawed (scientific and corporate) PR-efforts and an emotional, fearful, and ignorant public. Regarding the latter, challenger groups are stigmatized as neo-luddites, anti-science radicals, green terrorists led by ayatollahs, etc. Combined, these elements result in precluding a public debate on GM food in favor of technocratic decision-making and/or (“free”) market forces, in line with the existing power structure.

NGOs are found to respond to this de-politicizing discourse with a discourse primarily aimed at (re-)politicizing the GM food debate. They advocate five frames (*scientific uncertainty*, *Pandora’s box*, *alternative*, *public accountability*, and *corporate control*) which originate from an underlying idea of technological and economic developments as *contested* objects of which the direction is steered by certain *agents*. By revealing the power structure and specific interests underlying the development, introduction, and marketing of GM food—which are concealed by the discourse of science and industry—a discursive space is created for making it an object of political debate and regulation. In fact, contained within this process of (re-)politicization is the demand for the GM food debate to be acknowledged as a risk conflict.

Eventually, these results demonstrate how the GM food debate (in Northern Belgium) is really a struggle between processes of de-politicization (by the public scientific institute and industry) and processes of (re-)politicization (by the local NGO-platform). However, for any broad democratic debate about *alternative* technological *futures*, the acknowledgment of a risk conflict is a necessary precondition. Finding publicly funded scientific institutes siding with agribusiness conglomerates against civil society in a common effort at de-politicizing vital issues such as world food security, is a very troublesome observation. In interviews, the NGOs in question argued that they experienced the local debate as a situation of university scientists versus consumers, with these scientists acting as spokespersons for industry interests (Maesele, 2009b). This has taken place in a much broader context in which GM food has become a symbol for anti- or alter-globalization protests. In the second half of the 1990s, a broad coalition of social movements/NGOs organized to fight the ruling politico-economic neo-liberal consensus by opposing the prevailing processes of globalization and the growing power of

multinational corporations. The controversy surrounding GM food was closely connected to this wider protest movement as a confluence of several themes and claims in this debate (human and environmental safety, labeling and consumer choice, environmental conservation, intellectual property rights, food security, poverty reduction, etc.) created the conditions for a coalition of social movements that was not self-evident before: environmental, nature, north–south/Third World, and farmer movements together with consumer organizations found common interests in opposing GM crops and food. A European Union still seeking for public credibility and trust has responded to this confluence of themes, claims, and movements (Jasanoff, 2005), at first with a de facto moratorium on new approvals in June 1999, and after a regulatory overhaul in April 2004 by only approving GM varieties for processing. Only in March 2010, the Commission approved the cultivation of a GM potato for industrial, not food, purposes. Nonetheless, the prospects for GM food in Europe are still uncertain.

Finally, the construction of a frame matrix is only a first step in the process of shedding light on the role of news media in facilitating (or impeding) a broad democratic debate on technological applications such as GM food. The subsequent step is to systematically examine the selection, combination, and presentation of these frames in their coverage. This will not only allow to examine socio-scientific debates in terms of the interpretive frames (and their sponsors) that influence or fail to influence news discourse, but also to uncover the ideological nature of news discourse and its contribution to democratic debate. For instance, do we find news media to discourage a thorough public debate on GM food by covering events mainly through the *scientific progress* and *cost–benefit* frames? Or is public debate encouraged by stimulating an open discussion on the extent of *scientific uncertainty* or *corporate control* (e.g. the dependency on multinational corporations such as Monsanto) people are willing to tolerate when it comes to matters such as world food security? To fulfill a role as facilitators of public scrutiny, discussion, and (science) democratization, journalists have the task of *framing* the GM food debate as a *conflict* between opposing responses to uncertainty, by revealing the competing sets of assumptions, values, and interests underlying these responses, instead of amplifying the idea of a scientific consensus. Amongst others, this will require relying on dissenting sources, such as NGOs, in addition to institutional sources (such as scientific institutes and industry).

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