GRAINS OF DOUBT: A COMPARISON OF THE POLITICALLY CONTESTED VISUAL LANDSCAPES OF GENETICALLY MODIFIED ORGANISMS IN THE UNITED STATES AND EUROPE

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ABSTRACT OF THE DISSERTATION

Grains Of Doubt: A Comparison Of The Politically Contested Visual Landscapes Of Genetically Modified Organisms In The United States And Europe

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The dissertation focuses on two lines of inquiry. First, why are GMOs objects of contention? Second, why, and under what conditions, is opposition to GMOs successful? To answer these questions, I examine the way in which GMOs are depicted as objects of contention on the global and local level. Part One provides a framework for the project. Chapter Two presents the constructivist approach to the study of resistance to GMOs. Discourse and images are examined from the United Kingdom, Germany, Poland, Spain, and the United States. Part Two examines the global level of GMOs from an ideological and regulatory perspective. Chapter Three first examines the ideological component by exploring how sound science is projected in the United States and Europe. The narrative has three parts: it advances a neoliberal narrative of the technology, arguing that non-sound science approaches are in fact attempts to politicize trade. This establishes a relationship between

science, free trade, and GMOs. The second part of the narrative posits that failure to embrace GMOs will lead to a catastrophe. The third part of the narrative scapegoats the public, arguing that public ignorance will block GMOs, thereby ensuring the catastrophe. Chapter Four also focuses on the global level by examining the regulatory context in the European Union, as well as the trade conflicts between the EU and the US. Part Three turns to the domestic, or local, level, presenting five case studies. These case studies compare the political, economic, cultural, and public opinion of GMOs across countries, establishing the variance in the domestic context. Part Four looks at the images produced by the opponents of GMOs. The images are a successful refutation to the "sound science" narrative because they provide universal symbols of doubt and critique that can be redeployed within specific cultural contexts. The power of resistance is found within the logic employed by visual hegemony: the strategy of GMO resistance is to circumnavigate the logic of rationality of the proponents of GMOs and substitute the synecdotal reasoning that communicates a diffuse narrative of doubt and mistrust which critiques of the process, product, and implications.

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Jan Kubik, the chair of my committee, has been an outstanding mentor and close friend. He and his lovely wife, Martha Kubik, have graciously opened their home to my family, treating us as one of their own. I have close to 150 pages of a file called "Conversations with Jan" that are notes I've taken on our often sprawling conversations over the years, where Jan spent many hours teaching me how to think and how to teach. I don't think anyone else has had such a profound effect on my thinking.

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PART ONE: CONTEXT, THEORY, AND METHODOLOGY

The two chapters in Part One introduce the project. Chapter One discusses the global issue of GMOs, framing them as objects of contention and briefly setting up the conflict between pro-GMO and anti-GMO sides. Chapter Two introduces the constructivist approach to the topic, sets out the research design, and describes the data collection and analysis.

Chapter One: Introduction

My dissertation explores the international controversy over genetically modified organisms (GMOs). Genetically modified foods are the products of plant biotechnology and are produced from organisms in which the genetic material has been altered in a way that does not occur naturally by mating or natural recombination.[1] Ten years after the European Union lifted its moratorium on GMOs and twenty years since they became ubiquitous in American grocery stores, why do they continue to engender such resistance? An increasingly robust body of scientific literature declares GMOs to be safe for humans, animals, and the environment, and there have been no GMO-related scandals. This record would support the prediction that public attitudes toward GMOs would also moderate over time and that regulation would become increasingly permissive. Indeed, some countries like the United Kingdom display this pattern. However, GMOs remain objects of contention on both sides of the Atlantic, and resistance to the technology remains high. What explains the high levels of resistance?

In answer to this question, this project explains the current status of GMOs in public and political life by exploring the symbolic construction of risk surrounding the process of manufacturing, the GM products produced, and unknown implications of the technology. The contentious nature of the debate over GMOs

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[1] Most GM crops have been modified for insect resistance or herbicide tolerance (Borraz, Besançon, and Clergeau 2006). There are three parts of the genetic modification process: manipulation of DNA to remove important cells, transporting into plant cells, and then regenerating the whole plant from those cells.

reflects a larger phenomenon of disjuncture between elites, the public, and the state in regard to scientific issues. How does the state respond when there is a disagreement between scientific elites and the public? And how do the public and the elites couch their arguments to persuade the policy makers? I find that proponents of GMOs adopt a discourse of "sound science," which professes itself as a neutral, objective mechanism to evaluate GMOs. I argue that we must bracket the veracity of scientific claims in order to study the politics of GMOs. Doing so illuminates the reasons why the public forms opinions that are contrary to many scientific and political positions. In response to the single coherent narrative of scientific certainty, a diffuse set of challenges emerges. The risk of genetic engineering holds within it the potential for catastrophe, leaving the industries that produce and manufacture the technology in a perpetual state of crisis. Instead of the a unified narrative of scientific certainty, each challenge presents a multiplicity of diffuse narratives that unsettle the public's understanding of the risk presented by GMOs. Although the discourse of "sound science" is a closed system of thought that offers neutral, complete explanations about the safety of GMOs, challenges emerge on political, economic, and cultural levels that rupture the narrative. The cumulative effect is that GMOs are in a constant state of uncertainty and doubt. This introductory chapter first explores the science behind GMOs, surveying the history and controversy over the science. I then turn to an examination of the politics of GMOs and the way that they are discussed in political science literature. Finally, I preview the rest of the dissertation.

The Science of GMOs

This section reviews the scientific history and current state of the controversy over the technology of genetic engineering. Although the dissertation does not take a position on the state of the science of GMOs, a review of the scientific arguments provides necessary background to understand the way the political debate unfolds, particularly in terms of the memes that emerge. As mentioned earlier in this chapter, the overwhelming scientific evidence finds that there is little risk to humans or the environment from GMOs. However, as Chapter Six demonstrates, the scientific process has been vigorously policed by the ag-biotech industry, which many believe is evidence of the politicization of science. This section puts aside that debate in order to review the scientific claims made on each side of the issue.

History

The 20th and 21st century have been marked by agricultural revolutions, as technological innovations have increased agricultural yields, thereby increasing the agricultural capacity to feed more people. In the 1930s, the first revolution was driven by an effort to apply Mendel's work on inheritance in plant breeding on a large scale. High yield hybrid corn was developed, and inexpensive nitrogen fertilizer began to be mass-produced (Bernauer 2003, 5). In the 1960s and 1970s, the Green Revolution brought these green technologies to the developing world. Finally, a third revolution, that of agricultural biotechnology (ag-biotech) began in the 1970s with the discovery of rDNA, which gave birth to modern genetic engineering. This process involves splicing the DNA from a plant, animal, or microbe onto the DNA of another plant, animal, or microbe in order to transfer qualities of

one organism to another, thereby changing the characteristics of the host plant. As proponents of genetic engineering are quick to point out, the mechanics of this process are not new. Historically, gene splicing was done manually to change the size or color of plants (the Mendel hybrid experiments, for example). As technology has evolved, genetic engineering now involves complex gene splicing in laboratories to manufacture resistance to drought or pests, improve the color or size of a product, and to accentuate other positive traits. Most often, the plants are engineered to either produce a pesticide or to be resistant to pesticides used during crop spraying. The process of genetic engineering is part of a larger agricultural struggle to increase yields and create more resilient plants. The controversy is over *both* the unintended health and environmental consequences as well as the political, economic, and social impacts of genetic engineering.

Controversy

This section explores the competing scientific claims that have come to constitute the backbone of the debate over GMOs. Advocates of GMOs argue the dual threat of population explosion and climate change requires technological intervention. Advocates of the technology hold that, despite rigorous scientific studies, risk assessments, and field trials, there has been no evidence of GMO-related harm to people, animals, or the environment.[2] GMO technology has the propensity to reduce hunger, address public health problems (like vitamin A deficiencies) and alleviate environmental stress such as that caused by drought and

[2] Chapter Three addresses the way that proponents of GMOs actively refute scientific research that suggests negative outcomes, such as danger to Monarch butterflies or tumors in lab animals.

pests (Bernauer 2003). Increasing crop yields in places that food has trouble growing also has the potential help meet the challenges of the coming population boom. As the world's population is predicted to reach as 10 billion people by 2050, and climate change promises to increase drought conditions and decrease arable land, GMOs provide the most promising means of addressing the ecological strains. Additionally, GMOs have the potential to address environmental problems by increasing yields, requiring fewer pesticides, and allowing for soil conservation (Bernauer 2003).

Opponents of GMOs dispute the arguments advanced by GMO proponents, asserting that the benefits articulated are both nebulous and unrealized, in contrast to the unknown, potentially calamitous risks to the technology. Although proponents of GMOs claim the technologies are critical to preventing starvation, curing Vitamin A deficiency, and growing crops that are more resistant to climate change, these global benefits promised by proponents have yet to materialize. Consumers are asked to assume all of the risk by consuming GMOs, but see little benefit. Whereas Roundup Ready crops,[3] for example, may benefit farmers while producing a profit for ag-biotech companies, the benefits are never passed onto consumers either in terms of quality or cost savings. At the heart of the critique is the fear that the technology "promotes excessive corporate power through patenting of the food chain" (Bernauer 2003, 5). Opponents also argue that there are myriad "unknown unknowns" inherent in the technology; even if short-term negative effects have yet to materialize, opponents also warn of medium-to-long-

[3] Roundup is the herbicide manufactured by Monsanto. Roundup Ready crops are immune to Roundup, and so the herbicide can be used in fields.

term health risks to animals, humans, or the environment, including the loss of biodiversity. Cross-pollination of GM crops into non-GM or certified organic crops is a continual concern both in the US and in Europe, which requires all GM crops to be certified, labeled, and traceable. The concern about cross-pollination is not only one of the seeds spreading to conventional fields, but also of unpredictable hybrids occurring when cross-breeding occurs, as well as the production of antibiotic resistant crops as a result of cross-breeding pesticides with certain types of pesticide resistant GMs.

In short, there are different risk assessments based on perception of probability of risk embedded in the process of manufacturing the technology, as well as the end-product of genetically modified foods. The way these competing scientific claims are translated to the political debate requires a sophisticated construction of risk and probability. GMOs are, at once, scientific, technological, agricultural, political, economic, commercial, ethical, personal issues. In a 2014 interview, Michael Pollan argues that the pro-GMO community have successfully, but artificially, limited the debate to one over the veracity of the science, but this is not sufficient to understanding the complexity of the debate over GMOs:

> [We] never escape politics and we never escape economics, even when we are talking about science and technology. Even for science writers who have satisfied themselves on the health and safety of GM, there are other issues—much messier issues—that they need to pay attention to (2014, n/p).

These messy issues – what Capoccia and Ziblatt term a "knotty set of factors" (2010, 939) seep into each other, affecting risk calculi and the way the larger debate is

framed. The following section puts the science of GMOs into the broader political and cultural framework.

The Politics of the Science of GMOs

In this project I am interested in the broader question of the political implications of a misalignment between scientific findings and the public opinion. What is the role of policy when science and the public are in conflict? Political scientists are increasingly focused on the role of science not only in terms of the policies that are produced, but also the way in which environmental and scientific questions affect the political realm. Genetic engineering is a foundational innovation that prompted many people to fundamentally reimagine the relationship between science, politics, and society. In his theory of the risk society, Ulrich Beck discusses three manufactured risks that comprise the risk society; genetic technologies are one of the three "icons of destruction," the other two being nuclear power and environmental destruction (1992). Beck's concerns are about genetic technology writ large – that accidents or rogue scientists could, via either cloning or GMOs, bring about a "worst imaginable accident." Like Beck, Sheila Jasanoff (2002) also sees genetic engineering as one of the major technoscientific achievements of the twentieth century. Genetic engineering is, then, a phenomenon that is at once political and scientific, thus revealing the intertwined nature of politics and science. Although there exists a normative process that attempts to separate science from politics and portray them as existing in two different realms, genetic engineering uniquely challenges this process. Latour argues that genetic engineering is a product

of both science and politics; thus, it disrupts the politicized process of purification that aims to "separat[e] science and politics and conceal their hybrid and entangled character" (in Reynolds 2013). Thus, GMOs – the most visible product of genetic engineering – provide a means to explore the contentious relationship between science, the public, and the state.

A semiotic approach to GMOs helps to move beyond a focus on the science's self-reflection (on its own terms) and to instead understand the technology within a larger political and cultural context. As I note in Chapter Three, proponents of GMOs attempt to disguise the power of GMOs by insisting on, simultaneously, the fact that they are identical to conventional crops and vital to the survival of humanity. Unpacking the way that this argument works requires a close scrutiny of the discourse of sound science and the competing visions of the technology offered by opponents of GMOs. Understanding the way in which science influences policy (and policy influences science) is important because it explains how "democratically accountable political regimes" influence and are influenced by knowledge in their decision-making (Jasanoff 2002, 34). Just as importantly, the public perceives this divide and acts politically themselves to counterbalance what they perceive to be the overly vested interests of each party.

History and Culture of Political Resistance

As of 2013, the global market value of GMOs was $15.6 billion (James 2013). Although they are such major players in the global economy, ag-biotech divisions of life science firms have lost public trust and frequently seem to have trouble defending the role of GMOs in society (Schurman 2004). Despite the pressure from

the United States to make domestic markets safe for GMOs and to open international markets, there has been constant pushback from domestic sources. Against—and often in response to—the regulatory frameworks of the United States and the European Union, unique political and cultural understandings have been formed in different countries as coalitions against GMOs have taken shape. These coalitions formed early, creating trans-continental groups opposed to GMOs. In the 1980s a group of transnational NGOs such as the International Coalition for Development Action, the International Organization of Consumers Unions, and the Pesticide Action Network facilitated relationships between the United States and Europe. The members used these institutional vehicles to debate problems of agriculture and rural poverty, as well as other issues related to GMOs.

Environmental groups are commonly seen as comparatively weak—they are diffuse, underfunded, and heterogeneous enough to make coalition building difficult and inefficient (Rosendal 2005; Bernauer 2003). However, NGOs working in the area of consumer protection and environmental policy influenced policymaking in Europe and triumphed over the biotech industry. I argue throughout the dissertation that the fact that these groups are polysemic is one of the characteristics that allowed them to influence perceptions of GMOs so successfully, particularly in terms of the visual strategies deployed by anti-GMO groups. One of the mechanisms of success has been through an embrace of localism:

> localism has been especially appropriated by farmers, peasants, and other popular sector groups… For some, localism refers to greater local control and participatory democracy…. Others embrace more explicitly anti-capitalist politics, using local strategies and mobilizing local food movements as vehicles to resist or secede from the capitalist system of food production, exchange, and distribution" (Ayres and Bosia 2011, 49).

The anti-GMO movement successfully mobilized a broad array of social groups, including environmental, consumer, development, and agricultural groups. This was possible because they leveraged distrust of regulatory authorities and American multinational corporations in order to create a distrust of GMOs, creating alliances between European consumers and producers. These alliances successfully targeted both domestic and EU regulatory authorities (Bernauer and Meins, 2003; Ansell, Maxwell, and Sicurelli, 2006).

Political Controversy and the European Union

European regulatory policy on GMOs is a story of change and conflict. In the mid-1990s, Dolly the Sheep, the world's first cloned animal, was born in Scotland and quickly rose to fame. Hundreds of people died across Europe of Creutzfeldt-Jakob disease, the human variant of mad cow disease.[1] At the same time, the United States began to aggressively attempt to open European markets to imports of American GM products, lodging a complaint with the WTO over the European ban on rBST, the genetically engineered hormone use to boost milk production (Ansell, Maxwell and Sicurelli 2006, 97). Against this backdrop of uncertainty, tragedy, and conflict, Monsanto sent a shipment of mixed GM and conventional soybeans to the United Kingdom, setting off a firestorm of protest that resulted in a five-year European Union-wide moratorium on genetically modified crops.

At the end of the 1990s, anti-GMO campaigns mobilized with remarkable speed, framed in part as a resistance to globalization. In 1999, GMO protestors joined in the protests against the World Trade Organization in Seattle, Washington,

which were hailed as the birth of collective action against globalization. Brock et al depict the protests as beginning of an anti-globalization story, with "the new radicals" as the agent of change:

> Uniting under a banner proclaiming 'another world is possible,' many groups see themselves as part of a radical civil society made up of locally based organizations responding to the ravages of global capital. They have been consciously broadening their scope of action, positioning themselves as the representatives of a new global civil network in opposition to the corporate, governmental structure. Almost without notice, they have set the stage for a new form of collective action and have become a potent force in world politics, swelling in numbers from a few thousand organizations a decade ago to tens of thousands today (2006, 116).

As Chapter Five describes, the anti-GMO protests were among the most successful protest movements in modern history. The anti-GMO protests strategically fused notions of the global and the local, synthesizing universally recognizable symbols with local appeals. This global/local fusion is a manifestation of what Tarrow identifies of "scale shifting," or the coordination of collective action at a different level than where it began (2005, 32). This is one of the markers of the anti-GMO movement, at once responsible for the success of the movement and for the failure of "sound science" to persuade the public of the safety of GMOs. The appeal to universal, objective truths has usually been the domain of "science," so the local knowledge—in the form of "common-sense" stories and images—has become a venue for communicating doubt and uncertainty.

In 2004, the EU moratorium was lifted, and replaced with a comprehensive, farm-to-fork, regulatory framework based on the precautionary principle. The principle of precaution adopted by the EU implies that the risk assessment used by the government takes into account all relevant uncertainties (Waterton and Wynne

2004, 96). However, writing about regulation in Europe is a moving target. In June 2014, the EU's Environment Council voted to devolve regulatory powers over GMOs to individual states, which was met with considerable controversy. In 2013, only five European countries cultivated GMO crops: Spain, Portugal, the Czech Republic, Romania, and Slovakia (ISAAA 2013).[4] The decision to devolve the regulatory power over GMOs on its face permits greater choice, as it would simultaneously allow countries like the United Kingdom to begin cultivating GM crops and countries like Poland to ban all GM crops. However, opponents of GMOs strongly oppose this legislation, saying it will make regulation impossible and allow GM companies to reestablish a foothold in Europe. The European Parliament has the power to block the legislation, and began hearing testimony on the subject the week of October 15, 2014. On January 13, 2015, the Parliament voted to approve the new rules 480 to 159, with 58 members abstaining. The implications of the new rules are unclear at the time of this writing. Although the dissertation alludes to the new rules when possible throughout the following discussion, it is unclear what the final ramifications will be, so the regulatory discussions in this dissertation are largely based on the status quo as of June 2014.

Argument and Overview

The dissertation focuses on two lines of inquiry. First, why are GMOs still objects of contention? Second, why, and under what conditions, is opposition to GMOs successful? How does this vary across countries? What explains the variance? To

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[4] If the new EU policy on devolving GM decision making to the states goes into effect, it is widely believed that the United Kingdom will begin to cultivate crops as well.

answer these questions, I examine the way in which GMOs are depicted as objects of contention on the global and local level. **Part One** of the dissertation provides a framework for the project, introducing the dissertation in Chapter One and the theory and method in Chapter Two, which presents the constructivist approach to the study of resistance to GMOs. It also presents discourse and images are examined from five countries: the United Kingdom, Germany, Poland, Spain, and the United States. **Part Two** examines the global level of GMOs from an ideological and regulatory perspective. Chapter Three first examines the ideological component by exploring how sound science is projected in the United States and Europe. I argue that the narrative has three parts: it advances a neoliberal narrative of the technology, arguing that non-sound science approaches are in fact attempts to politicize trade. This establishes a relationship between science, free trade, and GMOs. The second part of the narrative posits that failure to embrace GMOs will lead to a catastrophe. The third part of the narrative scapegoats the public, arguing that public ignorance will block GMOs, thereby ensuring the catastrophe. Additionally, this narrative works within three frames: controlling the public, controlling science, and controlling the narrative. Chapter Four also focuses on the global level by examining the regulatory context in the European Union, as well as the trade conflicts between the EU and the US. I argue that the regulatory explanation requires an examination of the culture and politics on the domestic level, which is further explored in Part Three. **Part Three** turns to the domestic, or local, level, presenting five case studies of the United Kingdom, Germany, Poland, Spain, and the United States. These case studies compare the political, economic, cultural, and

public opinion of GMOs across countries, establishing the variance in the domestic context. I argue that each country follows a specific trajectory very much motivated by specific cultural contingencies. In order to help explain the variance, **Part Four** looks at the images produced by the opponents of GMOs. I argue that the images are a successful refutation to the "sound science" narrative because they provide universal symbols of doubt and critique that can be redeployed within specific cultural contexts. Thus, these images bridge the global and the local. The power of resistance is found within the logic employed by visual hegemony: the strategy of GMO resistance is to circumnavigate the logic of rationality of the proponents of GMOs and to substitute the synecdotal reasoning—the logic of association—that communicates a diffuse narrative of doubt and mistrust which critiques the process, product, and implications of genetic engineering.

Chapter Two: Theory and Methodology

I conceive of the debate over GMOs as a contest of competing narratives between sound science and the rejection of sound science. To understand the way that these narratives function across the five countries chosen for this project, I adopt a constructivist approach to the study of risk, built on an assumption that risk, in and of itself, must be activated—risk is not inherent in an event or process but rather something must be construed and then perceived as a risk, the "truths" of the scientific investigations of GMOs are incidental to the perception of risk surrounding them. A constructivist approach to science and politics understands the relationship as co-produced by actors in each realm—science interacts with other cultural fields, and social orders interact and co-evolve (see Bourdieu 1983, 1993). Constructivists understand science as contingent, dynamic, and strategically deployed.[5] A semiotic approach to the study of the politics of GMOs reveals the way in which stories about GMOs are told using text and images. In order to systematically investigate the phenomenon of GMOs as a symbolically constituted, global phenomenon, I compare them four European countries and the United States. This chapter sets out the theoretical and methodological underpinnings and the research design for the project.

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[5] See, e.g., Bruno Latour's (1988) work on the sociology of knowledge, especially *Science in Action,* for his analysis of how social context is necessary to understand scientific activity.

Theoretical Orientation

My approach to the study of GMOs adopts an ontological orientation that privileges pragmatic, substantive, and contextual approaches to political questions. In this sense, the research design is informed by two major ideas: Kubik's program of contextual holism and Sil and Katzenstein's closely related concept of analytic eclecticism. Contextual holism is based on two assumptions: (1) the holistic quality of socio-political phenomena and (2) their dependence on the contexts within which they emerge (Kubik 2013). Contextual holism embraces the following principles: (1) relationism ("weak" structuralism), (2) historicizing, (3) constructivism, (4) focus on informality (formal-informal hybrids), and (5) localism (Kubik 2013). My dissertation, through focusing on the political, economic, and cultural challenges to GMOs as they emerge in different countries, places resistance to the technology within a broader context, taking seriously the nuances of place, structure, and language that create specific modes of resistance. Analytic eclecticism also informs the spirit of the project through its emphasis on pragmatism and on substantive, rather than analytic, research questions. Sil and Katzenstein define the three goals of analytic eclecticism:

> First, it proceeds at least implicitly on the basis of a pragmatist ethos, manifested concretely in the search for middle-range theoretical arguments that potentially speak to concrete issues of policy and practice. Second, it addresses problems of wide scope that, in contrast to more narrowly parsed research puzzles designed to test theories or fill in gaps within research traditions, incorporate more of the complexity and messiness of particular real-world situations. Third, in constructing substantive arguments related to these problems, analytic eclecticism generates complex causal stories that forgo parsimony in order to capture the interactions among different types of

> causal mechanisms normally analyzed in isolation from each other within separate research traditions (2010, 412).

This project takes those tenets seriously, adopting a pragmatic ethos and commitment to context. The "messiness" in studying GMOs pays off in terms of helping to develop a more sophisticated understanding of how narratives emerge across context.

This approach is embedded within a constructivist orientation to the study of GMOs. Humans derive knowledge and assign meaning based on an interaction between ideas and their experiences; the way people perceive the world influences political action (Aronoff and Kubik 2012). Kubik writes that "the ontology of constructivism is anti-naturalist (the social world is different from the natural world)…the *signifying* process through which people build models of the world, particularly of the social and political world, has political relevance" (2013,). Thus, constructivists "study how such models are constructed, transmitted, maintained, and received, and how this whole machinery of cultural construction influences, and is influenced by, political and economic transformations" (Kubik 2013, 5).

Unlike material or behaviorist approaches to social science, constructivism adopts an anti-naturalist ontology that assumes people use a semiotic process to build models of the political and social world. In *Rhetoric of Reaction,* Albert Hirschman describes the semiotic approach as "a 'cool' examination of surface phenomena: discourse, arguments, rhetoric, historically and analytically considered. In the process it would emerge that discourse is shaped, not so much by fundamental personality traits, but simply by the *imperatives of argument*, almost regardless of the desires, character or convictions of the participants" (1991, x).

Discourse, then, has the power to structure the argument. A semiotic approach studies culture externally, from the perspective of discourse, and uses an analysis of texts as a means by which to understand a grammar of action motivation that proceeds from the discourse. The semiotic process reveals the way in which cultural construction of reality influences political life (Aronoff and Kubik 2012).

The symbolic interactionist perspective is a constructionist orientation that focuses on the relationship between how humans interpret their world, and how they communicate what they learn through symbols (Burg 2004). Herbert Blumer, the sociologist who developed symbolic interactionism in the 1930s, described how meaning may be understood as a "psychical accretion" of perceptions imposed on objects and events- meaning is not intrinsic, but grows out of the way other people act toward the thing. Discourse is a means by which these symbols are communicated.

Understanding the complexity of how political institutions are shaped requires a focus on the interaction between text and context. Vivienne Schmidt emphasizes the importance of broadening the study of discourse not only to a study of text, but also to a focus on context as well: "Discourse…is stripped of post-modernist baggage to serve as a more generic term that encompasses not only the substantive content of ideas but also the interactive processes by which ideas are conveyed. Discourse is not just ideas or "text" (what is said) but also context (where, when, how, and why it was said). The term refers not only to structure (what is said, or where and how)

but also to agency (who said what to whom)" (2008, 305).[6] In this dissertation, all external phenomena are treated as artifacts of analysis; thus, imagery and protests are included in political discourse. This approach allows for the analysis of action within a specific context.

Adopting such an approach that is sensitive to the dynamic relationship between cultural and political forces is particularly useful for complex questions of environmental crisis and controversy because it allows researchers to "attend to the complex interplay between agency, institutional/economic structures and ideologies but be embedded further in a political economy of the environment which pa[ys] explicit attention to the environmentally hazardous results of specifically capitalist forms of organisation of economic life" (White 2006, 61). In this dissertation, a constructivist perspective underpins the study of the interaction between science and policy in administrative, economic, political, and cultural contexts. Science, and its role in political life, is socially constructed. Jasanoff explains the notion of a co-production framework as "the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it…[s]cientific knowledge, in particular, is not a transcendent mirror of reality. It both embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions—in short, in all the building blocks of what we term

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[6] See also Schimdt 2010; Schimdt 2002. Schmidt's rendering of discursive institutionalism remarkably similar to Kenneth Burke's dramatistic pentad, which asserts that any rounded explanation of motives names an act, agent, agency, scene, and purpose.

the social. The same can be said even more forcefully of technology" (Jasanoff 2004, 4).

GMOs are not merely a neutral agricultural technology: both opponents and proponents have infused the technology with social, cultural and political import. The core of the debate is not a scientific one, and the political and scientific attempts to limit the debate to questions of hard science do not sufficiently capture the cultural and political salience of the issue. Thus, this project attempts to understand the controversy over GMOs within a wider political and social climate. The role of constructivists is to understand the way in which science, politics, and society interact in order to produce meaning. This requires moving away from essentialist understandings of culture as fixed toward an understanding of culture as a dynamic, contingent force. Studying the artifacts that emerge from these contexts is done through adopting a semiotic approach.

Semiotics

Researchers interested in the study of culture adopt either a psycho-social or a semiotic orientation. Psycho-social approaches rely on public opinion polling and surveys to get "in the heads" of political subjects as a means to study attitudes, beliefs, and motivations for action. Semiotic approaches, in contrast, examine texts as cultural artifacts that unveil the rhetorical construction of ideas. Semiotics is the study of signs, particularly the relationship between the signifier and the signified.[7]

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[7] There are multiple traditions of semiotics, predominantly traced back to the Charles Pierce tradition of semiotics and the Ferdinand de Saussure tradition of semiology. Daylight (n/d) writes: "While Saussurean semiology concerned itself only with intentional communication acts, such as speaking and writing, or other

The focus on semiotics facilitates an understanding of how symbols function in the public realm (Kubik 1994). Kubik writes:

> in the most general sense a discourse or a discursive formation is a set of semiotic facts, that is, a set of human products that are the be interpreted (regardless of whether or not they were intended to communicate anything). Moreover, such a set is often organized according to articulable principles that govern the construction of a model of the extra-discursive world ... discursive formations are therefore to be found not only among linguistic facts (oral and written) but among all human products that can be interpreted as a group of statements (1994, 13).

This idea that all human products are arguments—are persuasive artifacts—makes the extension of semiotics to the study of visuals possible. The next section explores the theory of visual semiotics. Visual semiotics is concerned with the creation of meaning through the visual manipulation of common images.

Visual Semiotics

Opponents of GMOs create visuals that articulate their objections to GMOs. These pictures become part of the symbolic construction of the technology. As the following chapters show, the clash over GMOs is one of rhetorical strategy as well as science. Whereas the imagery of opposition to GMOs is well-developed (and thus ripe for an iconographic study), proponents of GMOs do not rely on visuality as a dominant part of their defense of the technology.[8]

Despite the focus on the visual aspects of the environmental movement, and the frequent tangential references to the visual dimension of the protests against GMOs, little rigorous scholarly attention has been paid to the images deployed as

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related forms such as gesture and Morse code, Peircean semiotics included all sensory stimuli that could create another idea in the receiver's mind" (1).

[8] See Defense of Sound Science in Chapter Three.

part of the GMO debate. This is particularly surprising because the anti-GMO image campaigns in different countries are fun—rich, nuanced, and clever. This section articulates the theory of visual semiotics and explains how it will be used in the dissertation.

A critical approach to visual studies, labeled variously Critical Visual Theory (Ludes et al 2014) or Critical Visual Analysis (Aiello 2006), complements the constructivist paradigm by "taking into account the…strategies of image use, and the political, ideological, and economical contexts and interests [by] inquiring into the underlying rationales, worldviews, and values disseminated by collective actors and institutions" (Ludes et al 2014, n/p). [9] Social semiotics enables researchers to chart the codes that are used within a visual system and to explain how visual strategies are deployed to communicate specific meanings. There are three specific semiotics tasks performed in what follows: an analysis of the Internet as the means of transmission, the analysis of the images themselves, and the symbolic interpretation of the images.

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[9] In political science, research on the use of visuals has been particularly focused on affect and the role of emotions and the way in which images "prime" observers (see, e.g., Huddy and Gunnsthorsdottir 2000, Johnson and Eagly on issue involvement, Petty and Cacioppo 1990, Cacioppo et al 1992 on classical conditioning). Images convey important emotional symbols—icons that convey messages more subtly than words can. In the appropriate contexts, flags can evoke patriotism, tanks can stand in for war and strength—ideologies come equipped with a iconography that convey meaning—and logic of action—without words. Müller (2008) argues that, despite the willingness of political scientists to venture onto "visual territory," it has not become central to the discipline.

Internet and Transmission of the Images

Whereas "verbal modes of argumentation have been hegemonic" in most modern societies that rely on print media to convey information, online and mass media increasingly rely on images to make meaning (Ludes, Noth, and Fahlenbrach 2014). Kathleen Hall Jamieson argues that the electronic age of television produces "visual assertions" and "synecdochic phrases" that become "mere shards of a political argument" (1988,). It is easy to see how this argument becomes even more significant in the age of the internet, where the images become memes capable of transcending language, and are picked up and replicated, duplicated, and altered. Castells writes that "image making" becomes "power making" as "flows of messages and images…constitute the basic thread of our social structure" (2000, 507).

I find that the global pervasiveness of images and their accessibility via the internet are a *mechanism* of scale shifting—a means by which domestic frames of contentious issues are translated onto an international scale. Tarrow writes: "with the expansion and greater availability of electronic communication, shifting the scale of contention has become both easier and more rapid" (2005, 122). Thus, opponents of GMOs can exploit the channels of the internet in order to rapidly disseminate images that contest the hegemonic projection of biotechnology. This shift of context is particularly important because of the explosion of audience and context: Müller writes: "the production, dissemination and communication of visuals are no longer confined to their originally intended audiences. The dissemination of visuals can no longer be controlled, either by governments or the mass media" (2008, 110). Thus, the analysis of the imagery of GMOs cannot be done

without taking into account the multiplicity of contexts: both the domestic, country-specific context, as well as the global, memetic, online context.

Imagery of Resistance

Central to the analysis of the imagery of GMOs is the way visuals operate separately from verbal artifacts. Müller (2003) contrasts the logic of text-based communication that follows the rules of grammar and sentence structure to the visual realm which operates instead according to a logic of association. Krasni argues that images operate as synecdoches, reducing content to images that correspond to the way people think: "visually, metaphorically, elliptically" (2014, 134). As Chapter Six demonstrates, the key to understanding the debate surrounding GMOs lies in an analysis of this logic of association, which places images within this larger cultural and discursive context surrounding the issue. Interpreting the images provides insight into the power of resistance to GMOs.

The images collectively form a lexicon, which Barthes defines as such: "The interest lies in the fact that the objects are accepted inducers of ideas (book case = intellectual) or, in a more obscure way, veritable symbols (the door to the gas chamber for Chessman's execution with its reference to the funeral gates of ancient mythologies). Such objects constitute excellent elements of signification: on the one hand they are discontinuous and complete in themselves…while on the other they refer to clear familiar signifieds. They are thus the elements of a veritable lexicon" (1977a, 23). Collectively, then, the images become part of a syntax where "the signifier of connotation is no longer to be found at the level of any one of the fragments of the sequences but at that of the concatenation" (1977, 24). This syntax

is particularly important because it collectively creates a visual argument against GMOs that makes the public more likely to develop negative assessments of GMOs. Messaris argues that visuals lack a propositional axis—they cannot explicitly state an argument or cause the viewer to draw a causal inference. However, taken together, these images form a dynamic visual lexicon that portrays the GMO technology in a decisively negative light. Studying the images of GMOs is an opportunity to see the creation of this lexicon. The variation across countries provides a means to see where the syntax is universal and where it is particular. Through the construction of these images, opponents of GMOs also successfully shift the burden of proof of the debate over GMOs to the visual realm: even as GMO supporters argue that the technology is substantially equivalent to conventional food, the images reassert the difference between conventional and genetically modified foods. This expands the critique into three realms: process, product, and implication. The use of imagery is thus a significant, albeit under-studied part of the overall strategy of resistance.

Symbolic Imagery of GMOs

Through the process of interpreting the images, a context of resistance to GMOs emerges. As Müller et al note, visuals transcend language and cultural barriers: "with their increasing global dissemination, visuals have assumed an important role in international political communication…language barriers still set limits to global textual communication, yet visuals transgress those barriers and evoke different responses in different cultural contexts" (2009, 28). However, the inverse is true as well—the globalization of images can in fact serve a unifying

purpose; there is a least common denominator that can be used to convey an essential message about an object through a visual that unites movements across language barriers.

Through the process of assigning meaning to images emerges the process of what Barthes calls mythmaking. As Aiello argues: "The function of the mythical sign is not to represent, but to naturalize an historical and cultural concept. Myth causes an immediate impression and is thus experienced as *innocent and eternal speech"* (1996, 96). This process of normalization causes myth to be "read as a factual system, whereas it is but a semiological system" (Barthes, 1956, 115). Indeed, this blurring of fact and fiction is one of the strategically activated by political agents through the use of images: "Public agents use the affective qualities of pictures and audiovisuals strategically in order to manipulate their audiences politically and ideologically in order to influence their habits, especially, since images, with their affective qualities, can transcend the limits of fact and fiction" (Ludes et al 2014, 203-204).

Critical Visual Theory provides analytic tools that can be used to reveal the mechanisms by which counter-hegemonic images challenge dominant discourse. Stoehrel and Lindgren, writing about the internet campaigns of the hacktivist collective Anonymous, observe:

> It seems to us that in order to create public political debate and to mobilize social movements, hegemonic discourses as well as their channels of distribution need to be challenged in one way or another. It is only by pushing the established limits that people can provoke a discussion regarding the narratives surrounding their lives. However, the challenge of hegemonic discourse may not only be politically rational, but also emotionally and affectively subversive (2014, 238).

This notion of counter-hegemonic images is particularly important if, indeed, image making is power making (Castells 2000, 507).

The dissertation employs a pragmatic, culturally contingent approach to research design that involves adopting a semiotic approach that analyzes visual and discursive symbols. [10]

The following section introduces the methodological choices made to approach the question of GMOs. The power of resistance is found within the logic employed by visual hegemony: the strategy of GMO resistance is to circumnavigate the logic of rationality of the proponents of GMOs and substitute the synecdotal reasoning—the logic of association—that communicates a diffuse narrative of mistrust.

Methodology

Research Questions

The goal of the dissertation is to explain the phenomenon of resistance to GMOs in five countries. The dissertation addresses the following questions: Why does resistance to GMOs persist? What form does the resistance take? Does the form of resistance vary from country to country? If so, what explains this variance? Why is the resistance so successful? I argue that resistance to GMOs persists because it manages to successfully refute the doctrine of "sound science." Opponents of GMOs activate the idea of risk as an emancipatory strategy that reasserts the public's role in decision making over GMOs. The resistance narrative relies on the logic of

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[10] This culturally contingent approach is in distinction to scholars who employ an essentialist view of culture to explain differences between the US and Europe in terms of GMOs. I argue that attitudes toward GMOs are fluid, and informed but not overly determined by cultural variables.

association, which portrays GMOs as a "frankenfood" or a foreign, other food, which severs the link between GMOs and food. Finally, the resistance narrative nurtures doubt, and the possibility of catastrophe if GMOs are allowed to move forward.

Research Design

This project compares the construction of, and challenges to, the "sound science" of GMOs in the United States and Europe. To do so, I use a medium-N design of 5 cases: the United Kingdom, Germany, Poland, Spain, and the United States, and I study the politics of GMOs in each country. I first map the global terrain of GMOs, examining the ideological projection of sound science (Chapter Three), the European Union regulatory level and US-EU conflict (Chapter Four). I then turn to the local, domestic level, exploring the political, economic, and cultural levels of GMOs in each of the five countries (Chapter Five). Finally, I turn to the visual field, examining the anti-GMO imagery produced in each country (Chapter Six).

This follows Gerring's conceptualization of case studies as "an intensive study of a single unit for the purpose of understanding a larger class of (similar) units" (2004, 342). Medium-N analysis of GMOs is rare in the literature; although myriad studies compare two cases, or conduct in-depth case studies of one case, a systematic comparison of typical countries across Europe has yet to be conducted on a substantive level. What emerges is a disciplined comparative study but also thick description of the different challenges "sound science" encounters across different political and socio-cultural contexts.

Case Justification

I analyze the politics of GMOs in five countries: the United Kingdom, Germany, Poland, Spain, and the United States. These countries represent the range of policy and public opinion toward GMOs. Additionally, they represent old and new members of the European Union, importer and exporter countries, as well as very different political and historical trajectories.

These five countries are chosen as representative types of the range of cultural orientations toward GMOs. In no case is the issue of GMOs settled. Spain has the highest levels of GMO growth as well as the highest level of support for GMOs among the public. Germany initially had some public support for GMOs but the public turned against them in the early 2000s. The UK was initially extremely opposed to GMOs, but opposition has softened somewhat in recent years. Poland has been steadfastly opposed to GMOs, concerned that the technology will threaten the strong agricultural industry in the country. In the US, which grows the most GMOs and has the least regulation, the opposition has increased considerably.

These cases are not independent, which makes the task of establishing causality problematic. As previous comparative analyses of GMOs have noted, actors in different countries draw "from the same discursive field" and are affected by "a global economy and polity" (Kleinman, Kinchy, and Autry 2009, 364). The technology is global, and plays out in a separate but interrelated way across the different countries. This makes finding independent cases impossible and underscores the importance of analytic eclecticism; Peter Hall challenges comparative researchers to embrace "more extensive endogeneity and the ubiquity

of complex interaction effects" in their research designs (2003, 387). Thus, the specifics of each cultural locality interact with the broader discursive field and global environment, producing distinct mobilization strategies and articulation of the narrative of GMO opposition. The lack of a clear causal relationship reinforces the utility of a constructivist, cultural approach to understanding GMOs.

Data Collection

For this project I undertook a comprehensive review of the literature on GMOs in Europe and the United States, particularly focusing on the way that GMOs have been studied in political science and related social sciences. The economic and institutional data is drawn from primary sources such as economic reports and newspaper articles, as well as from other scholarly research. I also built an original dataset comprised of discourse and imagery. Two types of data were collected: discourse and visual. There is a robust Internet presence in all countries for the debate over GMOs, so I collected information about the major NGOs operating in each country, as well as major industry groups, consumer organizations, and spokespersons. Additionally, I searched newspapers for statements made by major politicians about GMOs, and political platforms that mentioned GMOs. I also cast a wide net for speeches, newspapers, websites, position papers, and interviews. I used a snowball methodology, continuing to follow sources that were referenced in the texts, until I reached a saturation point and I was confident that the discourse represented the major ways in which GMOs were depicted. In addition, I conducted searches of the major newspapers in each country for an understanding of how GMOs were discussed in the news media. The discourse dataset is comprised of

popular speeches, websites, fact sheets, open letters, editorials, and newspaper accounts. These were collected using N-Capture and imported into NVivo, a qualitative data analysis program. Then, I used the software to conduct naïve coding of the discourse based on major terms, and followed with manual coding. I employed a native German speaker to do the same, operating with the same codebook with the German dataset. I did my own translations of the English, Polish and Spanish materials, as well as my own translation of the text of the German imagery, consulting with native speakers for confirmation and clarity as needed.

Imagery Dataset

Although the literature on the topic of GMOs frequently references the centrality of visual imagery to the movement, there is no systematic study of the visual imagery used in the anti-GMO movement. I created a dataset of images from each country. Following Müller and Özcan, I treat visuals "as scholarly sources of information" (2007, 287). Global phenomenon such as resistance to GMOs can be studied through an analysis of imagery. A global analysis of images can reveal the way that ideas and symbols operate across cultural and language barriers.

To analyze the images of GMOs, I created an original dataset. This dataset consisted of a) images that were referenced or appeared on the country websites from Greenpeace and Friends of the Earth, and b) the first ten pages of a Google image search related to that country. For each of the five countries, I took screenshots of the first 10 pages of hits on Google Images (yielding about 150 images/country) Because Google's algorithm returns the most popular images and hits associated with a term, this represents the most prominent visual imagery

associated with GMOs in each country.[11] I restricted the search criteria to only websites with IP addresses from those specific countries.[12] Additionally, all images obtained from Greenpeace and Friends of the Earth were analyzed to determine the way these organizations used images to target specific audiences.

This dissertation uses a form of theoretical sampling (Glaser and Strauss 1967; Glaser 1978; 1998; Strauss 1987; Charmaz 2006). Bryman (2012) distinguishes purposive sampling from both convenience sampling and random sampling. Whereas purposive sampling does not allow generalization to the broader population, it does allow researchers to sample with research goals in mind, assuring that there is a good deal of variety in the resulting sample (418). I use three samples for my image selection. For Test One, my sample is the universe of images available on the websites for Friends of the Earth and Greenpeace for each of the countries. I analyze each of the images these websites display in relationship to their anti-GMO campaigns.[13] Test 2a creates a dataset of images based upon the top 10

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[11] The search terms were: "genetically modified organism" in the US and UK, "genetechnik" for Germany, "organismos modificados genéticamente" for Spain, and "organizmy zmodyfikowane genetycznie" for Poland

[12] For each of these, I also tried related terms (like GMOs or genetically modified food) to make sure it didn't significantly change the results—probably because these terms are used interchangeably in the metadata for the websites, there wasn't too big of a difference. I also did the same for Monsanto. I checked back a day and a week later to see whether the images had changed significantly; although they had somewhat changed in the order they were presented, none seemed to have been removed or added from the search to make sure the dataset was stable. Although it's likely that future image searches would yield slightly different results, Google's algorithm is stable enough so that the images should appear in broader searches. Screenshots of the image searches were archived.

[13] It is worth noting that these are not the only images in circulation from these organizations however – a good number of anti-GMO images have been produced by

pages of image searches for GMO in each country. This is a form of *typical case sampling,* where I assume that the images appearing in the top ten pages are indicative of the most common images in circulation. I explored the images on future pages to make sure that I had reached saturation in terms of novel imagery. A grounded theory approach to data collection stipulates that one carries on collecting data through theoretical sampling until theoretical saturation has been achieved (Bryman 2012, 420). Test 2b, finally, uses *maximum variation* sampling, selecting specific images that are very different from each other and seeing how far they "travel" across the internet.

After collecting the data, I then engaged in iterative coding of the images. I first coded them as either anti-GMO, pro-GMO, or neutral/unclear. There were only two images that were, on face, pro-GMO: an advertisement for grapple (a grape-apple hybrid approved for market) and happy people in a laboratory. There were 374 neutral pictures, which included both informative material such as graphs, maps, informative pamphlets or slides from PowerPoint presentations, as well as pictures of biohazard signs or only vegetables or only DNA strands that were unclear without further context. This left me with an anti-GMO dataset of 373 images (about 50% of the overall search). Tables 7 and 8 in Chapter Six gives the breakdown of images for each country.

Greenpeace, are in circulation on the internet, but do not appear on the organization's website. Those images are excluded from analysis in Test One, but not in Test Two.

Data Analysis

Although I use a general form of content analysis to determine an initial categorization schema for the images, a semiotic analysis of the images is much more closely related to the goals of discourse analysis, which "is fundamentally concerned with power relations and the situatedness of the meaning of language, both of which are outside the bailiwick of content analysis" (Herrera and Braumoeller 2004, 16).[14]As Müller and Özcan argue, visual analysis requires a methodology distinct from textual analysis:

> Visual sources require different methodological tools than textual sources, because visual communication follows a different logic than textual communication. While academic and journalistic texts are based on argumentation and reasoning, visuals follow a logic by association, connecting different meanings that would not necessarily make sense if written down or communicated orally. Visual communication is based on visual similarity and individual experience with the visual motif (2007, 287).

I use semiotic analysis to analyze the images collected, following Roland Barthes's (1977a) method of visual semiotics. Barthes understands images as containing multiple layers of meaning that must be unpacked.[15] To do so, one identifies the universe of images, and then reads the images moving from denotation to

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[14] See the Spring 2004 edition of the *Qualitative Methods* newsletter for an extensive discussion of the differences between discourse and content analysis.
[15] See also Konecki's (2005, 2012) grounded visual theory (*wizualna teoria ugruntowana),* which provides insight into how to code and structure the systematic analysis of visuals. Although he focuses mostly on photographs, his insights about placing images within a social and temporal context are useful for conducting analysis on a variety of images.

connotation to symbolic meaning, interpreting the way in which images construct the symbolic nature of GMOs (Barthes 1977a; van Leeuwen 2001).[16]

Once I constructed the anti-GMO set, I first translated all of the text in the images from German, Spanish, and Polish.[17] I then used NVivo to code the images. I used NVivo as a tool to highlight associations and to reveal major points of overlap in the texts. Because I was interested predominantly in interpretative rather than quantitative analysis of the discourse, NVivo provided a way to use associative analysis as a foundation for establishing coding categories. On the first run through I coded for denotative images—discrete counting things like the term GMO, apples, tomatoes, fields, labs, etc. These I coded in terms of object, effect, tool, agent, setting, and text. After that, I coded for connotative meaning, particularly in terms of naturalness of the food and catastrophe and risk. Finally, I determined the most complete categories were process, product, and implication. Table Four details the types of images classified in each category.

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[16] The distinction between denotation and connotation is tricky; Fiske (1982) articulates the distinction as: "denotation is what is photographed, connotation is how it is photographed" (91). However, Barthes comes to the belief in his later career that denotation and connotation are mutually constituted. Chandler (2007) argues that: "Connotation, in short, produces the illusion of denotation, the illusion of language as transparent and of the signifier and the signified as being identical. Thus denotation is just another connotation. From such a perspective denotation can be seen as no more of a 'natural' meaning than is connotation but rather as a process of *naturalization*."

[17] All translations are mine unless otherwise noted.

PART TWO: TRANSNATIONALISM AND GMOS: SOUND SCIENCE AND REGULATORY DEBATES

The two chapters in this part identify two components of the transnational context of GMOs: the ideological defense of "sound science" by proponents of GMOs, and the regulatory disputes between the United States and Europe. These chapters map the larger international environment that each country operates within. Parts three and four of the dissertation ask the way in which the global environment within which GMOs operate interact with the domestic contexts to produce varied outcomes.

Chapter Three: The Ideology of Sound Science and its Defense

Introduction

The politics of genetically modified organisms are disputed on the global and local level. The global level of the debate over GMOs has ideological and regulatory components that focus on the state responsibility in questions of risk. Modern life is replete with risk, from terrorism to air pollution to AIDS to parenting and health risks, articulated by the media in great detail. Geary paints a stark picture:

> Over the past months and years we have endured the SARS crisis, the BSE scandal and the foot-and-mouth epidemic. We've been warned of deep-vein thrombosis from air travel, brain cancer from mobile phone radiation and mutations from genetically modified organisms. We've been told that climate change threatens our coastlines, antibiotic resistant viruses threaten our children and wayward asteroids threaten our planet (2003, 47).

Indeed, everyday life is "stippled by ominous dangers, military conflicts, and environmental hazards" (Mythen 2004, 12).

Against this backdrop of uncertainty emerges a question of the best way to assess this risk. Political and economic forces in the United States advocate "sound science" as the means of adjudicating risk scenarios. This chapter charts the way in which the narrative of "sound science" functions in the public sphere. Within the discourse dataset, I first coded discourse as pro-GMO or anti-GMO. Of the pro-GMO discourse, I then coded the discourse based on the function of speech. Through an iterative process, I organized the discourse into the categories of controlling the public, controlling the science, and controlling the narrative. This chapter first focuses on the ideological projection of the "sound science" paradigm: how is sound science articulated as the defense of GMOs? The second part of the chapter is a discursive

analysis of the way in which advocates of the technology aggressively attempt control the context of the debate. I present a framework wherein sound science is defended through efforts to control the public, control the science, and control the narrative.

The Discourse of "Sound Science"

Advocates of GMOs argue that the veracity of scientific evidence is the exclusive criteria that should be used to value the acceptability of GMOs: if the science finds no damage to human health or the environment, then GMOs should be allowed to be cultivated or marketed without restriction. Sound science, then, is an argument based in the logic of rationality about the way policy should be set. The framework of scientism or "sound science" is based upon the belief that science is objective enough to guide policy because of its ability to transcend context-bound human values and particularized interests (Kleinman, Kinchy and Autry 2008). Scientists exist on the periphery as wise advisors able to "[clear] away the tangle of politics and opinion to reveal the unbiased truth" (Kinchy, Kleinman and Autry 2008, 156). Boundary making, which sets science apart from normative conflicts, is a legitimation strategy where experts strategically draw lines around science and policy to advance or thwart the cognitive authority of science (Gupta 2004, 131-133).

Whether science is "true" or not is often evoked to justify politically controversial decisions. Burgess argues that defusing the politicization of science-based regulatory debates has been part of the US strategy since the 1970s, as the United States has "been a willing accomplice in the ideological counter position of a

protective Europe against an unregulated America" (2013, 3). Burgess's account reminds us that there has historically been tension between regulation and politicization in the United States. The ideology of "sound science" supports a particular approach to trade that protects and exports US economic interests. Murphy, Levidow, and Carr argue that the policy makers use appeals to science "strategically and rhetorically to support their agendas…[and overstate] the level of consensus and consistency within each jurisdiction whilst at the same time concealing important interactions between them" (2008, 135). Karen Litfin, writing about the role of scientists in governing the transboundary ozone depletion problem, suggests that "inasmuch as scientific discourse permeates political debates, as often as not it serves to articulate or rationalize existing interests and conflicts" (1994, 197). As Chapter Six demonstrates, the advocates of GMOs go to great lengths to present a façade of unity, actively controlling the public, the science, and the story surrounding GMOs.

Science is depicted as the universal language—the way to create a global set of norms for evaluating contested concepts (Jasanoff 1998, Gupta 2004). However, as Levidow, Murphy, and Carr note, policy based on "sound science" is not, in fact, always based on the pure knowledge emerging from a test of ideas: instead, the politicization of science (and scientification of politics) can result in a "competition for the latest scientific evidence which supports or undermines a specific policy" (2007, 31). Weingart describes the act of recruiting confirming scientific evidence as "the recruitment of expertise far beyond the realm of consensual knowledge, right up to the research frontier where knowledge claims are uncertain, contested and

open to challenge" (1999, 158). Thus, the boundary between science and policy is a "flexible, contested" one where scientific evidence and thinking combine with political and social arguments (Levidow, Murphy and Carr, 2007; Jasanoff, 1990).

The position of scientific certainty, the political/intellectual move that asserts that a small enough amount of risk is deemed to be non-falsifiable from a political perspective violates one of the central tenets of science. Karl Popper (1963) maintained that scientific theories could never be verified, and that falsifiability has become the key to the philosophy of science and is one of the criteria that distinguishes science from non-science. As Sil and Katzenstein write,

> Knowledge claims, however produced and defended, are always in need of reconsideration and reconstruction on the basis of engagement with the experience of actors seeking to cope with real-world problems. In this sense, pragmatism … requires a "spirit of falliblism" on behalf of the scholar (2010, 417).

Thus, social scientists have moved away from notions of objective risk, focusing instead on the idea that conceptions of risk are inherently subjective (Slovic 1992; Fincuane and Holup 2005). To push this line of argument even further, it is possible to argue that risk is a social construct that is not only negotiated within each culture, but also varies based on the social context in which the technology operates.

As this chapter shows, the idea of "sound science" is not just theoretical, but is used as the foundation for all US policy toward GMOs at home and abroad. Scientism is used as a means of dismissing public opinion and projecting global trade policy. As the next section indicates, GMOs and the discussion of risk cannot be understood without this analysis of the interplay between the global and the local.

Neoliberalism, Scientism, and the Erasure of the Public

The debate over GMOs is not just domestic, but is part of a larger discussion over neoliberalism and globalization. There are three key parts of this narrative: 1: *Neoliberalism and scientism are rational and objective means by which to justify the technology of GMOs*; 2: *GMOs are capable of combating future catastrophe;* and 3: *The public's unwillingness to accept the first two premises is naïve and dangerous, based on a misinterpretation of science.* The specific discursive strategy used to advance this argument is analyzed later in the chapter; this section presents the theory behind the neoliberal argument, making the case for the mutually reinforcing ideologies of neoliberalism and scientism.

Neoliberalism and scientism are intertwined, rational, and objective

Proponents of GMOs attempt to open the global market to GM products. The narrative of globalization envisions the transnational expansion of economic activity and advocates global social integration; thus, proponents of GMOs are quick to discuss the global significance of the technology. Additionally, the executive branch of the United States has aligned itself with the defense of the ag-biotech firms who advocate the technology. Liberal democracy functions because of tension between a capitalist economy and democratic political systems; this tension was sustained by the "relative autonomy of certain institutions from one another and from the market -- law, elections, the police, the public sphere" (Brown 2003, 21). The loss of this tension results in the collapse of "sources of opposition to, and mere modulation of, capitalist rationality disappear" (Brown 2003, 21). Kütting (2007) argues that the power inversions of globalization are found embedded within global organizations

such as the World Bank, the World Trade Organization, and the United Nations –the organizations that adjudicate the dispute over GMOs. Kütting writes:

> the global division of labor and power overrules or arbitrarily applies the very same ethical or moral code of conduct stipulated by these institutions—it provides the structural base from which power is exercised. This is a fundamental, severe, and grave consequence of globalization and a fundamental intrinsic contradiction in the global neoliberal rhetoric (2007, 57).

Economic rationality has become the basis of state legitimacy, superseding the power of the nation-state. Kinchy, Kleinman, and Autry argue that "in the area of ag-biotech, one important mechanism for this depoliticization of economic issues has been the linking of neoliberalism with a discourse of scientism" (2008). This strategic positioning of economic issues outside of political forces is reinforced by what Bonneuil and Levidow observe in the legal literature:

> Taking the official rhetoric of trade liberalization at face value, mainstream legal literature generally sees 'science' as an external resource that could—at least ideally—provide a neutral arbitrator in trade law. Likewise they accept the conceptual separation between 'science' and 'policy' underlying the standard narrative of 'science-based trade disciplines' (2011).

Kinchy, Kleinman, and Autry (2008) note:

> advocates of ag-biotech denounce restrictions on genetically engineered products as 'unscientific' at least as often as they call them 'protectionist' or 'against free markets.' Labeling socio-economic concerns about ag-biotech trade 'unscientific' has been an effective strategy for depoliticizing the regulation of ag-biotech. This rhetorical strategy simultaneously asserts that ag-biotech evaluation should be a scientific matter and that socio-economic concerns are not scientific- and as such should not be discussed. Serious engagement with the economic matters associated with the introduction of ag-biotech is, therefore, off limits. This strategy appears to be an effective contribution to the neoliberal project, because scientism and neoliberalism are mutually reinforcing. When critics of ag-biotech challenge the neoliberalization of social welfare protections, their opponents emphasize the importance of science- based decision-making. Conversely, when policymakers advocate broadening the definition of scientific assessment, their opponents emphasize the dangers of interfering with the free market.

Thus, Kinchy et al (2008) argue that the dual position of neoliberalism and "sound science" are used in order to advance US trade policy while policing the boundaries of what is acceptable to discuss and what is not. Seen this way, "sound science" is not only the guiding philosophy of the US position on biotechnology but it is a strategic bargaining chip that, if necessary, regulators are willing to pursue legal action to protect. This connection is at the root of distrust of science. As Jarvis writes, the distrust of science and technology is related to its profit motive: "Risk and fear, an increasing distrust of science and technology and its profit driven outcomes… have become endemic features of late modern culture" (2007, 1-2).

GMOs are capable of combating future catastrophe

The fact that GMOs are being debated in the context of crisis compounds the ability of pro-GMO forces to marginalize public dissent. Vázquez-Arroyo writes that this tendency to erase the public is exacerbated in moments of catastrophe:

> Narratives of catastrophe not only *describe* the catastrophe in question but also *narrate* it and thus tacitly place political subjects as participants from whose standpoint the catastrophe in question is narrated ... [this] narrative ... conjures the experience of the participant who has a stake in the phenomenon in question. Hence, the political valences of narratives of catastrophe today, which encompass the citizen as a labile participant who, however powerless, is invited to tacitly authorize those in power to respond to the catastrophic menace described, and to render the response legitimate, as part of the depoliticized politics that characterize the present (2013, 4-5).

Proponents of GMOs argue that GMOs are the only chance of mitigating the effects of climate change and overpopulation. In the face of global starvation, the

only hope is to allow for the cultivation of GMOs. If the public questions this narrative, they are silenced, depicted as dangerously naïve.

Naïveté of opposition

The creation of a globalizing narrative leaves little room for public dissent. Bruner (2006) argues that globalization produces a profound shift of relationships between players within the public sphere: the state becomes the public, the market becomes private, and individuals disappear from the equation. In his analysis of the debate over nuclear weapons, Walter Fischer argues that elites discredit popular discourse with a "subversive pattern of ideological, bureaucratic, and technical arguments" (1994, 11).[18] As the public attempts to participate in scientific policymaking, "citizens and society at large are implicitly cast as passive entities, easily led by charismatic leaders and untoward events" (Jasanoff 2002, 35). People are thus "overwhelmed by privileged argument," which reduces them to spectators rather than active participants in political and scientific decision-making (Fischer 1994, 10). The act of constructing the public as passive participants incapable of understanding the technological nature of GMOs has happened at an almost fevered pace. Jasanoff finds that the public is "characterized as an irrational entity that is either ignorant of the facts or has been misled by the press and politics and that hence does not understand how to act in its own best interests" (2002, 35). Welsh and Wynne describe this act of framing the public as part of a larger process of asserting the normative claims of science:

[18] What Gorz (1993) refers to as expertocracies.

> Science and policy elites evoke science as a source of authority in ways which extend beyond scientific and technical domains, such as those involved in risk assessments, to include wider social and normative commitments. The use of science as a source of authority generates contestation and confusion as the normative commitments built into references to science, whether deliberately or not, are presented as if these involved no normative choices, only the findings and declaratory authority of science. When others question the normative commitments authorized by science in this way, they are then deemed to be anti-science. We characterize this as one form of scientism, which has been persistent…and deeply problematic as a mode of science (2013, 550).

The normative story of GMOs, then, is a process that attempts to diffuse the notion of risk through the assertion of technical evidence, thereby silencing critique or doubt (Levidow, Murphy, and Carr 2007). This act of scientiziation implies that risk analysis and other types of political disputes should be resolved through technical expertise rather than democratic deliberation (Levidow, Murphy, and Carr 2007; Bäckstrand 2004).

Thus, proponents of GMOs make a complex argument that weaves together a defense of neoliberalism and scientism as "objective," neutral standpoints of policymaking. GMOs are depicted as the only hope of combating the crisis and catastrophe that looms in the face of overpopulation and hunger. Part of this heroic narrative silences public dissent. The public is depicted as irrational and emotional, capable of acting rashly and dangerously. The way in which this narrative unfolds is dissected in later in the chapter. Because the narrative of sound science presents a closed system that provides little room for dissent, opponents of GMOs must locate their critique outside of the system. As the next section discusses, Ulrich Beck's theory of the risk society is a useful backdrop for examining the way "sound science" functions in the broader cultural climate.

Sound Science and the Risk Society

The risk society is "a phase of development of modern society in which the social, political, ecological and individual risks created by the momentum of innovation increasingly allude the control and protective institutions of industrial society" (Beck 1994, 27). This period is unique because we are capable, for the first time, of our own technological annihilation—of creating high consequence risks linked to the problem of modernization. As Jarvis notes, the crux of Beck's thesis is not the fact that technological risk is increasing, but rather that there is an "involuntary devolution of control over these risks in terms of their social managements that potentially poses the greatest social harm—indeed threatens our very social order" (2007, 9-10). This is the paradox that the risks society exposes: that as scientific progress advances, risk increases. Thus, society is left to calculate the probability of risk and its potential impact on social life.

The risk society also diffuses risk: no one is individually responsible for environmental risks because there are multiple actors involved in the creation of the risks—what Beck calls "a form of organized irresponsibility" (Smith 2001). In the risk society, Beck argues, no one and everyone is the political subject at the same time (Beck 1998, 19). Humans can now cause natural disasters, which creates "seismic shifts in the relationship between the natural and the social" (Mythen 2004, 5). Interests become more and more precise, and expertise more narrow, which means that risk divided across a multitude of sectors—Bronner's discussion of Beck invokes Hannah Arendt's "rule of nobody," which posits that "given the manner in which incalculable risk will ever more surely accompany every calculable policy

option. Alienation thus takes new forms as institutional paralysis threatens to leave the most dangerous ecological trends in place" (1995, 72-73). The regulatory crisis in Europe seems a case in point, where the EU's attempts to mollify the demands of the member states and the public are met with accusations of protectionism from the United States and irresponsibility from member states.[19] "Sound science" reasserts the naturalness of GMOs. The narrative of sound science attempts to show the equivalence of GMOs and conventional food. However, the visual depictions of GMOs as a foreign other reinforce the critique of naturalness.

Beck (1995) places the traditional risk assessment conducted by institutional actors in the category of natural objectivism—which is based on the combination of scientific knowledge and economic calculation—as such, risk is treated as an entity that is objective and can be calculated (Mythen 2004). The competing view of risk is a cultural relativist one, which argues that risk cannot be objectively measured or determined, and is instead a social construct (Lupton 1999). Rather than rejecting the natural objectivism approach out of hand, Beck (1999) argues that the objectivist approach is useful for scientists because they can objectively measure levels of acid rain or the hole in the ozone layer—but that the natural objectivist approach alone does not address the way in which risks are socially produced (Mythen 2004). Importantly, however, this adjudication of risk does not function only as an interrogation of science, but instead is discursively constructed. The

[19] The way in which the European Union is caught between the Scylla of the United States and the Charybdis of its member states is discussed in the following two chapters.

following sections chart the way in which the defense of science is articulated in the United States and Europe.

The Terrain of Sound Science

In the US, scientism is the dominant discourse adopted by policy makers (Kleinman and Kinchy 2003). A few key traits characterize scientism, or sound science. First, the regulatory arena in the United States espouses a culture of objectivity that rejects moral or unscientific standards for evaluation of science. The assumption is that GM technology is safe—without empirical scientific evidence of a risk to the environment, human health, or animal health, there are no barriers to introducing a biotechnology product to the market (Kleinman, Kinchy and Autry 2009; what Heller (2001) calls riskification). This places the burden of proof on those challenging the science or technology in question (Runge, Bagnara, and Jackson 2001). This approach creates a distinction between social values and science—decisions should be made based upon the authority of science, because science is always politically neutral and value free. Thus, regulators in the United States reject the argument that GMOs should be subjected to heightened scrutiny: since there has been no proven health or environmental fallout, any resistance is based on speculation rather than scientific evidence.

Pro-GMO forces couch their position in terms of "sound science," which is intended to confer neutrality and legitimacy on the topic at hand (Joerges and Neyer 2003; Ferretti and Pavone 2009). GMO proponents are quick to cite the hundreds of studies and endorsements from major scientific organizations, including the National Academy of Sciences, the British Royal Academy, the American Medical

Association, the American Association for the Advancement of Science. Michael Specter, a staff writer for the *New Yorker* and a critic of GMO skeptics, offers the prototypical sound science defense for GMOs:

> The safety of genetically engineered foods has been studied hundreds of times over the past two decades. The National Academy of Sciences, the British Royal Academy, and scores of other scientific bodies have concluded they are no more dangerous than other foods. There has never been a single case of a person becoming demonstrably sick as a result of eating genetically engineered food. The American Medical Association has said that G.E. crops "pose no new or different risks than any other crop, and there is no scientific reason to believe they would be any more risky." The board of the American Association for the Advancement of Science released a letter in which it stated that "the science is quite clear: crop improvement by the modern molecular techniques of biotechnology is safe." The letter also quotes from a recent report issued by the European Union, where the use of genetically engineered foods causes violent opposition. "The main conclusion to be drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research and involving more than 500 independent research groups, is that biotechnology, and in particular GMOs, are not per se more risky than e.g. conventional plant breeding technologies (2012, n/p).

This quote demonstrates the dominant strategy of proponents of GMOs: listing the scientific and academic pedigrees of the extant research, and thus concluding that there is no rational basis for resistance. The style is authoritative: the case is closed, and there is no room for interpretation and multiple narratives or doubt. This exhaustive recitation of the sound science pedigree of GMOs creates an insular narrative that is impossible to penetrate.

The Defense of Sound Science: Controlling the Cultural Space

The propagation of the "sound science" principle in the political and economic realms is an example of the proponents of GMOs playing offense. The second aspect of the "sound science" strategy involves the extra-scientific defense of

this principle. There are three ways in which "sound science" is defended on the cultural-political level: attempts to control the public, control the science, and control the narrative. A major component of the "sound science" agenda is defending it against detractors, particularly the public, scientists, and journalists who question the legitimacy of the research on GMOs. The hostile defense of "sound science" posits that any opposing forces are, at best, naïve and at worst hostile to truth. Henry Miller, an official at the FDA during the Reagan administration, is an excellent example. He was blatantly anti-environmentalist and led the opposition against any special regulations aimed at biotechnology. He called environmentalists critical of biotechnology "troglodytes" (Miller 1998) and "intellectual Nazis," accusing them of being ignorant of essential scientific facts (in Charles 2001). In Miller's view, the entire Environmental Protection Agency in Miller's view was "science-challenged." Charles (2001) describes how the scientists behind GMOs in fact considered themselves environmentalists and were children of the 60s and the 70s; they believed that one could reduce the use of chemicals used in pesticides through genetic engineering, thus actually decreasing the impact of agriculture on the environment. However, as Charles notes: "Those who occupy, in their own minds, the moral high ground are usually least able to accept criticism or even comprehend it. When the genetic engineers found themselves attacked by a new generation of environmentalists, they were incredulous and hostile" (2001, 68).

Embedded within this is a messianic sense of destiny and morality. Michael Specter pens this defense of the technology in his book *Denialism:* "No achievement of modern technology, not even nuclear power, has been more bitterly disputed

than our ability to alter the genetic composition of food or to create artificial products from human cells. Yet no discovery is more likely to provide solutions to the greatest threat the earth has ever faced: the rapid pace of global warming. If we do not develop clear technologies soon, our species won't survive" (2009, 20). Charles finds further examples of this messianic thinking; he writes that Monsanto also believed themselves to be visionaries—and the be able to save the world whist becoming rich: "There were all these great statements about how Monsanto was going to be a new company with new ideals—empowerment of the individuals, and there were going to be no favorites" (2001). Robert Shapiro, the CEO of Monsanto, infused the company with visions of a coming global apocalypse with Monsanto playing a messianic role, offering the world the technology and skills necessary to avert a looming environmental catastrophe. "This world will not go quietly toward extinction. The world is going to be prepared to pay people who can help it survive" (quoted in Charles 2001, 192). Thus, Monsanto believed that it could help prevent global catastrophe while turning a profit. To do so, they dedicated themselves to ruthlessly defending GMOs against all detractors. The following sections outline the way in which advocates of GMOs controlled the public, the science, and the story.

Controlling the Public

As Chapter Five will further reveal, public opinion is without a doubt the biggest obstacle that the ag-biotech companies face. This section explores the strategies that ag-biotech companies have used to frame public dissent. I find that the construction of the public proceeds in three parts. First, proponents of GMOs label the public as naïve, ignorant and fearful. Second, this ignorance is constructed

as harmful. Finally, the solution is to bring only correct knowledge to the ignorant public and to ignore calls for labeling or increased regulation.[20]

The United States overtly attempts to forcibly open markets to GMOs, and rejects the precautionary principle as an alterative to "sound science." This is one strategy of controlling the commercial space of GMOs. The US also engages in rigorous defense of the cultural space. The following section explores how the public, scientists, and journalists are framed when they deviate from support of GMOs. For the most part, the defense of sound science has occurred on US soil; however, I also identify the moments when the debate has spilled over into Europe.

Frame 1: ignorance leads to fear

Advocates of GMOs believe that the public misunderstands the risks inherent in the technology. Gaskell et al note:

> For industry and regulatory bodies, for whom risk assessments point to no unique risks from GMOs, this opposition is seen as an example of the public's failure to understand risk. Many experts judge that the benefits outweigh the possible risks—if indeed there are any risks at all. And as these experts observe the public opposition, they assume that since the benefits are not in dispute the public must be misperceiving the risks (2004, 188).

This assumption—that if only the public were better informed, they would have no reason to reject the science of GMOs, pervades discourse surrounding GM policy in both the United States and Europe.

United States. The proponents of GMOs learned from the experiences of the empowered European public and thus focused on making sure that the American opposition was disempowered and cast in a negative light. In a 2013 editorial,

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[20] This framing of the public mirrors what Welch and Wynne (2013) find in the British government's depictions of the pubic sentiment toward GMOs as well.

Nature attempts to strike a position of compromise, arguing that the public has a good deal of information, but much of it is flawed. They argue that the image of an uninformed public no longer applies:

> People are positively swimming in information about GM technologies. Much of it is wrong— on both sides of the debate. But a lot of this incorrect information is sophisticated, backed by legitimate-sounding research and written with certitude. (With GM crops, a good gauge of a statement's fallacy is the conviction with which it is delivered.) Armed with misinformation, debaters have taken to the streets, the supermarkets and social media. With a topic as sensitive and dear to people as the food they eat and give to their children, those who play to the fears, concerns and uncertainty surrounding GM crops often seem to have the upper hand. And the fears are entwined with mistrust of the seed companies. Supporting GM crops can seem a thankless job: it is worthwhile to stand up for good science and the promise that it holds, but defending profit-hungry corporations feels less rewarding ("Fields of Gold" 2013, 6).

Nature's position, while on face seemingly compromising, still uses "good science" as the default criteria. More interestingly, they acknowledge that the biotech firms, shockingly, are losing the battle—"those who play to the fears, concerns, and uncertainty surrounding GM crops often seem to have the upper hand" (2013, 6). While this is to a certain extent a rhetorical device, it's also underscores the power of the anti-GMO movement. Without a cohesive core, without a compelling message, without non-fringe leaders, the message nonetheless has the industry on the defensive. As such, proponents of the technology attribute public distrust of GMOs to a *mis*perception of risk, caused by the manipulation of public opinion by anti-GMO crusaders (Gaskell et al 2004).

Another component of the anti-GMO narrative depicts the public as awash in scientific inaccuracy. In public opinion surveys, it is common for the public to answer fact-based questions about GMOs incorrectly. For instance, a 2015

Oklahoma State University study found that 80% of the population supported labeling foods with DNA (and 82% supported labeling foods with GMOs). When asked questions like "genetically modified tomatoes contain genes while ordinary tomatoes do not," Eurobarometer finds about 26% of the European public answers the question correctly (Gaskell et al 2003), compared with the National Science Foundation's finding that 47% of Americans correctly answer the question. Triana argues that the lack of knowledge will lead to fear: "if 47 percent of Americans don't understand that DNA is the basis of all life, imagine the fear invoked in consumers when they see a big, scary 'CONTAINS GMOs' label on their favorite potato chips or popcorn" (2013, n/p). Thus, the connection between scientific ignorance and the "irrational" fear of genetic engineering is made explicit.

As Michael Specter, a staff writer for the New Yorker, writes: "Americans demand labels, at least in part, because they are afraid" (par. 6). Examples of discussion of ignorance and fear are pervasive in political discourse. At a House Agriculture Committee hearing in 2014 about labeling GMO products in the United States, Members of Congress and their expert witnesses constructed the public objection to GMOs as based on fear, ignorance, and misunderstanding (quotes from the hearing as cited in McAuliff 2014). The following exchange took place between Ted Yoho, a republican from Florida, and the expert witness David Just, a professor at Cornell University:

> Yoho: "What is the biggest drawback? Is it the ignorance of what the product is, just from a lack of education?"

> Just: "It is ignorance of the product, and it's a general skepticism of anything they eat that is too processed or treated in some way that they don't quite understand…Even using long scientific-sounding words make it sound like it's been grown in a test tube, and people get scared of it."

Schrader, a democrat from Oregon, evoked the specter of the European Union, warning that labels are a slippery slope to having all GMOs banned: "It's obvious that while the science in the EU in incontrovertible about the health and safety benefits of genetically modified hybrid crops, that because of politics, people are afraid to lead, and inform consumers."

The rhetoric of ignorance and fear extends beyond the halls of government. Neal DeGrasse Tyson, an astrophysicist and public intellectual that is something of a hero of the left, made major headlines in 2014 with his denouncement of anti-GM sentiment: "I'm amazed how much rejection genetically modified foods are receiving from the public," Tyson told a French interviewer. "It smacks of the fear factor that exists at every new emergent science, where people don't fully understand it or don't fully know or embrace its consequences, and so therefore reject it."

Europe. This depiction of an ignorant public is not unique to the United States; indeed, it has been the most popular explanation for public rejection of GMOs across Europe. Heller (2001) finds that in the mid-1990s in France,

> the media focused almost exclusively on the associated environmental and health risks, presenting the public as a monolithic entity that perceives the risks and benefits associated with GMOs with varying degrees of rationality or irrationality. Interviews…described a public that had lost confidence in food and science regulatory bodies because of scandals surrounding recent food scares such as mad cow disease. If the public rejected GMOs, they claimed, it was because of inaccurate perceptions of the risks and benefits associated with the technology (2001, 26).

Supporters of GMOs in Poland also frame the opposition as people operating from a position of ignorance: "Currently in Polish media there is no substantive, educational programs on GMOs. The effect of this situation is the misinformation of the society and the general fear of new, unknown and potentially dangerous genetic engineering methods" (Twardowski and Małyska 2012, 250). The Biotechnology Committee of the Polish Academy of Sciences aligns itself with the United States, praising the safety record of the use of GMOs in North and South America, and frames the European stance against GMOs as protectionist: "The European attitude to GMOs is either suspicious or hostile. This is mainly because Europe lags behind the United States in terms of using new technologies in agro-biotechnology and seeks to stop the inflow of its cheaper food and fodder" (BioTechnologia 2012, 8).

The public is thus depicted as ignorant and fearful, resistant to being educated about the truth of GMOs. Proponents of GMOs frame the public as rejecting scientific consensus. Using this anti-science motif as a backdrop, proponents of GMOs often frame the topic as a referendum on technology. Naam writes: "The GMO debate is often an emphatic and barely-disguised metaphor for our larger debate about whether technology is destroying the world or saving it, whether we should try to control nature or live within it" (2014, n/p). Johnson argues that GMOs have become metaphors "to discuss our technological hubris (or prowess)" and he warns that we should be "explicit about it. We should notice when the metaphor begins to diverge from the ground truth" (2014, n/p). Welsh and Wynne diagnose this strategy of constructing transforming a public that persists in asking questions into ignorant, anti-science public:

> Public uncertainty or discontent with policy commitments…are thus translated, wholly inaccurately, into allegedly exaggerated, public reactions to science arising from deficits in public understanding. If these persist, they are depicted as anti-science. In such developments, legitimately relevant issues for the GM debate, or others like it, are dismissed as insignificant (2013, 544).

Thus, the public goes from being portrayed as innocent objectors to active resistors. This is reflected in Jarvis's framing of GMO opponents as a:

> wave of recidivist movements championing organic foods, natural herbal medicines, environmental protection, and a return to nature, and who broadly reject the progressivist thesis of science and technology as benign benefactors, is now widespread across most advanced industrial societies (2008, 3)

This quotation is significant because it contrasts the recidivist movement with the progressivist scientists, and because those who interrogate GMOs are seen as inherently regressive. As this section has shown, the public is constructed as ignorant and naïve in this first part of the rhetorical strategy. The next step articulates this skepticism as dangerous.

Frame 2: public skepticism is dangerous

Once public ignorance is clearly established, the narrative then goes on to frame public skepticism not only as naïve, but also as dangerous.

United States. If the public refuses to accept the "truth" about GMOs, they move from being labeled as fearful and ignorant to being depicted as anti-science and dangerous. A connection is often drawn between GMO skeptics and climate change deniers. Nathaniel Johnson, in his wide ranging review of the GMO controversy for the e-magazine *Grist*, frames it as a matter of consistency: "It's hard to make the case that we should trust science and act to stem global warming, while

at the same time we are scoffing at the statements of **snort** *scientists* on genetic modification" (Johnson 2013a, emphasis in original). This is a common example of the way that fellow- liberals indict liberal skepticism of GMOs; the argument here is clear: advocates of science should not pick and choose the science they embrace. The dangers of climate change denialism can be found in denial of GMOs as well.

Europe. The danger of GMO denialism also permeates European discourse. When opponents of GMOs ask why the benefits of GMOs have failed to materialize, the blame is placed on the protestors themselves. Marc Lynas, one of the more vocal supporters of GMOs, argues that: "anti-tech campaigners complain about GM crops only being marketed by big corporations when this is a situation they have done more than anyone to help bring about" (In *The Economist* 2013).[21] Thus, he argues, the outspoken resistance to GMOs has created a regulatory arena too costly for any companies except major multinational corporations to compete in. Fewer demands on the government would create more of a market for GMOs, which would allow smaller businesses to compete and more products to come to market. This type of

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[21] Mark Lynas was one of the most outspoken British crusaders against GM foods. In 2013, he announced that he had switched sides in the GMO debate, and believed the technology was key to fighting global hunger. Vandana Shiva wrote on Twitter that "saying that farmers should have the freedom to plant GM crops is like saying rapists should have the freedom to rape." When she was criticized for comparing planting crops to rape, she responded by saying that she was not undervaluing the experiences of women, but we need to move "from a patriarchal, anthropocentric worldview to one based on #EarthDemocracy." Shiva (2013) expanded on this position in an editorial in Al Jazeera article, writes that: "The resource grab that is essential for "growth" creates a culture of rape - the rape of the earth, of local self-reliant economies, the rape of women. The only way in which this "growth" is "inclusive" is by its inclusion of ever larger numbers in its circle of violence. She wrote: "I have repeatedly stressed that the rape of the Earth and rape of women are intimately linked, both metaphorically in shaping worldviews and materially in shaping women's everyday lives."

claim is common in pro-GMO discourse: claims that the public's ignorance does damage, and they have helped to bring about the situation they critique.

Protestors are also framed as being enemies of science and obstructing the search for truth. Rothamsted Research, which runs field tests in England released a open letter to protestors after they disrupted a field trial in 2012. In it, they wrote: "We do not see how preventing the acquisition of knowledge is a defensible position in an age of reason…" (In Korzun 2013, 90). Unlike Monsanto, Rothamsted Research invited a dialogue with protestors and argued that their research would not be commercialized (Korzun 2013).

Frame 3: educating the naïve public

Pro-GMO elites frequently cite the lack of science education as the reason for public ignorance. If there were only better education and better communication, then the public would understand, and support, the science behind GMOs (Braun 2002). This is a redemption narrative - an ignorant, fearful public can be cured through knowledge. *Nature* (2013) quotes an analyst of the biotech industry as observing: "Now, they realize that they have to be articulate and educate an uninformed public." This interpretation of the problem, then, is that there is a reluctance to "inform" consumers of the "truth" about GMOs. Underlying this idea is the notion that if only they were informed about the truth of GMOs, they would change their minds. Indeed, advocates of GMOs espouse a positive relationship between increased knowledge about GM technology and support of GM food (Boccaletti and Moro, 2000; Moerbeek and Casimir 2005, Koivisto-Hursti and Magnusson 2002). Additionally, experts perceive less risk for GM technology than

the public does (Savadori et al 2004). Thus, experts argue that, due to the low level of information among individuals, more information should be provided so that they can correctly interpret the scientific information and thus support GMOs (Noomene and Gil 2007).[22]

Europe. Monsanto expected a welcome reception in Europe in the mid-1990s. They did not expect a hostile public and the European Union to close its markets to their product. Although Monsanto had initially intended to operate quietly in Europe, they quickly realized that an "uninformed" public could derail their operations. As Monsanto, reeling from the European rejection, attempted to assess its losses, the lesson they learned was that they needed to shift strategies. The solution, they determined, was more communication: "We have not done a very good job communicating about GMOs," said Cathleen Enright, executive director of the Council for Biotechnology Information, which runs the site. "We want to get into the conversation" (quoted in Sands 2013, n/p). The model of communication suggested by Monsanto is not one of a dialogue, but rather improving the one-way

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[22] The frequently repeated claim that providing information about GMOs will shift public opinion has been challenged by the literature. Morris and Adley (2001) find that the level of "don't know" responses in a European-wide survey on GMOs is highest in Ireland, Portugal, and Greece—countries with some of the highest support for GMOs. They conclude that low self-reported knowledge leads to support of GMOs. Gaskell et al (2003) find that Europeans are more knowledgeable about biotechnology than Americans are, but hold far more negative opinions about the technology. Durant and Legge (2005) find that providing people more knowledge about GMOs actually increases skepticism about the technology. BBVA (2010) asked people whether they understood the term genetically modified food; 45.7% of the EU did—43.4% of Poles, 40.5% in the UK, compared with 32.8% in the US. The Mellman Group, commissioned by Pew to do a longitudinal study on public opinion in the US from 2001-2006, on the other hand, did find that people where more likely to support GM foods after getting information about them (Mellman Group 2006).

communication about the products. Again, there is a sense that if the public knew the "truth" behind the science, then they would accept the technology. Monsanto's mea culpa for sending GMO-tainted products to Europe expressed a promise to communicate more. Monsanto released a 5-point pledge that promised to listen to its customers. The pledge stated:

> Monsanto focused so much attention on getting the technology right for our customer—the grower—that we didn't fully take into account the issues and concerns it raised for other people. We didn't understand that when it comes to a serious public concern, that the more you stand to make a profit in the marketplace, the less credibility you have in the marketplace of ideas. When we tried to explain the benefits, the science, and the safety, we did not understand that our tone—our very approach—was seen as arrogant (quoted in Van Yoder 2001, p. 40).

United States. Despite the limited success of this communication strategy in Europe, the GMO lobby is trying the same approach in the United States. They recently created the website GMOanswers.com, a major initiative meant to facilitate communication with the public. The banner on their website reads "Skeptical about GMOs? We understand. We want to do a better job answering your questions." The website then reads: "Who are WE? More than 100 experts have contributed to this site including independent experts in **leading academic institutions, industry groups,** and **representatives** from member companies" (emphasis in original). The website invites the public to contribute questions about GMOs. One question, submitted by Bella19 from Gatesville, TX, reads "Gmos are not healthy and we dont [sic] want them on our food. Can you find something else ?" (note that they leave Bella's capitalization, prepositional, punctuation errors intact). Brian Scott, a farmer from northwest Indiana, responds at length:

> That's a very good question for me as a farmer who raises GM crops. If the market creates so much demand for something other than the GM corn and soybeans that I'm growing, then I'm sure farmers like me will choose to grow something else. But if you believe foods made with these crops aren't safe, then you have plenty of other options. Certified organic products are out there and are labeled so consumers can know they are buying foods raised under a certain set of rules for production. Voluntary non-GMO labels can be found as well. If people want to avoid GMO foods, then they can seek out these labels. As far as safety goes, I don't happen to share your belief. Consumers do deserve choices and can demand them with their hard-earned dollars, but farmers deserve choices, too. Each farmer should have the freedom to farm how he or she chooses. Right now I'm choosing to use GM crops on most of my acres.

This scripted exchange on the GMO Answers website clearly depicts the way in which the proponents of GMOs imagine the relationship between farmers and consumers: the naïve (nearly illiterate) anti-science questioner, answered by the concerned, hard working farmer. In this response, Brian, the farmer-author, emphasizes multiple times that he and his family are farmers, and then reframes the debate over GMOs choices to include the freedom of choice for a farmer to grow GM crops.

This section has shown that the public is the GMO lobby's most powerful adversary. As Chapter Five demonstrates, protest in Europe successfully shut down nearly all GMO related commerce for more than five years, and public refusal to by GM products has had incredible impacts on the industry. As such, Monsanto and other members of the ag-biotech industry have focused on controlling the public. They depict the public as ignorant of the true results of science, this ignorance as dangerous, and then attempt to educate the public about the "true" science of GMOs. There are a few implications to this. First, the idea of knowledge is limited. The GMO lobby rejects, for example, any attempts to label GM products in the United States—

so knowledge is only about the safety, not about which products actually contain genetically modified material. The recent hearings on GM foods in the US Congress echoed the depiction of an ignorant, fearful public who could not be trusted with the knowledge of GMOs. The second implication is that this strategy travels to Europe as well. In Europe, the focus is on the damage done by a skeptical public—the ability of protests to work against the common good.

All of these arguments rest upon the assumption of good science—the idea that the science of GMOs is conclusive. As the next section demonstrates, the ag-biotech industry aggressively polices the science of GMOs as forcefully as it polices the representation of the public.

Controlling the Science

Because the veracity of "sound science" relies on the unanimity of scientific findings, it is no surprise that the legitimacy of that science is rigorously policed. Perhaps more than any other scientific debate, the anti-GMO scientific findings have been disputed, impugned, and the scientists had their character assassinated and careers threatened.

Europe

The two biggest scientific scandals both occurred in Europe: the Pusztai affair of 1999, and the Séralini scandal of 2012. These two studies are emblematic of the way in which anti-GM scientific findings are handled. In 1999, Dr. Arpad Pusztai, a research scientist at the University of Aberdeen, conducted an early experiment where he fed GM potatoes to rats; these were underweight and had immune cells

that were less reactive than rats fed non-GM potatoes. Before the results of the experiment were final, the television show World in Action asked him to do an interview about his preliminary results, where he described that the early results from the study indicated that the GM potatoes were producing abnormal results in rats. When the interviewer asked him about whether the effects in rats were due to their consumption of GMOs, he made two statements that would define the rest of his career: that he would not eat GM foods if he could help it, and he opined that "it's very unfair to use our fellow citizens as guinea pigs" (quoted in Johnson 2013e). This personal denouncement of the biotech industry, and the allegation that the industry was performing experiments by feeding people GM crops, caused a firestorm in the international community. The controversy was intensified by the fact that, in the same program, a Monsanto representative who was asked to comment on Pusztai's study responded by saying that they didn't do long-term tests on animals. The statement by Monsanto that they were not doing long-term animal tests added validity to Pusztai's claims, and introduced a profound concern about gaps in knowledge about the effects of GMOs.

Pusztai's study was later published in *The Lancet,* but the results were disputed and Pusztai was accused of mismanaging the experiment and even fabricating the data; he ultimately lost his research position at the university (Randerson 2008). Although Pusztai had sought permission to speak about the preliminary results of the study on TV, his director, under pressure from the biotech industry, responded to the crisis by sealing the lab, confiscating his notebooks, and forbidding further contact with the press (Johnson 2013e). This response—shutting

down the research of politically contentious experiments—further inflamed the anti-GMO movement's belief about the dangers of GMOs.

Even after losing his position, he continued to warn of the potential dangers of the technology, arguing that Monsanto politicized the technology: "The difference with GM, he says, is that there is a political agenda at work. "Ninety-five per cent of GM is coming from America, so naturally it is in their interests to push it," he says, "I have no ideological grounds against Monsanto [the biotechnology company]. For me it's a scientific argument. They have not done a proper job [of testing], and they are just using their political and economic muscle to foist it on us" (Randerson 2008). Thus, Pusztai attempted to reclaim the scientific and objective high ground. The Pusztai scandal had a lasting impact on the trust of the British public:

> Moreover, the activists believed the scientific establishment couldn't be trusted to render an honest judgment, not when science itself was under attack. One had only to witness the bumbling and panicked response of leading British scientists to media reports of Arpad Pusztai's experiments. Pusztai was suspended from his job, and the Royal Society's investigation of his case looked suspiciously like a premeditated effort to discredit a well-meaning scientist (Charles 2001, 227).

The second example starts out similarly: in 2012, Gilles-Éric Séralini, a French researcher, held a press conference, before which he took the unusual step of requiring journalists to sign confidentiality agreements. At the press conference, he announced that mice fed genetically modified ingredients were shown to have developed large tumors, providing strong evidence that Roundup Ready corn was toxic.

The study immediately came under attack from the academy and the ag-biotech industry, and the journal *Food and Chemical Toxicology* retracted the article in 2013, claiming that the small sample size and other methodological problems were proof that the study never should have been published.[23] The authors refused to retract, and instead re-published the article in *Environmental Sciences Europe* without further peer review. The Séralini scandal, as with the Pusztai scandal, shows the immensely politicized nature of the GMO debate on both sides of the issue. Scientists who manage to publish studies that indicate that there are environmental and health effects of GMOs are immediately disavowed by the academy, and the results sanctioned. Both of these scandals are marked by the fact that the scientists appealed to the media before the scientific community; they held press conferences or gave interviews before the articles were published before there were final results. This meant that public opinion and media coverage became intimately related in the debate over the veracity of the scientific claims. To some in the scientific community, this act of appealing to the public and the media further cast dispersion on the results of the studies.

United States

Pusztai and Séralini are not the only scientists whose career has been threatened or ended by anti-GMO findings; the biotech industry has also been known to go after young scientists who publish results that dispute the safety of GMOs. Johnson (2014) also documents how the Bivings Group, a PR firm employed by the ag-biotech industry, engaged in a misinformation campaign, adopting

[23] The study has also been criticized by others in the academy (see, e.g., Kuntz 2013).

pseudonyms and waging a smear campaign against a scientist who had questioned GMOs in an online forum. John Losey, a professor of entomology at Cornell University published an article in the journal *Nature* in 1999, which found that BT corn killed Monarch butterflies. He subsequently received calls from scientists at Monsanto and Novartis. Charles recounts the confrontation between Jeff Stein, a representative from Novartis, and Losey;

> [Stein] urged Losey to consider the potential damage that his paper might cause. Europe was already in flames over genetic engineering…The Monarch had a cult like following; it was perhaps the most charismatic insect on the continent. A paper that predicted its doom at the hands of genetic engineering could be 'a trigger to similar reaction in the United States.' The Novartis representative also suggested that Losey might be endangering his own career (2001).

Thus, the conversation evoked all of the components: a fear that the public's "cult like following" of the Monarch butterfly would interfere with rational assessment of the paper, a fear of the reaction in Europe spilling over into the United States, and a personal threat about Losey's own professional well-being.[24] This type of conversation represents a policing of science that extends beyond the rational evaluation of scientific evidence.

In a similar incident, Ignacio Chapela, a professor at the University of California at Berkeley, published a controversial paper in *Nature* in 2001 arguing that transgenes were flowing into wild maize populations. The article attracted controversy and the editors of *Nature* later published a note saying there were methodological concerns and insufficient evidence to have published the original piece. In 2003, Chapela was denied tenure, despite a unanimous vote in his favor by

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[24] Charismatic microfauna, symbolic kin to charistmatic megafauna such as pandas and dolphins (see, e.g., Peterson 1999).

the tenure committee, shortly after Berkeley had signed a $25 million dollar sponsorship agreement with Novartis (now Syngenta), a major agribusiness company (Johnson 2013e). Chapela was ultimately granted tenure after an independent review process, wherein Lawrence Busch, the head of the review committee, said that the Novartis sponsorship heavily influenced the tenure process.

There are several ways one could interpret the way in which the science of GMOs is policed. One story would be that this is the way good science is done: research findings are released in the public sphere, other scientists debate and attempt to replicate findings, and "bad" science is dismissed while "good" science is confirmed. It could be that the rare studies that find dangers from GM crops are examples of "bad" science. However, these examples also indicate the high-level involvement of the ag-biotech industry and its willingness to put pressure on not only scientists but also journals and research institutions when results unfavorable to their position are found. Indeed, this tendency to dismiss the public and the science is also found in the way that the ag-biotech industry and its supporters react to negative news stories about the technology, an idea explored in more detail in the next section, which charts the way in which proponents of GMOs operate by controlling the narrative.

Controlling the Narrative

Monsanto and the rest of the biotech industry intensely focus on the way they are portrayed in the media. This emphasis on their public image has been true since the 1980s; Will Carpenter, who was in charge of public relations for Monsanto in the 1980s, wrote in a memo to executives in 1989 which worried that

"Environmental organizations clearly are becoming more activist in the area of biotechnology…and the predominance of press articles and editorials, while not wholly negative, are more questioning in tone and less supportive than they have been in the past" (quoted in Charles 2001, 92). This attempt to see the changing sentiment of the media toward GMOs, and to attempt to change the narrative, is the third way in which supporters of GMOs defend sound science against its detractors.

Europe

Worried about their image in the media, Monsanto attempted a goodwill campaign in England in 1998. They took out a series of "informational" advertisements filling full pages in leading newspapers, proclaimed: "Food biotechnology is a matter of opinions. Monsanto believes you should hear all of them" (Arlidge 1999). The advertising campaign presented, over a series of several weeks, "facts" about biotechnology it wanted the public to consider. However, this informational approach was matched with a moral campaign. One ad read: "Worrying about starving future generations won't feed them. Food biotechnology will" (Monbiot 1999, 111). This type of ad struck the wrong chord with the British public—not only taking the moral high ground, but also chastising the public for concern over poverty. The advertising campaign ultimately backfired on Monsanto; they were sanctioned by the Advertising Standards Authority for publishing "wrong" and "misleading" claims (Arlidge 1999). In response, Dan Verakis, a spokesperson for Monsanto, again claimed that the campaign was for the purpose of education: "We were the first biotech company to attempt to explain this complicated science and to help consumer understand it better. We expected it to be controversial and

we expected the activist industry to be very critical,' he said. 'We do not wish to mislead anyone" (in Arlidge 1999). As Monsanto reasserted the veracity of the science, they again cast themselves as educators and explainers – not engaging in a conversation over the concerns of the community, but instead breaking down the complicated science for public understanding.

United States

In the United States, journalists who demonstrate what are sometimes perceived to be anti-GMO biases are also subjected to character attacks and stiff criticism. Carey Gillam, a journalist for Reuters, came under heavy attack from the agricultural industry for her recent reporting of GMOs. On April 9, 2014, she published an article claiming: "Bill seeks to block mandatory GMO food labeling by states," Gillam wrote: "Advocates of labeling say consumers deserve to know if the food they eat contains GMOs, or genetically modified organisms" (2014). A paragraph later she wrote: "Makers of biotech crops and many large food manufacturers have fought mandatory labeling, arguing that genetically modified crops are not materially different and pose no safety risk."

After these seemingly innocuous comments, Gillam faced intense criticism and calls for her resignation. Roseburo (2014) chronicles the attacks on Gillam, putting together a review of the various places on the Internet where her article was called into question. For instance, Val Giddings, former executive vice president of the Biotechnology Industry Organization (BIO), accused Gillam of fueling the

"astroturf" anti-GMO campaign with her articles.[25] Giddings then criticized Gillam for making claims that are "false and flagrantly so" in her articles. The website Academics Review, co-founded by Bruce Chassy, a retired professor of food science at the University of Illinois, also criticized Gillam's coverage, publishing her article with a red F stamped over it. Keith Kloor, who writes for *Discover* magazine's "Collide-a-Scape" blog, argued that the article was part of a trend of "false balance" on the subject of GMOs, implying there was a still a debate over GMOs and accusing Gillam of ignoring the scientific consensus. Jon Entine, executive director of the Genetic Literacy Project, posted Gillam's article on their website, before using the comments section to attack her. He wrote: "This writer is known for her sloppy and biased writing--considered an embarrassment by most independent science journalists." These attacks, from across the industry, forcefully patrol the boundaries of what is knowledge and what is science: both what is considered true, how it is reported, what is fit for publication, and what are facts are what aren't.

Defenders of Gillam framed the attack as motivated by fear; Gillam tweeted: "A bit astonished at the level of fear out there over truthful reporting..." Maria Nestle, one of the major voices on food policy, echoed the accusations of fear: "They are scared to death…they have an industry to defend and are attacking in the hope that they'll neutralize critics…It's a paranoid industry and has been from the beginning" (in Roseburo 2014). We see, then, an aggressive attempt to control the public, the science and the narrative of GMOs, presenting a logically complete defense of "sound science."

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[25] Astroturf, incidentally, is a Monsanto product (Dee 2003).

Conclusion

Sound science is the guiding philosophy of the United States and its domestic and international policy toward GMOs, which are rooted in a globalizing discourse. This narrative frames GMOs as the sole tool by which to stave off potential catastrophe, and the intent to control those who do not ascribe to this belief in GMOs.

When it is challenged, the proponents of GMOs go on the offensive, portraying the public as either ignorant, fearful, and passive participants who need to be educated, or as harmful, anti-science luddites doing real damage to society for the sake of ideology. When attacks come from scientists and journalists, proponents also mobilize to attack the character of those objecting to the technology.

The analysis in this chapter has demonstrated the way in which proponents of GMOs use "sound science" to control the public, the science, and the narrative of GMOs. The goal is to maintain the image of GMOs in the public space, refuting negative images. These three parallel narratives demonstrate the way in which proponents of GMOs aggressively protect the "sound science" façade. Although the damage wrought by the public may be depicted accidental in this narrative, the scientists and journalists who oppose GMOs are depicted as doing active, intentional harm. This goes beyond defending the science to an active policing of the narrative of science—a narrative that asserts a purity of scientific findings and closes off room for dissent, questioning, or reframing the topic by discrediting voices of opposition.

The next chapter examines the conflict between the US and the EU over GMOs. The fact that there is active dissent against GMOs, and sustained opposition

to the technology, indicates that opinion leaders—political and economic elites, as well as the public—are not persuaded by this narrative. The European Union has undoubtedly posed the biggest barrier to the global spread of "sound science"—and its ability to make the world safe for GMOs. Even as the EU has frustrated the efforts of Monsanto and similar corporations, the economic and political strength of the United States has prevented the ability of environmental civil society to gain any real traction outside of the European Union (Drezner 2007). The result, Drezner argues, is a stalemate between the two great powers.

Chapter Four: European Union Regulation and Transatlantic Conflict

The previous chapter discussed the construction and projection of the sound science ideology. This chapter focuses on the way in which this ideology is contested on the international level in terms of the European Union's approach to GMOs. The chapter examines the international context of GMOs, which is primarily determined both by EU regulatory policy and by the sustained trade conflict between the United States and the European Union. The following analysis explores the way in which EU policy has shaped, and been shaped by, both internal and external regulatory factors.

Regulatory Politics

The primary approach in the political science literature to the question of GMOs has focused on the subject of regulation—particularly the regulatory gulf on the issue between the United States and Europe and its impact on trade and transatlantic relations.[26]

In the late 1980s, life sciences corporations began to heavily invest in bringing agricultural biotechnology to the market (Schurman 2004). This led to genetic modification of organisms, and reached the threshold of mass production in the 1990s. By building an infrastructure for seed delivery, securing patents, navigating regulatory regimes, and heavily lobbying governments, it seemed clear that ag-biotech companies would remain global competitors in the emerging market.

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[26] Perhaps the most prominent work is Pollack and Shaffer's (2009) book *When Cooperation Fails: The International Law and Politics of Genetically Modified Foods,* which provides a multilayered analysis that takes into account institutional, legal, domestic, IR, and constructivist factors that have created the current legal regime surrounding biotechnology.

However, all of that began to change as the market, reacting to the vocal opposition from the European public and the tension between the United States and the European Union, began to turn against GMOs.

The United States and Europe have traded places in terms of the strength of regulation over the past thirty years. Vogel (2012) observes that a regulatory flip-flop occurred around 1990; before 1990, the United States tended to be more risk averse than the European Union, whereas after 1990 the regulation adopted by the European Union tends to be more risk averse.[27] He uses a tripartite explanation for why the change occurs: the intensity of public pressure, the policy preferences of government officials, and the criteria policy makers use to assess and manage risk. This regulatory politics perspective (Vogel 2012; Kelemen and Vogel 2010) asserts that domestic politics shapes a government's position on international environmental policy both through the strength of domestic environmentalists asserting pressure on their government, and because the strength of the environmental movement means that there are stronger domestic regulations on corporations—this means there are incentives to support incentives on foreign actors as well. This argument is broadly similar to Kurzer and Cooper's (2007) explanation of how GMO regulation came about in the EU: the anti-biotech movement pressured domestic governments to oppose GMOs, and these states thus

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[27] Jonathan Weiner and his colleagues (2012) dispute the flip-flop hypothesis and argue that, when looking beyond food-related questions, the United States is often more risk averse—they take a quantitative approach and look at a broad spectrum of regulatory situations including terrorism and tobacco regulations. This dispute has led to considerable scholarly exchanges, including a 2013 special issue of the *European Journal of Risk Regulation.* However, for the purposes of this project, GMOs fall well within the scope conditions of Vogel's argument.

shaped European policy through casting their votes on the EU level. A similar line of argument asserts that GMO regulation is a form of protectionism; this is the argument that the United States argued at the WTO. Because GMOs are primarily produced by multinational corporations, most of which are not European, regulations in fact help small and medium European businesses compete (Rosendal 2005 finds some support for the protectionist argument). Thus, the way in which the debate over GMOs has manifested itself in the international arena has a major impact on domestic politics and policy. The following sections provide the political and economic context for the dispute over GMOs in the European Union over the past three decades. The second part of the chapter then examines that debate in terms of the US-EU conflict.

European Union

The European Union limits the GM products that are allowed to be produced and sold within its borders. As of 2013, a few commodity crops and enzymes used during food processing produced by genetically modified organisms within contained facilities are allowed to be sold, with each crop specifically approved (Frewer, van der Lans, et al 2013). The following sections trace the evolution of the EU's regulatory history across three time periods: pre-1996, 1996-2004, and 2004-present.

Pre-1996

Europe's regulation of food safety has evolved over time. In 1978, the Directorate-General XII on Science, Research, and Development proposed that all

research involving recombinant DNA (rDNA) would require notification of the EEC (European Economic Community, the precursor to the EU) and authorization by national authorities (Rosendal 2006). The United Kingdom, the leaders in rDNA research, strongly resisted any proposals for EEC-wide regulation. This debate over whether biotechnology ought to be regulated on the state level of the EEC level persisted throughout the 1980s. It revolved around three questions: whether to use "sound science" or a precautionary approach to risk evaluation and assessment, whether the legislation should be tailored to specific sectors (e.g. agriculture or pharmaceuticals) or should encompass all sectors, and whether the regulation should concentrate on the process of genetic engineering or the products generated (Rosendal 2005). In response to these questions, there was an expansion of European oversight as the ECC developed the mutual recognition principle and the minimum harmonization method of food regulation. Until the mid-1990s, food related debates were generated by economic rather than health or safety concerns. Alemanno notes that "no explicit reference to public heath or consumer protection was made in the Treaty of Rome until the adoption of the Single European Act (1986) and the Maastricht Treaty (1992)" (2006, 233).

In 1990, the EU began to create an explicit framework for regulating GM foods. Directive 90/220/EC attempted to balance the power of individual states and the EU in regulating biotechnology. Under this directive, member states maintained regulatory powers over GMOs, such as individual risk assessment and authorization for release, but it allowed for 18 GM crops to be imported and cultivated, and

thousands of research trials began across the continent (Skogstad 2003). Thus, the early 1990s were the most prosperous for GMOs in Europe.

1996-2004

By the mid-1990s, the EU-level regulatory framework had "lost public credibility and legitimacy" (Skogstad 2003, 328). This was due primarily to the handling of the BSE (Bovine spongiform encephalopathy, or mad cow disease) scandal. The EU regulatory committees tasked with investigating BSE and advising the European Commission politicized the conflict, downplaying the potential risk to the public and underestimating the number of people who would contract BSE. When it became evident that the Commission had underestimated the impact of the crisis, NGOs exploited this oversight, advertising the fact that the scientists advising the commission had willfully distorted the risk from BSE, thus putting the European public at risk. As a result, the BSE crisis weakened the trust that Europeans had both in the "objectivity" of scientists advising the commission, and the European government as a whole. The issue also underscored the ability of consumer groups to mobilize public sentiment over food issues.

Opposition to GMOs varied on a state-by-state basis; however, the countries like Spain that supported GMOs were unable to gain real traction on the EU level for EU-wide support of GMOs. Instead, the tides turned against GMOs because of the unwillingness of domestic governments to trust the EU and because of increasing public concern over food scandals that NGOs used to capitalize on the fear of GMOs. In 1996, the EC approved Monsanto maize in the face of widespread protest. In response, the European Parliament condemned the Commission's decision, and

Austria, Italy, and Luxembourg invoked the safeguard clause of the treaty of Rome to prevent the licensing of GM products in their countries. This triggered a legitimacy crisis in the EU system; Austria, Denmark, Luxembourg, Greece, France, and Italy, later joined by Belgium and Germany, instituted domestic bans on GMOs.

In wake of the opposition, the EU was compelled to take proactive measures to create a food safety regime that would "avoid the balkanization of the internal market" (Alemanno 2006, 232). These crises led to the precautionary principle being written into the Treaty of Amsterdam in 1999. In response to the growing protests, the Council of Environmental Ministers put the moratorium into place in 1999, halting all new approvals of GMOs for commercial use.

Post-Moratorium Regulatory Processes

In 2004, the EC lifted the moratorium and put in its place a "farm-to-fork" regulatory schema to govern GMOs inside the EU. Levidow (2006) argues that European policymakers began to frame the issue as one of restoring public confidence and accommodating the "consumer rights" agenda, which helped to placate critics and to strengthen the European position while bypassing the debate over sound science versus the precautionary principle. Bernauer (2003) argues that there is a paradox—that the fragmentation of decision-making authority actually led to a harmonization of policy on the EU wide level. The total ban was replaced with a policy that required each use of GMOs to be labeled, traceable, and approved on a case-by-case basis; a few GM products, mostly for animal feed, were approved by the commission. The regulatory framework retained the requirement that GM foods and crops undergo mandatory case-by-case risk assessments in order to stay

licensed, and the risk assessments must be made public. Additionally, there were comprehensive labeling and tracing provisions that identify and follow GM foods through each step of the production, processing, and marketing process (Skogstad 2006, 231). Finally, the new provisions did away with the 1997 Novel Food Regulation which followed the US and Canada in declaring that GM foods were substantially equivalent to conventional foods.

Before early 2015, in order to apply for approval of a new crop, a request for release of GM food, feed, or seed is submitted to the EFSA. If the EFSA approved the request, then the European Commission accepted their recommendation and presents the proposal to a committee of national officials; if the expert committee is undecided, the Council of Ministers weighs the issue—only the expert committee and the Council can block the proposal from the EC, which requires 232 of 321 votes to block (Kurzer and Cooper 2007). Abstentions do not count as nos, and are often nearly a third of the votes. Germany often abstains because of internal divisions within the government, as does Spain, because of cross-cutting social pressures (Kurzer and Cooper 2007).

This process was not without controversy. In 2012, the EFSA broke with EU precedent and fast-tracked the approval of Monsanto's Intacta GMO soybean and Amflora potato for use in food and feed. Jose Barroso, the president of the European Commission, was widely considered to be instrumental in persuading the EFASA to fast-track the approval of the new GM crops. The EFSA's justification for the fast tracking mimicked the language used by the FDA and declared that the soybean was "substantially equivalent to the natural bean" (Onusic 2012). The EU Parliament

responded to this controversy by postponing a vote on the EU budget in order to withhold funding for the approval of other GMOs. This issue again points to the lack of cohesion on the EU level over GMOs, stymieing the ability of GMOs to gain much traction moving through the process.

The economic resistance to GMOs in the European Union exists because of a highly concentrated and interconnected production chain (Kurzer and Cooper 2007). Anti-GMO NGOs first put pressure on the grocery chains, which created an incentive for food processors to phase out the production of GM crops. Thus, the overwhelming success of the anti-GMO movement in Europe can be attributed to the "successful mobilization of the consumer" (Kurzer and Cooper 2007, 117). These anti-GMO campaigns successfully drove a wedge between biotech firms and food manufacturers, retailers, and farmers. As a result, the capacity for collective action among the biotech industry has been diminished (Bernauer 2003). The results have been astonishing: "in effect, the anti-GE movement closed the Western European market to agricultural biotechnology. As a result, the mainly US-based agricultural biotechnology industry was sent reeling" (Schurman and Munro 2010). This section reviews the economic implications of the GMO resistance in the European Union after the moratorium, focusing specifically on the industry level and the agricultural level.

Until the moratorium on GMOs passed, the life science industry was predicated on a model that integrated agrichemicals, crop sciences, pharmaceuticals, and health care (Schruman 2004; Bernauer 2003). This model began to disintegrate as life science firms began to reevaluate the wisdom of keeping agricultural firms as

part of the model. Avanta Seeds stopped testing GM seeds in the Netherlands after deciding it was unprofitable, and BASF moved its headquarters from Germany to the United States. Finally, biotech firms began undertaking an economic restructuring and sold their agricultural divisions (Schurman 2004). Sensing that the ag-biotech industry was in disarray, the anti-GMO movement, spearheaded by Greenpeace, focused on lobbying the EU for a mandatory labeling of products containing GM foods, assuming that consumers would refuse to buy anything labeled GM, and so stores would refuse to sell them. The biotechnology firms "became persuaded that labeling was the price to pay to end the moratorium," and retreated, withdrawing their objection to the labeling legislation (Skogstad 2003, 331).

Public Opinion and Political Mobilization

This section looks at public opinion and political mobilization the European Union-wide level, before examining these topics on a country-by-country basis.
As the food scandals of the 1990s intensified, social movements quickly mobilized to link the uncertainty over GMOs with the public's fear of a new food-based disaster (Schurman 2004). The European press frequently framed GMOs within the larger "mad cow" context. The result was that social movements capitalized on the heightened public awareness to bridge the frames; although the issues were technically separate, public opposition to these technologies was cumulative: "For instance, while disputes over beef and milk (rBST) hormones, BSE, dioxins, and GMOs were distinct issues within the food sector, their contestation was cumulative. Perhaps most dramatically, the hormone and BSE disputes spilled over to shape the public response to the growing and marketing of GMOs" (Ansell and Vogel 2006, 23).

Exploiting the link between GMOs and other food safety concerns was an intentional strategy chosen by NGOs. Ansell, Maxwell, and Sicurelli argue that "the contestation over mad cow disease created a window of opportunity for NGOs to mobilize attention to the GMO issue" (2006, 97).

The reinforcement of the link between BSE and GMOs worked: after 1996, European attitudes toward GMOs became significantly more negative (Gaskell, Allum and Stares, 2003). The uncertainty surrounding GMOs meant that they became the emblem of the entire food crisis. Ansell and Vogel argue that this is because

> obviously the debate over biotechnology that followed on the heels of the BSE scandal was also about the changing technology of producing food. More generally, the technology of food production and marketing has become so complex and technologically sophisticated that the regulation of food has become increasingly challenging (2006, 17).

Although most accounts of the anti-GMO movement begin in Europe with protests in the mid-1990s in the wake of the BSE and other food scandals, the movement against GMOs actually began two decades earlier. In the early 1980s, concerned Europeans mobilized, formed NGOs, and began putting pressure on national and EU-level governments to increase the rigor of regulation (Schurman 2004). The anti-GMO movement mobilized NGOs that represented broad cross-sections of society, targeting local organizations such as GM Free Cymru (Wales) and international groups like Consumers' International (Ansell, Maxwell, and Sicurelli 2006, 99). Groups like Greenpeace and Friends of the Earth had connections at multiple levels of governance and thus were able to tap into networks at local, state, and international levels. These NGOs also mobilized specialized interest groups that

spanned across consumer, agricultural, and environmental constituent groups (Ansell, Maxwell, and Sicurelli 2006, 99). Ansell, Maxwell, and Sicurelli (2006) characterize the anti-GMO groups operating in Europe in four categories: groups with national constituencies located within a specific nation-state; groups with national constituencies that have both national and European branches; groups with an international constituency and that are based in Brussels; and groups with a transnational constituency that have both national and European branches.

Once the US began exporting GMOs to Europe in the mid-1990s, these early adopters were able to mobilize a powerful anti-GMO movement. The arrival of the unlabeled GM wheat on European soil, combined with the concurrence of other food scandals, infused life, resources, and focus into the anti-GM movement. Schurman and Munro show that, "By the mid-1990s, when GE products began to come onto the market on a significant scale, a robust grievance frame was in place" (2006, 31). Seeing the potential for major change, Greenpeace devoted a major campaign and 15 full time staffers to the cause (Schurman and Munro 1996). After Monsanto sent GE crops to the UK in 1996, Goldsmith Trust, an environmental foundation, started financing the anti-GMO work of the Genetics Forum. In 2010, Greenpeace collected over a million signatures on a petition that demanded the EU place a moratorium on GM crops.

Along with direct action like cutting down GM crops that were growing on test sites, anti-GM advocacy groups have put pressure on food retailers, monitored companies and countries for compliance with the moratorium, lobbied all levels of government for an all-out GM ban, and challenged the scientific evidence offered in

support of GM crops (Ansell, Maxwell, and Sicurelli, 2006, 97-98). Not only is that anti-GM action in Europe impressive because of its multifaceted reach and set of strategies, but also because it created connections cross-class/interest group partnerships as farmers were mobilized to take action alongside the NGOs and consumers. Ansell, Maxwell, and Sicurelli (2006) trace the way the politics of food unify disparate parts of the population—environmentalists, consumers, and small farmers in a "transnational advocacy network." Schurman (2004) notes that an often-overlooked aspect of the success of these social movements was their ability to successfully target organizations, not just governments. By highlighting issues like "deliberate release" of the technology, different segments of the population, for example those concerned with gene patenting, corporate concentration, biodiversity, and global issues, were all brought together into a broad coalition opposed to GMOs (Schurman and Munro 2006).

EU Conclusion

The European Union continues to be charged with reconciling irreconcilable differences between member states. The EU faces largely anti-GMO public opinion and a dried up market for the technology, but sustained international pressure to open the market to products from the United States. Less than a quarter of citizens in the European Union regard GM foods positively, although there is some optimism about the technology. Even as the EU approves crops there is no real market for them, and EU regulation represents a controversial deepening of EU power. In the early 1990s, GMOs were allowed in Europe, largely regulated on the state level, and there was a market and a research agenda. After the US began exporting crops, and

the BSE scandals of the mid-1990s, member states revolted, which led to a de facto moratorium on the crops. In 2004, the moratorium was lifted, replaced by a farm-to-fork regulatory regime. Although broadly workable, the regulatory apparatus still came under fire both from countries that wanted relaxed regulations as well as from countries that didn't want to grow crops at all. In 2014, a new policy was introduced that would allow states to opt-in or opt-out of EU restrictions. The European Parliament approved these regulations on January 14, 2015, but as of this writing the implications are still unclear. The following chapter makes some predictions about the way these new regulations will affect individual countries.

US and EU Conflict

Competing forces exert influence over the EU: domestic and transnational. The domestic politics of member states play a major role in the path the European Union has taken on GMOs. The other major influence is pressure from the United States and the interaction between the US and the EU over GMOs. The regulatory literature asks how the two governing bodies can look at the same objective set of scientific data and decide to create public policy so differently, and what the consequences are. This section puts that question into the context by examining the conflicts between the US and the EU over GMOs.

The Early Years of US-EU Disputes

The United States' official position on trade of GMOs is that the European Union imposes an unjust trade barrier by refusing to treat GM crops as substantially equivalent to conventional crops. US policy makers and trade representatives argue

that they act in accordance with the default, value-free position of "sound science" and neoliberalism. Based on these principles, the United States rejects alternative means of adjudicating trade disputes; thus, scientists shape political decisions under the auspices of neutral scientific advice (Weingart 1999).

As Gupta (2004) argues, "sound" science is called upon in order to mediate political conflict over trade. Mariann Fischer Boel, the EC Agricultural Minister, argues that the Member States play political games in their refusal to act to certify GMOs as safe, even when new scientific information isn't being introduced (quoted in Davison 2010). This "soundness" is equated with technical precision, value neutrality, and objectivity. Whereas the EU has continually defined and redefined its position toward GMOs, the United States has remained stable, refining it around the edges but otherwise staying constant in its defense of the "sound science" of GMOs. Thus, scientists and policy makers in the United States articulate the position of "sound science" as the default, logical, objective position.

The United States argues that "sound science" is a neutral arbiter of international trade policy and is the only way to avoid protectionist trade restrictions. At the General Agreement on Tariffs and Trade (GATT) negotiations in 1994, the United States successfully advocated to have the SPS (Sanitary and Phytosanitary) Agreement adopt a "sound science" model for regulation. The SPS is perhaps the most significant policy document for the evaluation of GMOs in international trade. As Kleinman, Kinchy, and Autry describe, the SPS agreement:

> allows countries to block imports of food products that pose a clear and measurable health risk, but not to selectively block imports from certain countries while allowing the same products to be imported from other countries or to be produced domestically. To meet this objective, the SPS

> agreement requires that the measures countries take either be based on conventional scientific risk assessment or comply with the standards of one of three existing international bodies (which use similar approaches to scientific risk assessment)" (2009, 363).

This has important implications for trade barriers; because the WTO adopts a neoliberal model to evaluate trade disputes, it effectively invalidates claims based on the precautionary principle.

Intense trade disputes emerged between the two bodies as Europe issued a moratorium on the import of GM crops, which the US viewed as an unjustified trade barrier—and the two bodies essentially hit an impasse that negotiations couldn't solve (Pollack and Shaffer 2009). Both the US and Europe appealed to international bodies to help adjudicate trade disputes. When the negotiations inevitably failed, the United States, along with Canada and Argentina sued the EU in front of the WTO for its ban on importing US GMO products. Kelemen (2010) argues that opening the European markets to GMOs was politically untenable due to the domestic political climate of various member countries. As such, the EU instead took the opposite strategic tact, and sought to internationalize the precautionary principle through the 2000 Cartagena Protocol on Biosafety. Cartagena's adoption the precautionary principle lent it an air of legitimacy, thus making it easier for the EU to justify the moratorium on importing GM crops. The strategy was particularly successful because the moratorium did little to hurt EU companies or farmers, few of which grew GM foods (Kelemen 2010, 343). [28]

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[28] Spain was granted an exemption to the moratorium

US-EU Conflict, 2004-Present

In 2006, the WTO ruled that the EU had illegally blocked GM imports from 1999-2003; they did not, however, confront the EU's new policy that had been in place since 2004 (Regulation 1829/2003/EC and 1830/2003/EC; see Commission of the European Communities 2003a, 2003b). The US hoped that the outcome at the WTO would result in Europe realizing that its moratorium was anti-scientific, and Europe hoped that US regulators would become more amenable to precaution. Since the WTO conflict, there has been a softening in tone in US-EU relations. Ron Kirk, the Obama administration's trade representative, has indicated that the administration prefers returning to negotiation instead of increased litigation (Pollack 2013). One result of the WTO decision was that it referred to the Codex Alimentarius, the international set of food standards, in its decision—the Codex Alimentarius (Book of Food) existed as a reference point on food safety and standards with no enforcement mechanism. Ironically, the WTO's ruling on GMOs put weight behind the Codex—what Pollack and Shaffer (2009) refer to as hardening the soft law of the Codex while softening the hard law of the WTO. The WTO primarily adjudicates the international level of the dispute—for example, the trade dispute over whether the EU can restrict the importation of GMOs from the US, and whether the US and Canada could impose import tariffs on French Roquefort cheese in retaliation.

This change in strategy from the US government mirrors a shift in tactics displayed by US GMO interests. US officials specifically attacked the EU's reliance on the precautionary principle for being anti-science: Ann Venemen, the Secretary of Agriculture under the Bush administration, advocates a "sound science" approach as

an alternative to the precautionary principle: "Today the argument is more compelling than ever for clear and common standards based on 'sound science' ... unfortunately, in Europe there is now a competing concept called the Precautionary Principle, which seems to rest on the premise of the mere existence of theoretical risk. ... [T]his concept, which is not based on any objective standard, could easily block some of the most promising new agricultural products ... especially those based on biotechnology" (USDA 2002).

In November of 2014, the USDA approved a potato manufactured by the J.R. Simplot company. This potato is engineered to produce less acrylamide, a cancer-causing chemical that potatoes emit when they are fried at high temperatures (Pollack 2013). Previous attempts to bring GM potatoes to market in the US have failed, but there is high hopes for this potato for three reasons: it has a discrete benefit to the consumer, it is manufactured using genes from other potatoes, rather than other species, and its owner is a competitor of Monsanto. In short, this potato is emblematic of a new culture in GM crops, and perhaps the best hope of turning around anti-GM market forces.

There is at least some evidence that the US and EU are beginning to meet in the middle in terms of GMOs for both domestic and international reasons. Davison (2010) points to GAO and USDA Inspector General reports recommending increased control over the GMO system. Because of the recent problems with cross-contamination of unauthorized GMOs into the food chain, the GAO recommends increased oversight over the GM industry to help monitor whether there are economic or environmental affects of GMOs, or food safety concerns, with pressure

on the EC to deregulate policy making on GMOs to the states and with the US slowly adopting GMO-specific regulation on a state-by-state basis.

Conclusion

The United States has pursued the cultivation and marketing of GMOs both at home and abroad for the past thirty years. The US government has domestically spoken with one voice in terms of evaluating claims against GMOs solely on the basis of sound science. In the international arena, GMOs have been a source of continual conflict between the US and the EU. Whereas the US has accused the EU of protectionism for refusing to import GM crops, the EU has struck back forcefully, creating a regulatory apparatus that requires individual approval of each crop by the European Commission. Although the tenor of the conflict has changed somewhat under the Obama administration, the substance has not and GMOs remain a source of contention.

The regulatory politics explanation provides a framework for understanding the conflict between the United States and Europe, and the way that domestic actors influence international actors. Kelemen (2013), in his review of Vogel's book, asks about the "turtles all the way down" problem of any causal explanation—if public opinion, political elites, and regulatory criteria drove the shift in regulatory stringency, what were the drivers behind those three factors? He suggests that, in the United States, partisanship is an explanatory variable that Vogel does not explore. He suggests that opinions over climate change and greenhouse gases, for example, break down along partisan lines. However, there are not the same partisan divides over GMOs. Indeed, the political divide is much more of a geographic one

than a partisan one (Shaffer 2013). If there is a flip back on GMOs it seems that the persistence of negative public opinion toward GMOs in the United States will likely be the driver. Indeed, Vogel (2013) references in his work the question of why does what Americans want, or worry about change? He argues that we need to understand the shift in American public opinion and why it stopped being concerned with risk. Here, on the issue of GMOs, there is a shift back—and *I argue that understanding the rejection of sound science is key to understanding why that shift has occurred.* The regulatory literature is an important backdrop for this project because it creates the framework within which the debate over sound science is operating.

PART THREE: CASE STUDIES

This part conducts case studies of each of the five countries: The United Kingdom, Germany, Poland, Spain, and the United States. For each case, I examine the political, economic, cultural, and public opinion context of GMOs. The end of the chapter offers a comparative analysis of the variance between the countries.

Chapter Five: Case Studies

The previous two chapters established the global context for the debate over GMOs by examining the ideology of sound science, how it is articulated in the global discourse, as well as its specific manifestation in the case of the European Union. This is the backdrop for all EU countries. Against this backdrop, specific domestic responses to GMOs emerge. This chapter presents five case studies of the United Kingdom, Germany, Poland, Spain, and the United States. Each case study examines the way political, economic, cultural, and public opinion context of GMOs, and how they have changed over time from before the European moratorium to present. This analysis shows that there is significant variance between countries both in terms of change over time and in terms of how the issue is understood and articulated politically.

Case One: United Kingdom

Introduction

In the early 1990s, John Gummer, the UK's Conservative Minister of Agriculture, fed his four-year-old daughter Cordelia a hamburger on national television to demonstrate that British beef was safe (in response to the mad cow disease scare). Shortly after, over one hundred British citizens died from a form of mad cow disease. When Tony Blair attempted to assure a skeptical British nation of the safety of GMOs, the media immediately resurrected the Cordelia incident, both

reinforcing the link between GMOs and other food safety incidents, and impeaching the government's credibility on food safety. The public was convinced that the BSE scandal "suggested systematic conflict of interest on the part of UK authorities, and the cases discovered at the time threatened to be merely the tip of the iceberg" (Ansell and Vogel, 2006, 14). This is the environment into which GM crops were introduced in the United Kingdom.

Genetically modified crops enter Britain mainly as animal feed. There is not yet commercial cultivation of crops, but there have been experimental trials of GM potatoes and wheat in recent years. In 2014, Rothamsted Research successfully completed a field trial of GM Camila sativa ("false flax") (BBC News 2014). In short, the United Kingdom is moving away from its position as an early, outspoken critic of GMOs.

Perhaps as a result of the initial high-intensity scrutiny of GMOs, public opinion is moderating from its high levels of opposition in the late 1990s and early 2000s, and the government has signaled an intention to begin growing GM crops in 2015. As Chapter Six explores in greater detail, neither Greenpeace nor Friends of the Earth currently maintain an active GMO campaign in the UK. Email correspondence with Issy Griffin from Greenpeace UK, indicated that, although a "watching brief" on GMOs is maintained, there is no need for an active campaign against GMOs "because of the sterling work many grass roots groups and organisations like Greenpeace and FoE put in over 10 years ago now" (author correspondence 2015).

Thus, professional NGOs consider GMOs a more or less settled issue in Britain, and have taken the issue off of high priority. However, the conservative minister of agriculture announced that, should the EU vote to devolve power over regulating GM crops to the states, the UK will begin cultivating crops as early as 2015 (Nelson 2015). Whether this will lead to an increase of GM-labeled crops on the shelves of UK grocery stores, or the public will continue rejecting GM crops, is uncertain.

Political

The prince's opinion on GMOs has been enormously influential. When Prince Charles spoke out against GMOs, it "obliterated Monsanto's efforts to win sympathy for genetically modified crops" (Charles 2001, 222). Charles quotes Philip Angell, Monsanto's former head of public relations: "It changed the coverage of the debate and the profile of the issue almost forever. And it blew away the low profile approach of our advertising." (2001, 222)[29] Prince Charles has remained on the offensive; in 2008, in an interview with the *Daily Telegraph,* the prince called GMOs

[29] The rhetoric of the Prince mirrors that of the Church of England, which also opposes GMOs. Religious opposition has predominantly come from England. As Omobowale et al (2009) note, in 1999 the Church of England asserted religious authority over the topic of GM food in their statement that "religious traditions, which are reservoirs of wisdom accumulated and sifted over the centuries, have a vital role to play in helping society to reach the right conclusions" about the genetic modification (GM) of food crops. The Church has taken a position advocating the labeling of GMOs to provide consumers the information needed to make informed choices. The Scottish Anglican church has also vocally opposed GM food, accusing scientists of playing God and going against the natural order of food production (Paarlberg 2000).

a “gigantic experiment… with nature and the whole of humanity which has gone seriously wrong” (in Randall 2008).

There were also reverberations of Prince Charles’s outspoken position on Downing Street. In 1999, William Hague demanded at Prime Minister Tony Blair's question time: "Why hasn't the Government accepted the advice of English Nature, which is by law the Government's advisers on these matters, by delaying for at least three years the commercial release of these crops until more research is done?" Mr. Blair countered: "There is a committee in the Government looking at this on the basis of scientific evidence - I think that is the best way to proceed. The worst way is to raise fears in the public mind before the evidence is put before them" (in Waugh and McCarthy 1999).

However, Blair later recounted and put in place a UK-wide moratorium on GM crops. The government, feeling pressure from the United States to allow import and cultivation of crops, announced “GM Nation” in 2003, a nationwide debate over GMOs to take place in the UK. GM Nation involved over 30,000 participants and was one of the largest ever public engagement exercises (Reynolds 2013). The government and biotech firms decided to stage this debate because they were concerned that “public and political opinion was learning to see gene technology, genetic engineering, biotechnology and so on as a single, vague and disquieting phenomenon” (Mark Cantley, quoted in Gaskell et al 2009, 334).

As of June 2014, when the new EU policy to devolve decision making over GM crops to the individual member states passed through the EU Environmental Council, the UK’s government announced its intention to begin cultivating GM crops

(although Scotland and Wales remain committed to a ban). Owen Paterson, the UK environment secretary, who had been pushing for the "repatriation" of GM crop decisions, said that the agreement was a "major advance" in his plan to turn England into a center of GM research (Harvey 2014). This intent was reiterated when the European Parliament approved the measure in early 2015; British MEPs praised the new rules as a decentralization of power, and Sarah Cundy, the UK's head of GM Policy and Regulation, promised to fast-track the approval process for cultivation in the UK (Nelson 2015). Although Conservatives are the most vocal supporters of GMOs, the Labour party has voiced interest in the potential for job creation should GMOs be once again allowed in Britain.[30]

Cultural and Economic

The movement against GMOs arose in the UK in the 1980s, but there was little sense of urgency or risk, and the movement had trouble getting off the ground. Indeed, a GM product was already for sale in the UK, and selling quite well. Zeneca, a British biotech company, was already selling GM tomato paste in Britain, and the product was carefully labeled as such, which a sign offering "a world-first opportunity to taste the future." The front of the label read "Californian tomato puree: made with genetically modified tomatoes" and the back of the can read "the benefits of using genetically modified tomatoes for this product are less waste and reduced energy in processing" (Redenbaugh and McHughen 2004, 5). Their strategy

[30] There is also a federalist component to the political divisions over GMOs. Scotland and Wales have long opposed GM crops; the EU's 2015 decision to decentralize decision making power will give Scotland and Wales authority to ban the crops from being grown on their soil (Briggs 2015).

was to be upfront and provide consumers with full information: Simon Best, the director of biotech projects at Zeneca, described how the media strategy: "You will be able to go into a supermarket in February of 1996 and buy this … There was a huge uproar. But then it was all over" (quoted in Charles 2001, 188). Because it was actually more expensive to sell tomatoes this way because of the high initial costs of production, the Zeneca tomato was a marketing test to see if the British public would buy GM crops. And they did. Indeed, the initial response to GMOs in Britain was not one of panic and suspicion. GMOs were met with some skepticism but also a sense of humor and irony. A reporter London's Daily telegraph took a Flavr Savr tomato home with him. He wrote: "It prompted disturbing thoughts of Faust and Mephistopheles, devilish pacts with immortality, of Frankenstein and monsters with bolt running through their necks … the cuddliest of Frankenfoods" (Charles 2001, 135).[31]

The major shift in the movement against GMOs was catalyzed by three events in 1996 and 1997: the cloning of Dolly the Sheep, the BSE crisis, and the import of Monsanto's GM "Roundup Ready" soy into the UK (Gaskell et al 2003). As Monsanto prepared to sell GM soy to the United Kingdom, Zeneca's Simon met with Robert Shapiro, Monsanto's CEO (Schurman 2004). Zeneca's leadership encouraged Monsanto to label the produce as containing GMOs, but they ignored the advice, instead packaging it with conventional soy and sending it to Europe without advance notice or labeling it. Schurman and Munro describe the situation as such:

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[31] The term Frankenfood had actually originated in the United Kingdom; the OED reports the first known use in the *Sunday Times* in 1989 in the headline "Fear of Frankenstein Food."

"Monsanto stormed into Europe with the urgency of a general going to war and made one political mistake after another in its dealings with the European public, supermarket sector and governments" (2009, 172). Best, in a premonition of what would transpire, worried that Monsanto was gambling with the future of biotechnology in Europe (Charles 2001). Perhaps Monsanto believed it was better to ask forgiveness than permission, or maybe they believed that the UK public would fail to take notice of the possibility of GMOs in their food if no one called attention to it. Whatever the rationale, it backfired, creating a sustained—and successful—anti-GMO movement that started in the UK and spread across Europe. Monsanto became a major target of protest across Europe. In the UK in particular, the company was seen as an organization that would openly flout European citizens desires to abstain from GMOs (Schurman 2004). As Monsanto ramped up its multi-million dollar "good will" campaign across Europe, anti-GMO activists began to file complaints with the British Advertising Standards Authority, accusing it of false advertising (Schurman 2004). The protests tied Monsanto to the image of the "ugly American" exercising culturally insensitive and ethically shaky business practices (Schurman and Munro 2006). A consumer rights movement that advocated ethical consumption became a prolific force of change in the United Kingdom and across Europe (Johnston 2007).

These three events catalyzed the movement and gained the support of Greenpeace, Friends of the Earth, and the British Soil Association. The movement in the UK mobilized three groups: consumers, activists, and the elite. Schurman and Munro demonstrate that the early movements in the UK against GMOs focused on a "politics of counterexpertise," wherein the movement attempted to "exploit…the

scientific uncertainties associated with GM foods" (2009, 170) and to advocate that governments adopt a precautionary approach to GM foods (see also Purdue 2000). This politics of counterexpertise was supported by the perceived attack on science that proceeded the Pusztai affair.

Protest

The movements against GMOs included campaigns that directly targeted consumers, as anti-biotech groups used leaflets and letter writing campaigns to raise public awareness about the presence of GM foods in the grocery stores (Schurman 2004). Greenpeace produced a shopper's guide to help customers avoid products and stores that contained GMOs. Consumers directly targeted retailers and producers with phone calls and letter writing campaigns.

NGOs also targeted the grocery stores and producers themselves, as Friends of the Earth UK, the Soil Association and the Women's Environmental Network pressured the retailers and distributers to stop trading in GM products (Schurman 2004). In 1998, Iceland Foods agreed to go GM free; Malcolm Walker, the chairman of the chain, announced that he was determined to find a way to eliminate all "Frankenstein foods" from Iceland Foods. This resulted in a cascade effect that fundamentally changed the industry's approach to GMOs (Schurman 2004). Major retail chains in the UK such as Unileaver, Sainsburry's and Tesco's began to transition away from GMO products. High percentages of food in the UK is sold by major supply chains (Nicholson & Young 2012). As a result, the pressure from the anti-GMO movement to boycott retailers who traded in GM foods was enormously successful because there was such a high concentration of food retail (Kurzer and

Cooper 2007).[32] Anti-GMO groups produced blacklists of retailers carrying GM products, and this created enormous market pressure (Seifert 2006). As such, few stores in the UK carry GM products.[33]

Direct Action

Consumer protest was complimented by direct action, lead in large part by Greenpeace. Activists blockaded ports, disrupted seed trials, and engaged in other performative forms of protest successfully designed to capture the attention of the media. A major form of protest in the United Kingdom has been "crop-trashing," where protestors destroyed fields of GM crops (Doherty and Hayes 2012). In 1999, Greenpeace UK staged a high profile crop-trash at Lyng in Norfolk as a media oriented spectacle. This action resulted in the arrest and eventual acquittal of 28 participants and was highly visible; most other crop trashings have been covert and taken place at night.

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[32] Marlow (1973) traces the etymology of Boycott back to the refusal of Irish peasants to farm the land of Captain C. Boycott in the 1800s. She recounts the following story:
I said, "I'm bothered about a word."
"What is it?" asked Father John.
"Well," I said, "When the people ostracise a land-grabber we call it social excommunication, but we ought to have an entirely different word to signify ostracism applied to a landlord or land-agent like Boycott. Ostracism won't do—the peasantry would not know the meaning of the word—and I can't think of any other."
"No," said Father John, "ostracism wouldn't do"
He looked down, tapped his big forehead, and said: "How would it do to call it to Boycott him?" (Marlow 1973).
See also Tarrow (2013) *The Language of Contention: Revolutions in Words,* for his discussion of the way the contention entered into language at this time, first in terms of the word "revolution" entering French in the late 1700s and early 1800s. The coining of the word "boycott" seems to fit within this birth of the language of resistance and revolution.
[33] A complete list of products containing GM ingredients is found at GMfreeze.org

In the UK the protestors, groups of radical environmental activists linked through an organization called Earth First!, had developed direct action techniques of occupying spaces and damaging property that they used to protest the Conservative's plan to expand roads and airports (Doherty and Hayes 2011). These direct action techniques were redeployed in the face of technocracy. Activists perceived GM nation as an attempt to silence the public. As GM Nation activists began, activists across the UK mobilized and began to participate in direct action like dressing as giant corncobs and bees dancing in supermarkets and fields. As field trials spread across Europe, authorities hoped the field tests would "clos[e] down and narrow the debate into technical issues, they produced a more complex, turbulent situation, generating new forms of activist knowledge and critiques of GM crop science and its entangled ecological and social potentials" (Reynolds 2013).

The Prime Minister became the target of media and activist sentiment as well. One 1999 headline read: "THE PRIME MONSTER; FURY AS BLAIR SAYS: I EAT FRANKENSTEIN FOOD AND IT'S SAFE" (Voice of Mirror). There were also colorful symbolic acts of resistance; in February of 1999, Greenpeace dumped four tons of Roundup Ready soy outside of the Prime Minister's residence at 10 Downing Street; the truck transporting the soy bore a message to Prime Minister Blair; it read: "Tony don't swallow Bill's seed."

Public Opinion

Public opinion in the United Kingdom, as in the rest of Europe, changed markedly after the food scandals of 1996. In the 1996 Eurobarometer survey, 52% of respondents reported never having discussed biotechnology but by 2000 more

than 70% had heard of GM foods[34] (Gaskell et al 2003). Opposition to GM food in the UK rose more than 20 percentage points between 1996 and 1999 (Gaskell et al 2000). There is also evidence that the campaigns against GMOs influenced public opinion. By 1998—two years after the concerted campaigns against GMOs had begun, only 14% of the British public reported being happy with the introduction of GM foods into the food supply, and 96% wanted labeling ("Seeds of Discontent," 1999).

There is some evidence that public resistance to GMOs is beginning to wane. One is the resounding success of the social movements in the UK: the movement successfully targeted public opinion, grocery stores and retailers, and the EU Parliament. A 2013 survey co-sponsored by Farmers Weekly and Barclays Bank found that 43% of British citizens were completely against the technology, with 21% in support. Even though the public is still weary of the technology, the opposition no longer registers the same intensity of resistance.

Conclusion

The United Kingdom was the first country to receive a shipment of genetically modified crops from the United States. The crops arrived in the wake of the BSE scandal. The public quickly mobilized, in part because of vocal concern from Prince Charles, and began protesting the crops. Mobilization against GMOs happened quickly and effectively in the mid-1990s in the UK, and touched nearly all facets of society; this forced the government to take quick and decisive action. The British government, partially because of its close ties to the United States and its frosty

[34] The only country with a higher recognition rate is Greece.

relationship with the EU, has long been in favor of GM crops. However, the early public rejection of the crops led to a country-wide moratorium. The analysis above shows that the British population rallied early against GMOs. A consumers' rights movement emphasized a critique of the American corporations as well as a focus on ethical consumption. There has been considerable consumer-driven economic pressure, including boycotts, resulting in a closed market to GM crops. The rapid mobilization of the public in the 1990s, as well as the government's seeming willingness to engage in dialogue through hosting GM Nation in the early 2000s, meant that the public's opposition to the technology has moderated since the mid-1990s.

In 2015, the British government signaled its intent to begin cultivating GM crops. Although the majority of the public still distrusts the technology, ambivalence toward the European Union makes the public reluctant to accept EU-wide regulations. Whether there will be a market for the GM crops, and whether public opinion will continue to be cautiously optimistic, is an open question.

Case Two: Germany

Introduction

German resistance to GMOs has followed a different trajectory than the United Kingdom. In Germany, food biotechnology is linked to a broad spectrum of issues such as agricultural overproduction as a consequence of EU policy, other technological controversies such as the nuclear power debate, and the perceived economic imperialism of multinational companies and the USA (Peters et al 2007).

From its early start, the country experienced considerable internal conflict in terms of its position toward the technology. The public discussion over biotechnology began in the 1980s, when civil society organizations began raising early warning signs about the potential dangers of GMOs. In the late 1980s, a sociologist named Wolfgang van den Daele brought opposing forces together in a government-funded "participatory assessment" of genetically engineered crops. Monsanto agreed to participate, followed by leading German seed companies, academic researchers, and critics of biotechnology. Over the following two years, the group met ten times in Loccum, vigorously debating the arguments on each side of the biotechnology controversy.

Despite the early public concern, the German government remained heavily invested in biotechnology. In the early 1990s, biotechnologies were viewed as a huge economic opportunity not to be passed over, and the government heavily invested in the industry (Ferretti and Pavone 2009). The food scandals that hit Europe only reached Germany in 2000, when its first case was documented. The federal agricultural minister was replaced with a Green Party member, who adopted highly critical approach toward genetic engineering in agriculture. In 2001, as part of the Social Democratic Party-Green government, Germany adopted a policy of 'Agrarwende,' a significant shift in agricultural policy that focused on the consumer rather than the producer (Boecker Hartl, and Nocella 2008). There was sustained public debate over GMOs for the ensuing eight years. Due to sustained pressure from the citizen groups, the government banned all GM crops in 2009. However, Germany remains in many senses a study of contradictions: Angela Merkel's

Christian Democratic party supports GMOs, but they are opposed by the other parties in the coalition government.

Political

The political story of GMOs in Germany is a cooperative one between the government and professional civil society organizations. Ferretti and Pavone (2009) note Germany's tradition of including pressure groups in policy making, a phenomenon which has extended to science and technology. The German government took a proactive role in making sure there were clear lines of communication between civil society organizations and the government in order to adjudicate the controversy. The professional environmental NGOs—Greenpeace Deutschland and the BUND (Federation for the Protection of Environment and Nature) were able to successfully connect with the public. BUND and Greenpeace engaged in "informational activism" to educate the public, targeting specific organizations that used GMOs in their consumer outreach programs. As such, the topic of biotechnology remains highly institutionalized and well integrated into the political administrative systems, largely because of the political success of the Greens. This willingness to negotiate with professional pressure groups underscores the new orientation of the German government after Agrarwende that endorses a consumer, rather than producer, oriented policy toward agriculture. The model is one of responsive government. Katzek (2014) describes how today GMOs have become something of a third rail issue in German politics, where even conservative parties have adopted a stance opposing GMOs because the price of support is too politically costly.

In 2008, as the intensity of German resistance to GM crops began to increase, local politicians from Bavaria put pressure on the federal government, and in the government banned MON 810 (GM corn). Ilse Aigner, the German Agriculture and Consumer Protection Minister, announced that MON 810 could no longer be grown in Germany, and invoked the safeguard clause, which required an immediate halt to cultivation of the crop. This decision was championed by the Federal Agency for Nature Conversation, which assumed the task of environmental risk assessment in 2004 and adopted a (Green Party advocated) complexity-oriented, precautionary approach to evaluating GMOs (Boschen et al 2010).[35]

GMOs are still contentious in Germany. They are currently a flashpoint in the Transatlantic Trade and Investment Partnership (TTIP) free trade agreement with the US and the EU-Canada Comprehensive Economic and Trade Agreements (CETA), particularly because neither trade agreement uses the Precautionary Principle as the standard for risk assessment.[36]

Culture and Economics

In contrast to other EU countries where resistance came from consumer groups, in Germany there is sustained economic pressure from farmers to resist growing GM crops. Farmers create this pressure through farming collectives, which are cooperative relationships that establish GMO-free zones. These collectives have

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[35] The move to ban cultivation of crops was opposed by the German Central Commission for Biological Safety (the ZKBS) (Davison 2010). The ZKBS, which advocated a control-based approach to regulation, had its position weakened by Green Party controlled government.

[36] German critics have articulated particular concern over the fact that the North American risk analysis is not done by an independent agency (Euroactiv 2015).

enabled German farmers are able to resist the potential spread of GMOs through collective action; as of 2010, nearly 30,000 farmers were participating in over 200 GMO-free zones as of 2010. Consmuller, Beckmann, and Petrick (2011) find that cooperative establishment of GMO-free zones is both a political statement and collective action to stop the landscape from being altered in undesirable ways. These zones are successful because they prevent cross-pollination of GM crops and conventional crops, allowing entire regions to be certified as GM-free. Additionally, the contractual nature of these collectives prevents free-riding, wherein no farmer within the region benefits by switching individually to growing GMO crops (see Punt and Wesseler 2012 for a game-theoretic explanation of the political economy of GMO-free zones).[37]

Violent and divisive resistance to GMOs began in the late 1980s. Charles writes that

> a powerful antiestablishment youth movement had emerged in the country, hostile to mainstream commercial culture, big business, and technological solutions of all sorts. The Green Party was its political voice. Among other parts of the population, biotechnology awakened traumatic memories of Germany's recent past, in which modern science and technology became tools of military conquest and racial purity. And for whatever reason, German culture nurtured a profound—some called it romantic—attachment to nature, and a conviction that it was threatened by modern technology (2001, 101).

One of the conflicts emerged because, even as the government was banning the commercial cultivation of crops, the government provides funding for research on the technology. At the height of the protests, bombs were planted inside the Max

[37] As of 2011, GM-free regions existed in every EU member state except Denmark, the Netherlands, and the Czech Republic (GMO-Free Regions 2011).

Planck institute as well as at other institutes conducting research into gene technology. Lothar Willmitzer, a biotechnology researcher at the Max Planck Institute, says "I know of colleagues which always look below their car before they enter their car and so on. We had some tough times in Germany" (in Hecht 2010).

Although resistance to GMOs became calmer and more institutionalized in the early 1990s, occupations of GM fields remain a unique feature of German resistance. Protestors from local communities would occupy fields in attempts to keep the seeds from being disseminated, and, barring that, they would resort to nighttime field destructions (Seifert 2013). In 2005, a public database began listing the locations of all GM test fields, which made it easy to design and execute anonymous field destructions. Between 1995 and 2009 (when Germany banned MON 810), five long-term field occupations took place, as well as 74 anonymous field destructions (Seifert 2013). Open field destructions were far less common than anonymous field destructions. In 2004, a group which called itself Gendreck weg![38] modeled itself on protest organizations in France and began to plan specific anti-GMO protests, including the direct action and field destructions; they staged one field destruction each year.[39] In 2006, 15 Greenpeace activists invaded a field in Brandenburg and uprooted maize plants to protest the use of GM feed in dairies. Even once the ban on MON 810 was in place, research field trials faced occupation and destruction (Hecht 2010).

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[38] Seifert translates as Gene-crap get lost; dreck is dirt, filth, mess and weg! Is like go away! Or get lost!

[39] German "field liberators" were modeled on the French "faucheurs" like José Bove, the leader of French anti-GMO resistance, had become a folk hero and popular celebrity across Europe.

In 2004, the end of the EU-wide moratorium on GMOs revitalized the German anti-GMO movement; 10,000 protestors marched in Stuttgart (Seifert 2013). Germany's professional organizations were enormously helpful in lobbying the government for a ban of GMOs. Although some direct action took place, the majority of anti-GMO action was conducted via professional civil society channels and negotiations with the government. In 2012, Gendreck weg! disbanded; "The activists justified the move by explaining that since the end of commercial GM-cultivation was brought about through the banning of GM corn variety MON810, their major objective had been achieved. Political reform had thus rendered protests unnecessary" (Seifert 2013, 230).

Public Opinion

Seifert argues that, although protests against GMOs began relatively early, the movement was "slow to gain resonance with German's public" (2013, 224). Eurobarometer found that support for GMOs declined in Germany from 56% in 1996 to 30% in 2005. However, Boecker, Hartl, and Nocella (2008) find that, aside for 15% of the population deeply in support of or against GMOs, there is a general sense of ambivalence toward the technology. Christoph, Bruhn and Roosen (2008) also argue that the characterization of Germans as vehemently opposed to GMOs is overstated, and that about 50% of are conflicted about biotechnology. However, a 2013 survey by the Federal Agency for Nature Conservation found that 84% of Germans are against cultivation of the crops on German soil (EuroActiv 2015). As such, German popular opinion adopts something of a "not in my backyard" approach, opposing cultivation on German soil.

Conclusion

In Germany, direct action against GMOs was balanced by the professional civil society organizations advocating a ban on the technologies. The resistance to GMOs in Germany is a consumer rights movement, but also a critique of technology and a defense of nature, reinforced by the power of the anti-GMO farming collectives. Although Germany was initially a major player in the GM market in Europe, public pressure led to economic actors pulling out the market and government bans on the technology. Because of pressure from civil society groups, and the strength of the Green Party in the country, the country banned the cultivation of GMOs in 2009. Although the German public is opposed to GMOs in aggregate, many experts believe that the German public is largely ambivalent about GMOs – the issue lacks salience. GMOs continue to be a wedge issue in German politics, threatening the coalition government between the Christian Democrats who support GM technology and the Social Democrats who do not.

Case Three: Poland

Introduction

In 2004, the European Union was simultaneously replacing the moratorium on GMOs with its new regulatory regime and undergoing the largest expansion in its history as it added Central and East European countries. Observers of the enlargement were worried that the accession of CEECs would lead to a "race to the bottom" in terms of regulation and safety standards of GMOs (Huzair and Robbins 2011). Critics were concerned that the overly centralized nature of state control

over science in the Soviet era would lead to a "policy vacuum in biotechnology" as states withdrew control over science during transition (Huzair and Robbins 2011, 3). It was not clear the extent to which the new governments were capable of managing the biotechnology market. As the moratorium was being lifted, the old member states did not want a backdoor of biotechnology coming into Europe from the east. These fears proved to be, for the most part, unsubstantiated. Although some central European government do grow small amounts of GM crops - the Czech Republic, Romania, and Slovakia each grow less than 50,000 hectares - (ISAAA 2013), Poland and Hungary have been aggressively anti-GMOs.

The concern over the effect of EU expansion on the new GMO regime was compounded by the fact that the US government had brought the European Union in front of the World Trade Organization, which fostered the perception among many of the governments that the United States was trying to forcefully open Europe's markets to GM foods. Thus, as EU countries believed their non-GMO status was under attack from the United States, there was particular worry that the US would exploit the newly admitted CEE countries. There was a major concern among anti-GMO activists from the west that EU enlargement would act as a back door, allowing GM foods to flood the market from the east (Kacza and Lackner 2011, 151). Additionally, the United States was actively courting influence in Poland. In 2003, a team from the United States Department of Agriculture (USDA) visited Poland to assess it agricultural structure (Reynolds and Szerszynski 2012). At 1.9 million farms, Poland had the largest agricultural sector of all accession countries, but most were small family farms that averaged just 6-8 hectares (the US has an average farm

size of 200 hectares). The USDA recommended a market-based restructuring of the Polish agricultural industry with a consolidation of family farms into larger enterprises, and a reduction in the overall levels of agricultural employment amongst the rural population (USDA 2003). These recommendations hoped to steer Poland "towards a single, globally universal agro-industrial paradigm" (Reynolds and Szerszynski 2012, 194-195). As such, Poland became a proxy in the dispute between the European Union and the United States, with each side projecting its own hopes and fears about GMOs onto the country's transition. Despite these aggressive lobbying efforts by the U.S. government and U.S. companies like Monsanto, attempts to reform the Polish agrarian economy have met limited success, in part due to the efforts of the International Coalition to Protect the Polish Countryside (ICPPC), a civil society group dedicated to supporting the rights of peasant farmers and opposing GMOs.

Political

GMOs did not emerge as an issue in Polish politics until the mid-2000s. Opposing GMOs is a rare win-win for the Polish government, appeasing environmentalists, nationalists, and the agricultural sector. As a result, they have one of the strictest bans on GMOs in Europe, forbidding both feed and seed. The debate over GMOs in the government has been "a political tussle" between the EC, public opinion, and the opinion of political leadership, which Twardowski and Twardowska describe as "zigzagging between a strong opinion to GMOs and a wish for a 'GMO free country,' and pressure from experts and economic leaders to embrace GMOS" (2008, 8). When there has been movement away from these strict

bans, the anti-GMO movement, led by the agrarian ICPPC, have used street theater and mobilized farmers in protest.

Polish politicians have been unwilling to risk alienating the agricultural sector, and so all major parties oppose GMOs. They have been willing to stand up to the European Union and maintain their ban on GMOs, despite being repeatedly brought in front of the European Court of Justice. The EC filed a complaint against Poland in the Court of Justice, and won, in July of 2009; the Court ruled that Poland was violating the directive and lacked additional scientific evidence of the dangers of the plants (Mroz 2013). Poland's ban on GMO crops violates ED Directive 2001/18, which prohibits member states from regulating or banning crops that have been approved by the commission (Wrześniewska-Wal 2009). The Polish government passed some of the strongest anti-GMO legislation in Europe in 2012, refusing even to import EU-approved crops. In January of 2013, Poland again banned cultivation of GM corn and potato; the EC again took Poland in front of the ECJ. The constant push and pull between the EU and Polish government is likely to end under the EU's new decentralized rules regarding GMOs.

There is some support for GMOs from those in Poland who think that biotechnology is a means to compete in a high tech global economy (Twardowski and Małyska 2012). Poland experienced unprecedented economic growth in the 2000s, far outstripping its central and eastern European neighbors; indeed, the Polish economy was the only European economy to grow in the wake of the financial crisis of 2008. This is both a point of pride for the Polish government and people, and is the primary foundation of the arguments in favor of expanding the

biotechnology industry. Development of a biotechnology industry in Poland could recruit researchers with high intellectual potential (Twardowski and Małyska 2012). The Polish Academy of Sciences established a Biotechnology Committee; the scientists on the committee strongly support the use of GMOs for industry and agriculture. In its 2012 position paper, the biotechnology committee argues that biotechnology should be pursued to keep Poland's economy competitive: "For the sake of Poland's economy… [and in] view of the significant and continually growing role of Poland in the European Union, we believe that this country could and should become an advocate of the introduction of modern technologies in agriculture and other sectors of the economy" (BioTechnologia 2012, 8). This pro-GMO stance is in opposition to the official anti-GMO position of much of the Polish government, as well as the Polish agricultural sector.

Economics

The issue of GMOs reveals the class and economic divides within Poland. Whereas the high-tech economy is pushing for the expansion of biotechnology, as discussed in Chapter four, the traditional agricultural sector is staunchly against expansion. Whereas the pro-GMO stance extols the potential virtues of a high-tech future for the Polish economy, the anti-GMO position strongly reflects a distrust of multi-national corporations gaining power over rural Poland. Ethington quotes an activist for a Polish peasant group (SIE) as saying "I think these companies are trying to control production, and if you control food production you control everything" (2013, 59). Jadwiga Lopata, the founder of the ICPPC, one of the most outspoken farming/anti-GMO groups, also argues that the battle over GMOs in

Poland is related to competition between independent family farms and the multinational corporations. There is a spatial component to the Polish opposition to GMOs. Reynolds and Szerszynski explain how the small size of family farms make complying with EU coexistence norms impossible:

> In Polish debates around separation distances, zones and regions, the patchwork of family farms makes EU coexistence norms impossible. In 2008 the European Commission rejected a draft Polish law that would have restricted the planting of GMOs to designated zones. The Polish government had justified the measure by reference to the large number of small farms in Poland, arguing that this made the farm-level isolation of GM from conventional and organic crops impossible (2012, 194-195).

Thus, in Poland the issue of resisting GMO crops is intimately related to the issue of preserving small family farms, which are considered a vital part of Polish history and tradition.

The strength of the agricultural sector has prevailed in pressuring the government to adopt one of the staunchest anti-GMO stances in Europe. Although there are internal divisions over the future of GMOs in Poland, the anti-GMO stance allows the government to show its independence to the European Union as well as show solidarity with the agricultural sector. These alignments mean that it is unlikely that Poland will change its official position on GMOs in the near future.

GMOs have been perceived as a threat to the agrarian class, and have been opposed by all major political parties. Platforma Obywatelska (PO), or the Civic Platform, is the centrist party that has had control of the Polish government since 2007. They endorse the slogan “Polska wolna GMO,” (GMO-free Poland) and opposition to GMOs is part of the party platform. Opposition to GMOs is one of the few areas of agreement between PO and Prawo i Sprawiedliwość, (PiS), the right -

wing major opposition party (Twardowski and Twardowska 2008). The "General Polish Position on Genetically Modified Organisms," which articulates a policy of GMO-free Poland, was signed in 2006 and again in 2008; this reinforces Poland's law on seed and plant protection (Smith 2008).

Protest

Poland's political mobilization against GMOs was informed by its history of protest and its agricultural power, even as the newer economic segment advocated GMOs as a path to modernization. Anti-GMO social movements in Poland organized around the defense of traditional Polish food, agriculture, and rural social structure (Reynolds and Szerszynski 2012). The International Coalition to Protect the Polish Countryside (ICPPC), an agrarian-based organization, leads the anti-GMO movement in Poland and mobilized farmers in a campaign that targeted each voivodeship's administration and politicians. By 2006, all 16 Polish voivodeships had made GM free declarations, "putting Poland in the vanguard of the European GMO-Free Regions movement along with Tuscany and Austria" (Reynolds and Szerszynski 2012).

Activists in Poland articulate environmental narratives that connect GMOs with the history of occupation and warn against new attempts by outside forces to control Poland. Greenpeace Poland produced a movie that detailed the attempts of biotech giants like Monsanto to influence Polish politicians. The following story is commonly recounted by anti-GMO activists in Poland:

> In the early 1990s…a German biotechnology corporation developed transgenic potatoes in the laboratory, but it needed to test the new potatoes in a field trial. The company planted a field with the biotech potatoes, but local

> environmental activists in Germany kept digging up the potatoes at night and obstructing the field experiment. Finally, the company leased a plot of land from a Polish farmer just across the border. The biotechnology researchers were able to continue their experiment unimpeded because Polish citizens had never even heard of genetically manipulated potatoes, let along developed opinions for or against them (Harper 2004, 11).

Whether this story is true or apocryphal, it is a framing narrative that connects much of what Poles fear: predatory Western corporations exploiting Polish ignorance. GMOs are thus viewed as "ecocolonialism," and as a threat to tradition and the sense of what is Polish. These narratives "resonate with populations that come from a legacy of occupation and communism and have now emerged into a world that is now dominated by Western aid and influence" (Ethington 2013, 7).

Out of fear that the Polish government was on the verge of capitulating to the EU's challenge to the Polish feed and seed ban, 2011 was the most active year for the ICPPC's efforts to secure Poland as a GMO-free country. They organized "heists," including street theater, culminating in the Festival of Nature and Culture in December of 2011. They also created a "mutant," a stuffed pig/cow/chicken hybrid, which they used as a mascot for the launch of a coalition for a GMO-free Poland (See Appendix, photo Px-1). They presented to Marek Sawicki, the pro-GM minister of agriculture the mutant as a "symbolic looking glass," meant to depict the future of foods in a world with genetic modification (ICPPC 2011). In 2012, they held a "best anti-GMO poster" competition, and the image that won spelled out GMO with rope, the O shaped as a noose. In 2013, the ICPPC organizes a blockade of tractors to protest GMOs, and a solidarity protest in front of the Polish embassy in London.[40]

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[40] Julian Rose, a British aristocrat, is a co-founder of the ICPPC, along with Jadwiga Lopata, a Polish farmer.

Public Opinion

Polish public opinion is strongly against GMOs; studies have consistently found a significant distrust of GMOs in Poland (Szczurowska, 2005; Bukraba-Rylska, 2003; Janik-Janiec, Twardowska, and Twardowski, 2003). In 1999, about 1/3 of Polish society was against the use of biotechnology in food production; by 2010, almost 60% were opposed—and the number of supporters fell from 47% to under 30% (Twardowski and Małyska 2012). A survey from 2007 found that the negative public opinion extended beyond distrust of the technology to the industries and corporations working on them: over two-thirds of the public had negative opinions of biotechnology, scientists working on biotechnology, and the multi-national companies marketing these products (Lubiatowska-Krysiak and Twardowski 2008). The Eurobarometer 2010 survey found that only a quarter of Poles believed the development of GM foods should be encouraged. Seventy-five percent of Poles consider genetically modified foods to be fundamentally unnatural; 61% feared that the use of GM foods might hold negative consequences for future generations. The Polish Federation of Biotechnology, a group of experts who support biotechnology, conducted a public opinion poll in 2006 that found 70% of Polish citizens in opposition to the technology (Twardowski and Twardowska 2008). In 2008, *Gazeta Wyborcza,* a leading daily newspaper, found that 66% of Poles would not buy GMOs even if the price was significantly lower than conventional crops, 55% believed GMO cultivation in Poland should be forbidden (30% thought they should be allowed) and 45% thought that Poland should forbid GMO cultivation, even if it meant conflict

with the EC (37% disagreed). However, after a recent incent attack in 2006 60% of Polish farmers wanted the right to choose to purchase Bt10 because of its insect repellant properties (Twardowski and Twardowska 2008). The Polish population is opposed to GMOs and the number opposed has continued to increase, although particular situations affect the strength of the opposition.

Conclusion

International predictions about the stance Poland would adopt toward GMOs failed to take into consideration two factors: the strong history of protest in Poland and the considerable power of the agricultural sector and its ability to marshal resources (Ekiert and Kubik 1998). Poland joined the European Union in 2004, the same year that the moratorium on GMOs was lifted. Because of its eagerness to appear independent from the EU and other western influences, and the strength of the peasant and agricultural parties, Poland has aggressively opposed the technology, despite early concerns that central and eastern European countries would be a backdoor for crops entering the Eurozone. The public debate is split between two sectors of the economy: the traditional agrarian sector that views GMOs and multinational corporations as a threat to family farms and the new high tech economy that views biotechnology as a path to economic competitiveness. Although there is some pressure to allow crops to be imported because of potential boosts to the high tech sector, public opinion remains strongly against the crops. GMOs symbolize western imperialism—both from the United States and even from the European Union—in Poland. Resistance to GMOs has manifested itself in the form of support of peasant and agricultural life. The 2015 decision to allow

countries to opt-out of growing or importing approved EU crops is likely to be seen as a win for Poland, particularly because of its history of going against the European Union.

Case Four: Spain

Introduction

From the beginning, Spain has been the most pro-GMO country in Europe, and one of the few countries in Europe where GMOs are not a salient issue politically, economically, or culturally. Most in the country support GMOs, and thus far social movements have not had much of a galvanizing effect on the Spanish public. Spain's policy on GMOs is the most permissive in Europe. They were early adopters and approved GM corn in 1998. The *Bacillus thuringiensis* insect-resistant maize crops, first approved in 1998, have been continually monitored since they were first planted, making it one of the longest field tests in the world (Feretti and Pavone 2009). Spain was the only country that applied for and received an exemption from the EU moratorium on cultivating GM crops, and continued cultivation and field tests throughout the 1990s. About 10,000 hectares of GM crops were grown in Spain in 2013 (ISAAA 2014), and field trials of new crops continue (Seifert 2013). It is the largest producer of GMO corn and grain in Europe, as well as the top importer of GM corn and soybeans. Small, conventional farmers tend to support GM seeds, and the demand often strips the supply for seeds (Kurzer and Cooper 2007). Spain also operates under EU law, so there are restrictions on which crops can be grown and imported, and they all have to meet the EU's traceability

and labeling requirements. As such, there are safeguards in place, which may also keep the Spanish public from feeling as though they are exposed to potential danger.

Political

Political changes in power have had little effect on GMO policy, and GMOs have played muted roles in national elections. When the center-right *Partido Popular* gained power in Spain from 1996-2004, they continued to advocate Spain's exemption to the EU-wide moratorium (Di Masso and Lemkow 2008). In 2004, the Socialist Party regained power as the new EU regulatory policy went into effect. When this happened, Spain began abstaining from pro-GMO votes on the EU level.

Economic

It is somewhat of a surprise that Spain emerged as the leader in GMOs in Europe (Kurzer and Cooper 2007). On the whole, the Spanish economy is aligned in favor of GMOs. When the European Union adopted the moratorium on GM crops, there was an exemption put in place for crops grown in Spain because of concern over the negative effects the moratorium would have on Spanish farmers.

Although GMOs remain a dominant force in the Spanish economy, there is limited economic resistance from farmers and local municipalities. Four regions (Baleric Islands, the Canary Islands, Asturias and the Basque Country) and 117 municipalities in 14 regions of Spain have declared themselves to be GMO-free zones (GMO-Free Europe 2014). Even in the regions where there are GMO-free zones, there has been a lack of movement toward organic agriculture or "localist"

agriculture, which means that there are no real viable competitors to GMOs emerging in the Spanish market.

The fact that Spanish public opinion is relatively accepting of GMOs is surprising particularly given that there is little biotech industry and there is a high level of traditional farming (Kurzer and Cooper 2009). Kurzer and Cooper (2007) argue that, because Spain industrialized late, there was a heavy emphasis on modernization of agriculture within the Spanish government (see also Jones and Clark 2001). Although there has been a push by both Spanish and European NGOs to mobilize Spanish opposition, public response has been lethargic at best (Kurzer and Cooper 2007). Seifert (2013) lists three reasons that the anti-GM movement did not gain more traction in Spain: food issues are less controversial in Spain than in other European countries; GMOs are not a symbol of globalization as they are in other countries, and the socialist party in Spain does not engage in technological criticism.

Interest in debating GMOs has come late to Spain; until the late 2000s, public debate on GMOs was almost non-existent among the public or politicians (Di Masso and Lemkow 2008). Kurzer and Cooper quote a Spanish farmer who participated in protests against GM companies as saying: "We want to spark a debate on GM crops, because in Spain there is silence on this issue" (2007, 1050). Civil society organizations have also focused on cooperation and compromise over GMOs, rather than elimination, what Ferretti and Pavone frame as a call for participatory science: "Participative science occurs when also the final users of the scientific and technological products at stake are involved in the relative research process, from

the beginning to the final release on the market" (2009, 295). GMO protestors, then, aim at striking a conversation and hopefully sparking debate.

The most active political protest group is Greenpeace España, and most anti-GMO protests have been held in Catalonia. Greenpeace worked with two Catalan organizations to publish an internationally recognized study that demonstrated interbreeding of conventional and GM crops was inevitable (Seifert 2013). The imitative "Som lo que sembrem" ("we are what we sow") gathered 106,000 votes in favor of a prohibition on GM technology in Catalonia, but Parliament failed to act (Seifert 2013). The largest gathering to date in Spain was the 15,000- person protest in Madrid in 2010 under the slogan "For GE Free Food and Agriculture" (Friends of the Earth 2010). Seifert concludes that "the Spanish movement, in spite of the best efforts of some of its propagators, never succeeded in sensitizing Spain's public, igniting a nation-wide debate, or impacting Spain's biotechnology policy in any considerable way" (2013, 224).

Protest

A rare example of farmers and environmentalists staging a protest to disrupt field trials was in 2003—several years after these techniques were introduced in the rest of Europe. Fifty protestors "symbolically harvested GM-maize from a trial site and presented it to the authorities together with a manifesto" (DiMasso and Lemkow 2008, 4). In 2003, the Catalan group Transgenics Fora! (GMOs out!) and Assemblea Pagesa, the Catalan Peasant Assembly, decided to destroy a GMO field trial in the Catalan town of Gimenells. Seventy activists clad in white overalls wearing facemasks and "biohazard" badges used scythes and reaping hooks to

destroy GM wheat (Seifert 2013). Unlike in the UK and Germany, the legal consequences against Spanish activists were severe and involved lengthy jail sentences. Seifert (2013) argues that the harsh legal response was because of the historical influence of Franco's dictatorship as well as the anti-terror movement that emerged against Basque separatism and militant Islam.

There has been limited political engagement or mobilization in Spain around GMOs, which is reflected in high levels of support for the technology. Until around 2008, GMOs were largely a non-issue in Spain, and were neither a political nor a public object of contention. Most of the energy of anti-GMO protestors has been focused on raising awareness of the issue, but because a ban on GMOs in Spain seems relatively unlikely, there isn't much traction for opposition forces. The EU's mandatory labeling policies are in effect in Spain, and so the country has basic protections; thus, neither political party has an incentive to criticize the technology. The issue has gained some traction in Catalonia as an independence issue, but that seems to have not to have sufficient power to mobilize the public.

Public Opinion

Unlike the extensive polling that has occurred in other European countries, there's been relatively little public polling on GMOs in Spain. Based on Eurobarometer findings, Spain has one of the highest levels of acceptance of GMOs in the European Union—as many as 77% of people approved of the technology in 2007 (Feretti and Pavone 2009). In the 2010 Eurobarometer, though, only 40% of Spanish respondents agreed that GMOs were good for the economy, and 29% disagreed. There were also low levels of recognition—fewer than 75% of Spaniards

had heard of GMOs. The survey also found 72% of people approved of GM crops if they were regulated by the EU, the highest approval rate in Europe.

Conclusion

Despite the lack of a high-tech ag-biotech sector, there is broad support for GMOs in Spain. GMOs have not been much of a political issue, with broad continuity of support for the technology among both center-right and socialist governments. Because of the fact that Spain is covered by EU regulations, the Spanish public still enjoys the protections of the labeling and traceability requirements, without risking the potential negative impacts of a GMO ban. Additionally, there is broad support for the technology across different segments of the economy, although there has been limited resistance among farmers. Although protest groups have attempted to mobilize resistance to the technology, with some effect, there is little indication that Spain will tighten its restriction in the near future.

Case Five: The United States

The United States has been long assumed to be a stronghold for GMOs. Indeed, US trade and regulatory policy are devoted to advocating a sound science approach to GMOs and making sure the market stays open for their export to other countries. GMO crops originated in the United States; there has long been active political and regulatory support for the products. Unlike in Europe, there is no labeling requirement in the US; indeed, labeling is strongly opposed by the Grocery Manufacturer's Association, the largest lobbying organization that represents Monsanto and various other GMO producers and manufacturers. Although the BSE

scandal was strong enough to tip the debate over GMOs in Europe, it did not have such an effect in the United States. Although mad cow was also detected in the US, and there were similar regulatory scandals such as the 2000 StarLink scandal where GM corn that was only supposed to be used in animal feed was detected in taco shells, there has been much less of a push for regulatory reform (Stephan 2012). Ansell and Vogel (2006) attribute this comparative lack of outcry to higher levels of trust in government in the United States than in Europe:

> Of course, the United States also faces many of the same economic, technological, and political challenges in regulating food that Europeans have confronted. But the tensions associated with market integration or European state building are not present in the U.S. case. Moreover, the role of the U.S. federal government in regulating food safety is hardly a matter of conflict, and the basic institutional architecture has remained stable. In sum, U.S. food safety regulation may be conflictual but it is not currently contested (24).

Although the struggle against GMOs has been late in coming, I argue that there has been a recent uptick of momentum in the struggle against GMOs in the United States, and the momentum may be shifting in favor of greater labeling and regulation. Kleinman, Kinchy and Autry argue that casting the US only through a sound science lens "ignores a more complex history in which we find an explicit struggle between advocates of social regulation and supporters of liberal science-based regulation" (2009, 364). Indeed, although sound science has regulatory power, there is economic and political resistance to US policies. Labeling has been the focus of this movement. However, there has been increasing public opposition to GMOs and increasing movement within the market to produce GMO-free products. Unlike the other countries in this analysis, whose GMO policy is shaped by the European Union, the United States has created its own policy on GMOs. Thus, the discussion in

this section is somewhat more detailed than in the other case studies, in order to capture the complexity of the current politics of GMOs.

Political

The United States uses the "sound science" standard both in terms of its own policymaking and as a foundation for the position it advocates in the international arena. The extent to which Monsanto and other ag-biotech firms have been involved with producing and policing the science as well as the economics of GMOs is part of what West (2007) terms the science-industrial complex.

In the early 1970s, r-DNA was discovered, which proved to be the key to genetic engineering. Foreseeing a potential political backlash against the technology, in 1974, Paul Berg, the father of genetic engineering, persuaded molecular biologists working in the field of r-DNA to impose a moratorium on their research and assess the potential hazards of their work (Johnson 2013). When Congress began considering the regulation of biotechnology, then, genetic engineering was understood as a scientific, not environmental or agricultural, process. This framework has had enormous ramifications for the way in which GM crops are understood and regulated.

Monsanto anticipated that there would be regulations placed on GMOs, and so they approached the initial conversations with the US government with the goal of shaping regulation in its favor—both to preempt harsher regulations, and so that it could squeeze out competitors unable to afford to comply with a new regulatory schema. However, despite the fact the ag-biotech industry itself expected some version of GMO-specific regulation, the anti-regulatory sentiment of the Regan era

prevailed. In 1985, the Reagan administration unveiled a coordinated framework that regulated biotechnology using the existing bureaucratic mechanisms, rather than creating an independent regulatory agency. During the Reagan administration, a framework for risk assessment was codified that placed faith in "sound science" as an external, neutral arbitrator over conflicts surrounding scientific questions (see Chapter 3; also, Runge, Bagnara, and Jackson 2001; Jasanoff 2011). Confronted with the challenge of regulating GMO crops, the administration set up a regulatory apparatus that fit into the existing regulatory framework, assigning responsibility to three different executive branches: the Food and Drug Administration (FDA), the United States Department of Agriculture (USDA), and the Environmental Protection Agency (EPA). This framework is still in place in 2015. The FDA determines whether new food is safe, and only conducts risk assessments when there is a question as to whether the product is substantially equivalent to conventional food. The USDA regulates pests, and so has jurisdiction over plants that might increase weeds or vulnerability to pathogens. The EPA regulates pesticides, and so has an important role in approving crops that produce their own pesticides (Kleinman, Kinchy and Autry 2009). By employing the same regulatory schema used to administer conventional crops, the United States was able to avoid passing any GM-specific legislation or regulations. Thus, numerous GMO crops were created, grown, and marketed in the United States with little political or public challenge (Pollack and Shaffer 2009).

The Clinton, Bush, and Obama administrations have maintained a relatively consistent regulatory policy. Obama appointed Tom Vilsack, a supporter of the

biotech industry, as Secretary of Agriculture. Pollack (2013) provides a succinct summary of the reason why there has been little movement on questions of GMO regulation on the federal legislative level despite broad public support:

> This, in turn, points to the importance of what one might call the political geography of GM regulation in Congress, where support for stricter regulations was concentrated overwhelmingly in the northeast and the west coast, while legislators from rural areas in the Midwest and elsewhere were far more likely to oppose mandatory labelling or other new regulations. Thus, despite the sharp politicization of the issue and the broad public support for labelling in polling, the concentrated interests of farmers and biotech industry groups constituted a significant obstacle to regulatory reform. So did the structure of the American federal system (which left state labelling rules open to legal challenge) and the institutional rules of the US Congress (which effectively required bipartisan agreement in order to pass a divided Congress, and which disproportionately empowered Senators from farm states to block any proposed legislation). These factors did not absolutely preclude new and stricter GMO legislation, but they placed an extraordinarily high hurdle to its adoption in the foreseeable future.

One of the most controversial legislative initiatives regarding GMOs was the dispute over the Monsanto Protection Act. The Farmer Assurance Provision, more commonly referred to as the Monsanto Protection Act, was introduced as part of a six-month funding bill that expired on September 30, 2013. The bill was written by Senator Roy Blunt from Monsanto's home state of Missouri, with help from the late Senator Dan Inouye, of Hawaii. The bill limited the power of federal courts to halt the growth or sale of crops that were found to be dangerous. This legislation faced sustained opposition and public outcry after Obama signed it into law. Although there have been attempts to reintroduce the bill since its expiration, they bill has been derided as special interest and hasn't been re-passed.

Because of the lack of movement in the regulatory arena, opponents of GM have increasingly turned to the courts for oversight over GM crops, with limited

success. The most high profile example of this was the controversy over Roundup-Ready alfalfa, which was deregulated by the USDA in 2005. A district court judge initially ruled that the USDA failed in not conducting an environmental impact statement and issued a permanent injunction on planting RR alfalfa. The decision was upheld by the 9th Circuit Court of Appeals before being struck down by the Supreme Court on a 7-1 decision (Oliphant and Huffstutter 2010). In 2013, the Supreme Court also ruled in favor of Monsanto, ruling that farmers could not grow Monsanto seeds without buying them; however, the decision, authored by Elena Kagan, emphasized that the ruling was narrow, and could not be generalized to other questions of genetic engineering (Liptak 2013).

Thus, both the courts and the executive branch in the United States have upheld the "sound science" approach of the biotech industry. The executive branch has acted aggressively internationally to export the ideology of "sound science" and to open markets to American GM crops. Although the tone of US foreign policy in regard to GMOs has shifted, the substance has stayed consistent.

Economic

Since the late 1990s, biotech firms have been struggling to maintain their footing even as they negotiate from a place of relative strength. In 1999, Monsanto's stock stagnated, despite a strong stock market. Investors began urging Robert Shapiro to take actions that mirrored the life science industries in Europe and to break off the life sciences company from the pharmaceutical business (Charles 2001, 258).

Although Monsanto opted to stay intact and not sell or spin off its life-science industry, this debate underscored the fundamental problem with the economics of GMOs. The economic debate over GMOs in the United States reveals a problematic supply-demand relationship (Bernauer 2003). The supply and demand cycle is between the ag-biotech firms producing the seeds and the farmers and food producers further down the distribution chain. Because the end user—the consumer—does not know whether the food they buy has genetically modified ingredients, there can be no demand for such food. All direct benefits accrue within the production chain, with no direct benefit for consumers, who nonetheless assume the risk of genetically modified crops (Huffman, Rousu, et al 2007).[41] This relationship shielded the producers from economic pressure from the consumers for a while, but there is some evidence that this is changing as pressure for mandatory labeling increases and as companies voluntarily opt out of growing and buying GM crops. Michael Pollan, a self-professed "liberal foodie intellectual" and professor of journalism at UC Berkeley, argues that the lack of benefit offered to consumers in the United States drives the resistance to the technology. He argues:

> Part of the reason consumers are objecting to GM is that GM hasn't offered consumers anything of value. What if they did? I think that if they actually saved orange juice for America, people would get behind it. I think if they could produce a substantially healthier cooking oil, Americans would get behind it. I mean, we're the ones who bought Olestra. You're irradiating your head on a daily basis— but we're willing to do it, *if* it offers a benefit. Americans are not all that skeptical of technology. We sit for all sorts of things that Europeans don't sit for. And we trust our regulators, on balance, in a way that Europeans don't (the reason they don't is because of mad cow

[41] See conclusion for discussion of GM apples and potatoes that were approved in late 2014 and 2015 that suggest GM agriculture is slowly moving in a new direction; these crops were approved too late for formal inclusion into the analysis of the dissertation.

> disease, and a few other things). So I think that too is an industry talking point— that if we have labeling nobody is going to buy this stuff. I think it's arguable at best. It reflects the industry's failure to offer anything of value to consumers, which has created a vacuum into which critics –and, yes, some fearmongers— could step (cited in an interview with Johnson 2013).

Thus, as Gaskell et al argue, "'the Achilles heel' of GM foods is not so much the misperception of the scientific risks, but rather the perceived absence of benefit for the consumer" (2007, 193). Wilson argues that "The public tends to hybridise risk. People do not compartmentalize categories of risks and benefits of agricultural biotechnology; they consider them mixed together and then decide whether they find the resulting chimera acceptable" (2002, 152). In the United States, this process of risk evaluation underscores the public's increasing opposition to GM technology. Without a clear material benefit, the public is unlikely to change its mind about the potential risks. [42] With nearly no federal regulation and a public that will almost assuredly oppose GMOs if they hit the market, ag-biotech firms in the US have mounted swift, high profile opposition to labeling initiatives. The ag-biotech industry has formed a powerful coalition with the Grocery Manufacturers Association (GMA), a trade and lobbying group, which represents most of the grocery producers and distributers in the United States. The GMA spearheads much of the anti-labeling movement.

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[42] See, for example, the public's uncritical embrace of cell phones, despite evidence that there may be a risk of exposure to cancer-causing radiation. The clear material benefits to the consumer virtually extinguish any evaluation of potential risk from the technology. However, without any benefits from GM foods, the public is left with only the risks to ponder.

Although agricultural producers and distributers are aligned in their opposition to labeling initiatives, there is some evidence that the opposition to GMOs is beginning to penetrate corporate America. However, as Charles notes, if food producers and manufacturers abandon GMOs, it will ruin the industry:

> if they move, they will not issue inflammatory press releases or send people into the streets with banners. But their verdicts will be decisive…Food companies could, if they put their minds to the task, crush the current products of the agricultural biotechnology industry, leaving behind only fading memories of past hubris (2001, 297).

There are signs this is coming to pass. The opposition to GMOs is beginning to penetrate corporate America as conventional growers and distributers have begun to diversify their offerings or phase out GM foods. They do so for two reasons: the ability to trade with Europe (what Pollack [2013] terms the Brussels effect), and perception of mounting domestic pressures.

First, US agricultural producers and distributers increasingly feel the pressure of producing crops for a hostile EU market. Because of the strict GMO-free policy, Europe will reject products with even trace amounts of unapproved GM varieties. In 2006, the EU discovered trace amounts of Bayer Cropscience's Liberty Link 601 rice (unapproved in Europe) within a shipment of conventional rice. Both EU and Japan ordered systematic testing of all US rice shipments, and US farmers sued Bayer Cropscience for damages and lost revenue; Bayer paid $750 million into a compensation fund to reimburse 11,000 farmers who said their crops had lost value (Harris and Beasley 2011). As a result of the incident, Bayer announced it would not commercialize any of its approved varieties of GM rice. The second challenge comes from the fact that farmers hoping to export their crops face

mandatory labeling and traceability requirements from the European Union. Farmers that trade with Europe have begun to seek GMO-free certification, and even Monsanto withdrew its applications to cultivate maize, soybean, and sugar beets on EU soil (Pollack 2013). Instead of trying to overturn the regulatory rules, they seem to have accepted the difficulty of approving crops for cultivation in Europe, and instead are focusing on how to speed up the bureaucratic process surrounding getting approval to import and market GM foods in European markets (Pollack 2013, 30).

Domestically, consumers are beginning to opt-in to purchasing GM-free products in numbers that are beginning to be noticed. Pollack quotes the vice-president of the North American Millers Association "Our customers are telling us that they have very serious concerns or are flat-out opposed to GM wheat … [w]hile this opposition may have nothing to do with science, the customer is always right" (2013, 262). Corporations that promote themselves as healthy and environmentally friendly have, unsurprisingly, taken the lead in voluntarily divesting themselves of GMOs. Whole Foods announced that, by 2018, it will require labeling of all products it carries that contain GMOs. A.C. Gallo, the president of Whole Foods, told the New York Times: "We've seen how our customers have responded to the products we do have labeled. Some of our manufacturers say they've seen a 15% increase in sales of products they have labeled non-GMO" (Strom 2013). Ben and Jerry's Ice Cream is the most high profile example of a company going completely GMO-free (Stuart 2013). The company announced in 2013 that roughly 20% of its ingredients were not GM-free, and that they would be seeking non-GM sources throughout 2014. This

decision, the company says, was both one of sourcing food in a way more aligned with its social and ethical commitments, as well as because they saw the trend toward GM-free consumption.[43]

Although Ben and Jerry's is somewhat of a niche, upscale product, mainstream companies are moving away from GMO produce as well. Eighty Target products are certified as GMO-free. Additionally, General Mills announced in 2014 that its Cheerios would be GMO free, and Post took the GMOs out of Grape-Nuts (Gasparro 2014). Smart Balance margarine also converted to non-GMO, and Chipotle announced it would switch to GMO-free corn tortillas. Nielson's market research found that Non-GMO was one of the fastest growing labels in the United States, with sales increasing 28% in 2013 to about $3 billion (Gasparro 2014), a number the Non-GMO Project puts at closer to $6 billion (Lindholm 2014). Cargill, long one of the largest growers of GMO crops, announced in 2014 that they would begin to offer non-GMO varieties of soybean oil, corn, and beans. They cite the pressure from consumers as the justification for creating the non-GMO line.

The Cargill position underscores the delicate position that food manufacturing companies find themselves in regarding the future of agriculture and manufacturing in the US. Cargill is now producing major products as GM free; yet, they are members of the GMA, and they warn on their website that mandatory labeling is "misleading" to consumers who might take the label to imply that genetic modification is dangerous (McLaughlin 2014). Cargill argues that a GM label doesn't

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[43] One of the causalities of the Ben and Jerry's decision to go GMO free is the flavor Coffee Health Bar Crunch. The flavor has been retired and sent to the "Flavor Graveyard" because Hershey Heath Bars contain GM products.

provide any information about the product, since GM and conventional foods are substantially equivalent.

Although mandatory labeling bans have failed, many companies believe such labeling is just a matter of time. And given a choice of requirements to label products as containing GMOs, and to voluntarily become GM-free, many companies are choosing the latter. Because of the difficulty sourcing GMO-free products, companies worried about the consequences of labeling legislation that would require them to respond reactively are attempting to get ahead, and so are proactively seeking GMO-free sources so they can remain competitive (Lindholm 2014).

The Non-GMO Project is the primary third-party certifier of GMO-free products in the United States, and they have verified more than 20,000 products. Among other stipulations, the organization requires a 4-mile radius around any non-GMO certified field from any beehives to make sure bees aren't eating nectar or pollen from GMO crops (Gasparro 2014). Perhaps as a result, many of the products that actually *are* GMO-free aren't labeled as such, because their manufacturers are worried about giving up their larger position in the debate over labeling. Lindholm (2014) quotes Megan Westgate, the head of the Non-GMO Project, notes that there are anti-GMO initiatives underway that "for whatever strategic reasons get kept pretty quiet" (in Lindholm 2014).

Protest

Among activists, fear of GMOs is deeply embedded and can be traced back to the advent of the technology; Schurman and Munro trace the intellectual origins of

the anti-GMO movement that emerged in the US in the 1970s; they find the activists came from different movements concerned to varying degrees about "apocalyptic and unnecessary" nuclear technology (2006). Additionally, the activists linked these threats to a "technology-and private-property-based economic growth model" (2006, 152). Thus, even as early as the 1970s the critique of GMOs existed on two levels: that genetic engineering was an uncontrollable technology capable of environmental devastation, and that it emerged because of the neoliberal trade ideology advanced by the United States.

The initial resistance to GMOs emerged in the 1970s in response to the discovery of rDNA. The movement leaders came out of the social movements for civil rights of the 1960s. After the identity-based civil rights movements, a new social movement emerged that was focused on peace, nuclear power, the environment, and food politics (Schurman and Munro 2006). The anti-GMO movement formed not in response to food crises like those that would shake Europe in the 1990s, but in this more probabilistic—yet more terrifying—world of the anti-nuclear movement and all of the related threats to the environment and human existence: namely "the umbrella of concerns about a potentially apocalyptic and unnecessary technology" (Schurman and Munro 2006, 152). Here, you see again the default position of precaution: "If it turns out that after doing the studies, the scientific evidence shows GMOs are OK, I will change my mind," said Alisa Gravitz, a board member of the Non-GMO Project and chief executive of Green America. "But until then, why infect our entire food supply with this, when the early studies, the bona fide, peer-reviewed ones, throw up some red flags?" (quoted in Gasparro 2014,

n/p). Just as in other countries, there has been direct field action. Crop trashings have occurred in California, Michigan, Maine, and Minnesota. However, most of the protest has focused on advocating a mandatory labeling policy. The next section examines the way those initiatives on a state level.

Labeling

Environmental and consumer groups have been powerful in opposing stricter regulation, such as mandatory labeling. In 2012 and 2014, a series of ballot initiatives were proposed and defeated in California, Washington, Oregon, and Colorado, due to record-breaking expenditures by the Grocery Manufacturers Association and ag-biotech firms. A ballot initiative did pass in city of Maui, Hawaii, successfully adopted a temporary moratorium on GM crops, which passed despite $8 million spent in opposition. However, a federal judge issued an injunction on the ban in response to a Monsanto-led lawsuit (McAvoy 2014). Labeling initiatives have had more recent success in front of state legislatures; in 2014, a mandatory labeling law was passed by the Vermont legislature, which the GMA and Monsanto are aggressively fighting in court.

Table 1: Labeling Ballot Initiatives in the US

	California Prop 37 (2012)	**Washington Prop 522 (2013)**	**Oregon Measure 92 (2014)**	**Colorado Prop 105 (2014)**
Amount spent opposing labeling initiative:	$46 million Monsanto: $8 million	$22 million Monsanto: $5.3 million	$20 million DuPont 4.5 million Monsanto $4 million	$12 million Monsanto 4 million
Amount spent in support of labeling initiative	$8.7 million Organic Consumer Fund	$8.4 million Dr. Bronner's Magic Soaps	6.9 million Dr. Bronner's Magic Soaps	$620,000 Food Democracy Action
% no votes % yes votes	**51.4%:** 48.6%	**51.1%** 48.9%	**50.5%** 49.5%	**65.7%** 34.3%

The anti-GMO movement seems to be showing belated signs of success; the battle to label GMOs has scared corporations into halting production. Even supporters of GMOs such as the *New Yorker's* Michael Specter call labeling a political inevitability. The anti-GMO movement of the 2000s has reformed around a pragmatic demand to require labeling. Environmental, food safety and consumer rights movements have coalesced around state-by-state labeling efforts under the banner of a "right to know" movement. The "Just Label It!" campaign led the support for mandatory labeling ballot initiatives in California and Washington in 2011 (see Table One). These ballot initiatives failed, but the first mandatory labeling law passed the legislature and was signed into law in Vermont in 2013.

In addition to pressure on states to adopt mandatory labeling laws, the anti-GMO movement has also targeted food producers and manufacturers to become certified as GMO free. The Non-GMO project, a non-profit organization, conducts extensive testing before declaring projects GMO-free.

Monsanto has aggressively litigated against both mandatory and voluntary labeling efforts. The FDA ruled, and multiple courts have upheld, that milk cannot be labeled rBGH-free or "not produced with artificial growth hormones" unless it come with the addendum "FDA states: No significant difference in milk from cows treated with artificial growth hormones." These claims are examples of false advertising, the agency and courts claim, because all milk contains a growth hormone.

GMOs are an increasingly salient issue among people in the United States; although ballot initiatives have failed in the bigger states of California and Washington, the passage of a mandatory labeling law in Vermont, along with the increasing potency of the GMO-free label, has given the anti-GMO movement new life. Despite sustained, billion-dollar opposition to mandatory labelling, the public's increasing support of GM-free products has caused a voluntary shift in the market that has increased the pressure to label products.

Monsanto's aggressive efforts to minimize labeling of products are part of an attempt to limit consumer influence of consumption patterns. Blue argues that:

> Actors who support GM foods (biotechnology companies, governmental organizations, agricultural research universities, non-profit research institutions) attempt to persuade consumers of the safety of their products. Consumers will not necessarily directly challenge these claims; if concerned, they may just as likely respond by altering their consumption habits. These forms of engagement, although not overtly political, can nonetheless be very powerful (2010, 52-53).

Critics of labeling note that, like organic foods, buying foods labeled GMO-free can become a class issue—those who can afford to opt out of eating GMOs can, thus passing the risk onto the lower classes.

Public Opinion

Public opinion in the United States is more strongly against GMOs than in much of Europe. This is in opposition to the traditional understanding of public opinion toward GM foods, which holds that Americans are not concerned about the issue, especially compared to their European peers (c.f. Priest 2000, who predicted increased American opposition to GMOs). There has been a steady increase in concern over GM food in the past two decades, and a growing tide of public opinion in favor of stricter regulation (Pollack 2013). The issue is also increasingly salient; a CBS News Poll in 2013 found that 75% of people are either somewhat or very concerned about GM or genetically engineered foods, compared with 24% who are not concerned (only 1% didn't know or didn't answer). This shows a modest increase from 2012, where the same poll found that 73% of people were concerned about GM foods. CBS News also found in 2013 that an overwhelming 93% of respondents thought GM foods should be labeled, compared with 87% in 2008. A 2013 *New York Times* poll found that 93% of Americans believe food containing GM products is harmful (Kopicki 2013). This result is echoed by a poll by Just Label It, a coalition of NGOs and organic farmers, that found that 91% of respondents supported mandatory labeling—93% of Democrats, 90% of Independents, and 89% of Republicans (Pollack 2013). There are few other issues in American political life with such consistently high levels of opposition, which clearly indicates a mismatch between the perception that Americans don't care about GMOs (see, e.g., Stephan 2012), and consistently high levels of distrust.

Conclusion

Although there is a long history of Americans distrusting GM food, the topic has only recently become politically salient as Americans have begun to express dissatisfaction with a regulatory schema based only on scientific risk assessment (Skogstad 2006). Skogstad (2006) and other observers noted that the latent political sentiment in America more closely resembled Europe than many detractors gave it credit for, and Americans, like their European counterparts, believed that a more nuanced measure of GMO foods—one that accounted for social, economic, and moral dimensions of the technology, should be considered. Although the causal arrow is unclear, there has been a mobilization of Americans as the understanding of GMOs has expanded to include economic and social implications of the technology.

Despite the willingness of critics to dismiss the propensity of Americans to resist GMOs, there is ample evidence that the issue is increasingly contentious in the United States. The political action on the state level, along with the increasing economic mobilization against GMOs and historically high rates of public opposition—provides support for the argument that the technology is in fact an area of high contestation in the United States. GMO crops originated in the United States; there has long been active political and regulatory support for the products. Unlike in Europe, there is no labeling requirement in the US; indeed, labeling is strongly opposed by the Grocery Manufacturers Association, the largest lobbying organization, as well as Monsanto and the other major lobbying organizations. But, there is a sense that the tables are beginning to turn against GMOs. Public opinion supports labeling, and increasingly distrusts and opposes the technology.

Comparative Analysis

In this chapter I have analyzed the issue of GMOs across the five countries. The following section puts each case in conversation with each other, highlighting the important similarities and differences between them.

Political

First, there seems to be a lack of correlation between political party and stance on GMOs. Indeed, in each case except Germany there is a sense of continuity of policy between political parties in terms of opinion on GMOs: in the United Kingdom, Conservatives and Labour are tentatively on the same side. In the United States, there has been continuity on the executive level between each presidential administration, and no policies passed on the legislative level. In Spain, the Socialists and the center-right government all approve GMOs, and in Poland each government has opposed them. Similarly, attitudes toward the European Union seem not to be a predictor of the governmental stance toward GMOs: the United Kingdom and Poland both have used GMOs as a wedge issue between their country and the EU; in the UK, this is manifested as advocacy for fewer restrictions, and in Poland, a push for more restrictions. Germany is the major exception to this rule: GMOs have been more of an issue of contention, threatening the coalition government between the Social Democrats who oppose the technology and Angela Merkel's Christian Democrats, who support the technology.

On January 14, 2015, the European Parliament voted to decentralize decision making over GMOs to individual member states. The countries had disparate reactions. For Poland and Spain, little is anticipated to change: Poland already has a

complete ban on GMOs, in defiance of the European Union, and so this decision gives sanction to their existing practices. Spain, on the opposite side of the issue, will likely continue to grow GMO crops. Germany and the United Kingdom, on the other hand, have signaled divergent approaches. The United Kingdom plans to fast track the approval and cultivation of GM crops (Nelson 2015), while Germany plans to ban the crops entirely, expanding their current ban on MON 810 (Sarmadi 2015). Of course, these decisions are also reflections of the relationship each country has with the European Union and the UK's Euroskepticism. But they signal the broader variance between perception of GMOs across Europe—Poland and Germany converge on the *issue* despite (somewhat) divergent views on the European Union's power to regulate agriculture and GMOs, whereas Poland and the UK converge (somewhat) on the issue of EU power and diverge on the *issue* itself.

Economic

This chapter has demonstrated the way in which resistance to GMOs has manifested itself on an economic level by identifying different sources of economic opposition to GMOs: consumer pressure, industry-led opposition, and resistance from the agricultural sectors. Consumer pressure was more effective in Europe than in the United States initially because the U.S. supply chain was concentrated in the hands of a few major producers, distributers, and retailers. The ag-biotech industry adapted to the EU moratorium and labeling regime in Europe by largely withdrawing from most markets—like Germany and Poland—while only maintaining a marginal presence in other markets like the United Kingdom. Only in

Spain do we see a flourishing GM industry, and this is because of a lack of consumer pressure.

In the United States, the supply chain is much more diffuse than in Europe, and so consumer pressure has been much less effective than in Europe. However, producers and retailers in the United States, because of both the "Brussels effect" and because of pressure from domestic consumers, have begun the process of voluntarily moving away from GMO crops and seeking non-GMO certification.[44] Additionally, there has been voluntary movement away from GMOs on an industry level in response to market pressures. Across Europe, biotechnology firms have strategically divested themselves of their life science branches, signaling a lack of faith in the economic future of biotechnology in Europe. In the United States, Monsanto has chosen not to separate its life science branch from the rest of the company, despite the fact it has led to economic losses.

An additional source of resistance comes from the agricultural industry in terms of voluntary GMO-free regions where farmers agree not to grow crops within those regions. This has created economic opportunities for conventional farmers to compete on the global market and not risk being undercut by GM competitors. Of course, not all economic forces are anti-GMO; indeed, the Spanish economy in particular relies on GMOs to support its agricultural industry, and GMOs continue to

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[44] Although beyond the scope of this project, this means that the market for GMOs has shifted almost entirely to developing countries. "Notably, developing countries grew more, 54% (94 million hectares) of global biotech crops in 2013 than industrial countries at 46% (81 million hectares). Successful public/private partnerships were established by several countries including Brazil, Bangladesh and Indonesia" (ISAAA 2013)

be a cornerstone of the US economy. There are powerful forces in Poland that advocate embracing GM technology as a means of competing in a high-tech economy.

The European ag-biotech firms were sent reeling from anti-GMO sentiment, and after the moratorium the European Union adopted a strict regulatory policy. Why did the European Union adopt such a rigid policy? Although the biotechnology firms acceded to the new regulatory agenda that ended the moratorium in 2004, there is some debate about the reasons why the European Union adopted such a strict labeling policy at the end of the moratorium—and particularly whether it was a protectionist "win" for the EU and the ag-biotech industry. Some observers believed the EU ag-biotech firms were happy with regulations because they hoped the regulations would put smaller companies out of business. However, Stephan (2012) rejects the protectionist explanation for the EU precautionary stance toward GMOs, arguing that ag-biotech companies did not benefit from the collapse of the market for GM products and the closure of research and development plants. Kelemen and Vogel (2009) offer a more complete explanation of regulatory politics. They argue that the European Union chose to be leaders on environmental regulation, particularly in terms of GMOs. Domestic pressure from environmentalists put pressure on ag-biotech firms (Kelemen 2010). Thus, advocating regulations on the EU level hurt international (particularly US) competitors in a realm where the EU companies never would have been able to compete anyway. This explanation seems to be a good fit for the political economic state of the EU policy toward GMOs, but does not explain the more fundamental

question of why environmentalists were able to gain such traction and persuade the public to oppose GMOs.

Moreover, this chapter shows that there are economic challenges to the sound science narrative. Proponents of sound science insist that there is an elective affinity between sound science, GMOs, and free trade.[45] This implies that, given an open market, GMOs would be a sound economic decision for producers and consumers. The analysis in this chapter suggests that the pressures on the market instead have compelled corporations to voluntarily move away from GMO crops. This has been driven by a consumer demand for GMO-free products. The market in these cases is operating pragmatically. The fact that the free market could push demand away from the dictates of sound science upsets the privileged relationship between sound science and neoliberalism.

There is considerable variance in the political and economic status of GMOs in Europe and the United States. There is not only "spatial" variance in actor perception of GMOs from country to country but also temporal variance as those perceptions evolve. This lack of stability when it comes to defining GMOs and the risks they carry has created the conditions under which farmers and corporations act differently: members of industry continue to defend a sound science narrative but argue that market forces compel the transition away from GM crops, while farmers who oppose GMOs cite environmental and economic reasons. Both of these are materialist approaches to the question of the economic implications of GMOs,

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[45] See the discussion of sound science and its defense in Chapter Three. Ann Veneman, who was the Secretary of Agriculture under the Bush administration, was particularly forceful in asserting this equivalency (see Jasanoff 2011).

broadly asserting that GMOs are in the economic interest of primary actors. The dissertation thus interrogates the materialist foundations of the economic debate over GMOs. Sato articulates the difficulty of a traditional materialist approach to the question of GMOs: "Insofar as an actor's perception of her own material interests and political capacities is subject to the changing public perception of GM food, interest-based accounts need to incorporate such perceptions" (2013, 481). "Sound science" ideologically aligns itself with the discourse of the free market. Even so, the economics of GMOs are not universally pro-GMO. Indeed, in Europe, the ag-biotech industry has been relatively ineffective at influencing regulation and at shaping the market for GMOs, and economic industries have proven ruthlessly pragmatic in their willingness to try—and discard—attempts to bring GMOs to market. Thus, although there is an ideological alignment between grocery manufacturers and the ag-biotech companies that market GMOs, they are unwilling to take financial risks or to adopt products that are opposed by public.

Protest

As this analysis indicates, there is significant variation in terms of the trajectories of anti-GM movements and sentiments, as well as the primary message and strategy of resistance. The United Kingdom was marked by an early, intense resistance to the technology. The resistance was primarily consumer-driven, and led to a nation-wide moratorium. There is some evidence that the intensity has waned, given that major NGOs have ceased to focus on GMOs and that there has been indications that the government will begin to cultivate the crops, but this has not produced much of an outcry as of yet. The Conservatives have voiced their support

for GMOs, with tentative agreement from Labour. In Germany, initial optimism over the technology led to a relatively late opposition to the technology. However, the government's responsiveness to the protests—particularly to the civil society pressure—has led to GMOs becoming a third rail in German politics, opposed by all major political parties. In Poland, the issue of GMOs became equated with agricultural reform as they joined the European Union. There is a deep and pervasive mistrust of the technology throughout Polish society. Opposition has organized around defense of traditional agriculture and peasantry, as well as a means to express opposition to the European Union. In Spain, there have been repeated attempts to mobilize, but the issue has thus far failed to gain traction or salience. The plurality of the population supports GMOs, and there is no major context for resistance. In the United States, which has long been the stronghold of GM technology, there is a growing public opposition and support for mandatory labeling campaigns. Although there is sustained resistance to labeling on behalf of the major producers, there is a sense that labeling is inevitable, and so major food producers and manufacturers have begun to voluntarily shift away from GMO crops.

Public Opinion

In Europe there has been consistently low support for GMOs, although the numbers have fluctuated somewhat.[46] The Eurobarometer survey asks about seven

[46] Data collection of public opinion about GMOs reached a peak in 2003, but has declined since (Frewer, van der Lans, et al 2013). There is conflict over demographic predictors of public opinions toward GM foods. Some find gender to be a predictor of who is least likely to accept GM foods (Siegrist et al, 2006), whereas others find no relationship between gender and GMOs (Frewer, Howard, and Shepherd 1998).

areas of biotechnology: genetic testing, cloning human cells and tissues, cloning animals, environmental remediation, and their benefit to society. In the mid-1990s, 85% of Europeans supported tougher regulations on GM food; the 2005 Eurobarometer found that 27% of Europeans regarded GM food positively, but the number fell to 23% by 2010. In their report *Europeans and Biotechnology* (2010), Gaskell and his colleagues analyze the Eurobarometer reports from 1991 through 2010 to study trends in attitudes toward technology. Only 18% of Europeans reported not hearing about GMOs. They find that a majority of Europeans (53%) are optimistic about biotechnology, while 20% are pessimistic, compared with a high of 87% optimism for solar energy and a low of 39% optimism and 39% pessimism for nuclear energy. This indicates that Europeans are relatively willing to believe that biotechnology has the potential to enhance the lives of citizens. However, they also find that there is a downward trend from 2005 to 2010 on optimism in biotechnology (but an upward trend in optimism for energy technologies like water, solar, and wind).

Despite the overall optimism, the technology remains unpopular, with the public giving it low scores in terms of beneficiality, safety, equitability, and naturalness. As Table 2 shows, even in countries that are highly optimistic about GMOs and report high levels of support, in no country does a majority of the population agree that GMOs should be encouraged.

There is some evidence that income is a significant predictor of support of GM foods (Hossain and Onyango 2004, Baker and Burnham 2001).

Table 2: Public Opinion on the Question of Encouraging GMOs

	1996	1999	2002	2005	2010
Spain	66	58	61	53	35
Germany	47	42	40	22	22
United Kingdom	52	37	46	35	44
Poland	-	-	-	28	32
Compiled from Gaskell et al 2010: Percentage of respondents who agree or totally agree that GM food should be encouraged.					

Table 3: Public Opinion on Optimism over GMOs

	1991	1993	1996	1999	2002	2005	2010
Spain	82	78	67	61	71	75	74
Germany	42	17	17	23	24	33	12
United Kingdom	53	47	26	5	17	50	50
Poland	-	-	-	-	-	59	41
Compiled from Gaskell et al 2010: Percentage of respondents "optimistic" about GMOs – who agree or strongly agree that GM food will improve way of life.							

Conclusion

The remainder of the dissertation further explores the root of the political mobilization, attempting to answer the question of why there is such sustained resistance. Rather than focusing on the mechanics of the movements themselves, I locate the root of the critique of GMOs in the contentious discourse between the advocates of a "sound science approach" to GMOs and the way that the discourse of resistance has manifested itself materially. The connection between neoliberalism and sound science reflects deep dissatisfaction with the values of late capitalist society (Schurman and Munro 2006). Indeed, one of the interviews conducted by Schurman and Munro with movement participants frames the resistance to GMOs as

a resistance to capitalism: "'[I]f people think it's about food, I don't think so…I think it's about the domination of the means of reproduction of genes and the means of development, proteins…instead of enclosing the field you just own [the] soybeans" (2006, 73). Ronnie Cummins, a spokesperson for the US-based Organic Consumers Association, describes the product of GMOs as one that exists because of a new ownership of life: "Animal genes and even human genes are randomly inserted into the chromosomes of plants, fish, and animals, creating heretofore unimaginable transgenic life forms. For the first time in history, transnational biotechnology corporations are becoming the architects and 'owners' of life." (2002, 213). Vandana Shiva,[47] one of the leaders of the anti-GMO movement, is perhaps the person most responsible for the catastrophizing rhetoric of the anti-GMO movement. In a 2012 interview, Shiva describes her rationale behind the term seed slavery: "In another time, some people thought it was alright to own other people as slaves. In our times some corporations think it is alright to own life on earth through patents and intellectual property rights (IPR). Patents are granted for inventions, and life is not an invention" (in Confino 2012). As Chapter Six shows, the imagery of GMOs reflects a larger critique of neoliberalism, becoming one of the chief sites of resistance to the technology. However, I find that the critique, while rooted in capitalism, goes beyond that into an interrogation of the nature of food itself, and a successful articulation of doubt over the technology.

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[47] Shiva has considerable cultural cache in the United States; she has variously been called "the Gandhi of grain." Bill Moyers, a liberal political pundit, called Shiva "rock star in the worldwide battle against genetically modified seeds."

THE GLOBAL AND THE LOCAL

This chapter examines the way that images mediate the global and local levels of the debate over GMOs. I examine the images produced by Greenpeace and Friends of the Earth, as well as viral images that exist within each country. I conclude that the images that emerge from each country strategically cross borders, becoming part of a global critique of GMOs.

Chapter Six: Strategies of Resistance: Visual Depictions of GMOs

In *Lords of the Harvest,* one of the most authoritative journalistic accounts of GMOs, Dan Charles writes that conflict over GMOs is not only about facts. He argues that people "disagree far more passionately over the *story.* They quarrel over the nature of the characters, the plot, and over the editing. They also feud over the unknowable: the ending" (emphasis in original, 2002). This sense that the story is larger than the facts is at the root of the controversy over the technology, and is mostly missing from scholarly accounts of GMO resistance. Although some argue that GMOs are a "proxy war" for battles over technology or corporate control over food, I find that these are the set pieces for a basic story that's focused on GMOs themselves. The iconography of GMOs show that, while people may be worried about the externalities, they are also worried about GMOs themselves. GMOs are not just a referendum on technology writ large, but are themselves worthy of inquiry. The visual culture of GMOs is instrumental in disrupting the link between biotechnology and food as we know it. What are these stories? How do they function and what are their political impacts? As discussed in Chapter Three, GMOs are particularly contentious because they span the global and the local. These images further bridge the global and the local, visually refuting the arguments made by proponents of sound science through creating negative associations with GMOs.

This chapter analyzes the cultural level of resistance to sound science, particularly focusing on the images used by opponents of GMOs. The images critique sound science by indicting the process, product, and implications of GMOs. The

previous chapters have asked the question of why there is such sustained resistance to GMOs. Part of the answer, this chapter argues, lies in the way that opponents of GMOs—both organized interests as well as members of the public—articulate the resistance to GMOs. The visuality of GMOs is ubiquitous—there are some 5.4 million websites that use the term "GMO," and the Internet is the predominant channel for debates over the technology.[48] Even as GMOs are ubiquitous in discursive space, they are also opaque. The product of GMOs cannot be seen: it is visually indistinguishable from its conventional counterparts, and, in the United States, is not labeled, so its commercial presence is opaque as well. Thus, part of the strategy of GMO producers and manufacturers is to render the product invisible. The counter-strategy is to make GMOs visible while critiquing the process of their production, the product itself, and implications of their introduction to the environment.

Chapter Structure

The chapter employs two tests to understand the variance between countries and the way the images function in the public sphere. First I study images produced by Greenpeace and Friends of the Earth, conducting a semiotic analysis of the images on the websites for each country.[49]

The second, more robust study is based on analysis of a database of images collected from each of the countries based on the most common Google Image results. I first analyze these images in terms of their content (Test 2a), searching for

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[48] As per Google searches in January 2015
[49] See Chapter Two for explanation of methodology

patterns or "logics of association" for each country. Then, I attempt to put the images back into a political and rhetorical context by tracing a selection of images back to their source (Test 2b). The process fails, revealing that the images are in fact viral and memetic, often appearing on hundreds of websites in dozens of variations. At the end of the chapter I discuss the political implications of the viral imagery. Most importantly, I find there is a qualitative difference in kind between the imagery produced by Greenpeace and Friends of the Earth traced in Test One and the viral imagery discussed in Tests 2a and 2b. Whereas the NGO images are largely mirrors of reality—often reflecting protests and fields—the viral images construct (sur)reality, using a logic of association and synecdochic phrasing to indict the "objective," naturalist logic of GMO defense, thus offering powerful critiques of the technology. I expand these categories to critiques of *process, product*, and *implications*. For the *process*, I examine the images of the technology itself; these most often take the form of needles, or juxtaposing medical and agricultural images. The images that depict the *product* make visual what genetically modified foods look like. These are often fanciful, imagining fruits of different sizes or colors. Finally, images that show the *implications* of genetic engineering imagine the impact of the technology such biohazardous foods, and forms of catastrophe. I find that I find that the narrative of opposition to GMOs depicts the foundation of the pro-GMO argument – the "sound science" figure – as an oxymoron: while "sound science" asserts the equivalence of GMOs and non-GMOs, the opposition posits that the product of genetic modification is not food at all, but a dangerous, toxic, foreign creation.

Theory

This chapter constructs a dynamic, symbolic constructivist explanation for resistance to GMOs. This approach is in contrast to the two dominant approaches to explaining cultural differences in the politics of GMOs. The first looks to psycho-social variance in attitudes toward culture and technology. The second focuses on static cultural explanations, and conclude that some countries are just inherently pro-GMO and some countries are inherently anti-GM. My focus differs from the former by locating the object of inquiry in text and external artifacts, rather than in attitudinal studies. My explanation differs from the latter by arguing that culture is dynamic, rather than static, and the meaning of GMOs is constructed and changes over time. As observed through a semiotic lens, GMOs are cultural objects that are part of contested terrain in which their meanings and significance are established, communicated, and challenged. A constructivist approach to the politics of science situates the discourse surrounding GMOs within a cultural context, providing mechanisms for understanding both the way in which ideas are transmitted as well as the strategic way in which ideas are deployed and manipulated in politically contested discursive, visual space. This idea of the hegemony of the image is particularly interesting in light of the power struggle over knowledge that exists between the pro and anti-GMO forces. Whereas the pro-GMO forces repeatedly assert the dominance of their claims verbally, they are virtually absent from the visual game. Forays into advertising ended poorly for Monsanto.[50] Thus, images are

[50] See Chapter Five's case study on the United Kingdom; also, image searches for Monsanto are entirely dominated by anti-Monsanto "captured" versions of the imagery. Examples are given in the appendix.

used predominantly to combat the arguments made by the pro-GMO actors. They appeal to emotions as they are employed to create a counter-hegemonic discourse (which sometimes is overtly articulated by the text, and other times left for the audience to fill in the rest of the argument). The narratives that emerge combine traditional symbols in unconventional ways, part of the strategy of "visual reversion and subversion" (Stoehrel and Lindgren 2014, 207). In this case, because there is no dominant visual narrative of the hegemonic voices, the use of images is a terrain that hasn't been colonized yet by the pro-GMO forces. The visual articulation of the GMO debate is a critical part of the overall cultural landscape. The clash over GMOs is one of rhetorical strategy as well as ideas. Whereas the imagery of opposition to GMOs is a well-developed iconography, proponents of GMOs do not rely on visuality as a dominant part of their defense of the technology. The imagery used by the GMO opponents is thus particularly significant, given the seeming decision on behalf of the pro-GMO forces to cede this part of the territory to the opposition.

Despite the focus on the visual aspects of the environmental movement, and the frequent tangential references to the visual dimension of the protests against GMOs, little rigorous scholarly attention has been paid to the images deployed as part of the GMO debate. This is particularly surprising because the anti-GMO image campaigns in different countries are rich, nuanced, and clever: images of square oranges, blue bananas, and mice with kiwis inside of them. These images that attract the eye and assert that GM food is "other."[51] They also successfully shift the burden of proof of the debate over GMOs to the visual realm: even as GMO supporters argue

[51] A variety of Photoshop contests were held to create these images; see, e.g., Freaknews.com in 2005

that the technology is substantially equivalent to conventional food, the images reassert the difference. The use of imagery is thus a significant, and under-discussed, part of the overall strategy of resistance.

An additional important theoretical component of the argument is that the images do not have "authors" or definitive sources. Barthes (1977b) articulates this notion as the death of the author: once the image exists in the public realm, the author ceases to have control over the image or its interpretation. Mukhongo observes this is particularly true of images on the internet:

> the meaning of images posted online lies in the various users diverse cultural contexts, and subsequently, how users interpret images online, is then not determined by the intention of the sender, but by the users themselves. The death of the author is necessary for the reader to be liberated and interact meaningfully with an image, in order to derive multiple meanings from it" (2014 331).

Further, the death of the author also allows for images to become memetic. Richard Dawkins introduced the notion of a meme as "a unit of cultural transmission, or a unit of imitation" (1976, 192), theorizing that memes were the way cultures transmitted information, much like genes transmit DNA or viruses can self-mutate but preserve its core structure. Dawkins notes that memes are characterized by fidelity, fecundity, and longevity. Hristova notes that memes "emerge at moments of contestation of dominant narratives and through their participatory structure of imitation and mutation, and they allow for the dissolution of points of ideological conflict as well as for the reestablishment of a normative

narrative" (2014, 265).[52] Online memes "spread faster, mutate more significantly, and remain active for a period of time" and most use humor, rich intertextuality, and anomalous juxtaposition as key components (Knobel and Lankshear 2007, 199).

The key to understanding GMOs lies in an analysis of the memetic nature of the images as well as in the logic of association, which places images within this larger cultural and discursive context surrounding the issue. Interpreting the images provides insight into the power of resistance to GMOs.[53] The power of resistance is found within the logic employed by visual counter-hegemony: the strategy of GMO resistance is to circumnavigate the logic of rationality of the proponents of GMOs and substitute the synecdotal reasoning—the logic of association—that communicates a diffuse narrative of mistrust. The following discussion examines the images that have emerged out of resistance to GMOs in each of the five countries. I find that the images are infused with a discourse of doubt and uncertainty through a critique of the process, product, and unknown implications of GMOs.

Test 1: Institutional Deployment of Images

The first set of anti-GMO visuals analyzed came from the websites of Greenpeace and Friends of the Earth. These organizations were chosen because they a) all have global chapters as well as branches in each country, which allows for the observation of variance, and b) because they are the two most prominent anti-GMO

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[52] If not too threatening to the health of the state body, these cultural viruses are left unchecked as they build immunity, and further, in Derrida's terms, the "autoimmunity" of the nation-state (265). As discussed in the concluding chapter, discourse surrounding GMOs is replete with viral metaphors, and is a valuable line of future inquiry.

[53] Chapter Two discusses the distinction between discourse analysis and content analysis.

NGOs (Ansell, Maxwell, & Sicurelli, D, 2006). I first captured all of the images from each country and then cataloged them by theme. The pictures were broadly organized into two themes: protests and fields.

Table 4: Image count for Test One

	Greenpeace	Friends of the Earth	Total[54]
United Kingdom	**1**	**0**	**1**
Germany	**17**	**5**	**22**
Poland	**5**	**0**	**5**
Spain	**10**	**7**	**17**
United States	**1**	**5**	**6**
Total	**34**	**17**	**51**

United Kingdom

As discussed in the previous chapter, Greenpeace and Friends of the Earth have made strategic decisions to no longer run an active GMO campaign inside of the United Kingdom. GMOs do not appear as part of the Greenpeace campaign at all. They are only mentioned as part of the sustainable agriculture global initiative, in an article about achieving a GMO-free Europe. The picture accompanying it is a field with the shape of Italy mowed into it, "kicking" the phrase "OGM."[55] Friends of the Earth similarly buries the topic of GMOs under three subheadings: "Land, Food and Water"/ "Sustainable Farming"/ "The truth about GM." The page contains no images, but only a brief description of why GMOs should be opposed.

Both of these organizations have decided to strategically deprioritize GMO campaigns in the United Kingdom. The results are consistent with the findings in

[54] These images were last checked on January 13, 2015. Some of the images are part of a rotating set, and so not every image appears every time.
[55] Perhaps a pun – Italy is "giving GMOs the boot"

Chapter Five that the issue is being reframed as a part of a larger advocacy campaign for sustainable agriculture. Additionally, the picture of Italy on the Greenpeace page reinforces the idea that GMOs are a European-level issue, rather than an issue unique to the United Kingdom.[56]

Germany[57]

Unlike in the United Kingdom, Greenpeace Germany has a robust internet campaign for GMOs, including it both under "Themes" as well as under "Campaigns." The themes present a wide variety of images of fields. One shows a scientist in a field looking at pods of some kind, wearing hazardous gear. Another shows rice farmers mowed into a field, and the caption reads that it is in support of organic rice cultivation in Thailand. Another photo shows a farmer dropping a potato into the soil. His bag reads "Potatoes without GMOs!"[58] Another picture shows Greenpeace protestors in a field with a yellow and black caution sign reading "No GM wheat in the field! No GM bread in the bag!"[59] Another shows a man spraying crops. A different picture shows a close up of hands in wheat. Another picture shows fifteen figures of the Statue of Liberty with cooking spoons in their hand wearing sashes that read "Liberty for Europe to be GMO free" Each of the statues have a different national flag. A final picture shows two men dressed in hazmat suits in a cornfield dragging a giant bottle of milk with the biohazard sign on it. The sign reads "GM

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[56] See Chapter 5 for Greenpeace's explanation for not focusing on GMOs.
[57] Unless otherwise noted, all translations in this chapter are my own.
[58] "Kartofeln ohne Genetechnik!"
[59] "Gen-Weizen kommt nicht auf den Acker! Gen-Brot kommt nicht in die Tüte!"

corn in Cow feed!"[60] Another picture shows Greenpeace activists attaching a sign that says "Gen-Milch" to a billboard. Another shows four Greenpeace boats next to a large ship with a sign on the side that reads "GM Soy: dangerous, unnecessary, unwanted!"[61]

Additionally, Greenpeace Germany has a campaign to stop the use of GM feed in McDonalds' chicken. An anti-McDonald's ad depicts a biohazard sign that says "Genfutter" underneath, and then an arrow pointing to a chicken, the large golden arches M, then a hamburger, then a man. Underneath it reads "Food chain" Produced with genetically manipulated feed."[62] Another picture is an upside down chicken that looks as though it's giving the audience the middle finger. A third reads "Caution! With GM Feed!"[63] on top of a picture of a McDonalds box, some chicken wings, and a chicken sandwich. A forth shows a cartoon chicken with its arms crossed. A biohazard sign is in the background and corn is dangling. The headline reads "Hunger strike. Chickens have no choice. We do."[64]

Friends of the Earth Germany (Bund für Umwelt und Naturschutz Deutschland (BUND) maintain a vibrant internet presence in its anti-GMO campaign. There are five images. The first is of a protest with the giant, blow up angry tomato. Across the image are the words "Together against GMOs. Become a member today."[65] The second picture is the green and white "GMO free" emblem. The third is an advertisement for the Roundup Weed Killer. The fourth is a sign that says

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[60] "Gen-Mais im Kuhfutter!"
[61] "Gen-Soja: gefährlich, überflüssig, unerwünscht!"
[62] "Nahrungskette produziert mit genmanipuliertem Futter"
[63] "Achtung! Mit Gen-Futter!"
[64] "Hungerstreik. Hühner haben keine wahl. Wir schon."
[65] "Gemeinsam gegen Genetechnik. Jetzt Mitglied werden."

"GENMAIS 300 m." The final picture is also of a protest. The sign reads "No GMOs in food and agriculture." [66]

The plurality of images in Germany highlight the places GMOs might still exist—fields in particular, as well as agriculture and herbicides. The anti-GMO McDonalds campaign also underscores this connection by reminding consumers that chicken feed contains genetically modified ingredients. The one picture of a protest asks Germans to become members of Friends of the Earth—rather than to protest—underscoring the professional civil society nature of Germany's anti-GMO movement.

Poland

There is no anti-GMO Friends of the Earth campaign in Poland; the organization's webpage is not well developed as of January 2015, and so contains no campaign like those seen in other countries. This section thus focuses on Greenpeace.

Poland's Greenpeace campaign focuses primarily on protest. The first picture on Poland's Greenpeace campaign page is a bushel of green vegetables with the tagline "Help us Rescue the Planet. Support Greenpeace."[67] One picture shows an older man and a younger boy with the tagline "Bolivians with their own agricultural produce."[68] One particularly interesting picture shows a giant ship labeled "HOPE" and a smaller rowboat. The rowboat is flying a Greenpeace sign that says "Poland

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[66] "Keine genetechnik im essen und in der landwirtschaft."
[67] "Pomóż nam ratować planetę wesprzyj"
[68] "Boliwijczycy z ich wlasnymi płodamu rolnymi." The reason why it's a picture of Bolivia is not made clear.

doesn't want! NO!" and a Greenpeace logo. The caption reads 2005.11.18: "Blockade of the ship "Hope," transporting 25,000 tons of GM soybeans originating from Argentina."[69] The images of Greenpeace blockading ships are particularly interesting in light of the neoliberal arguments in support of GM trade: there is a physical disruption of the trade itself. The next picture in English shows a man reading a sign that says "Keep our food safe! Stop GMOs!" The final picture shows a field of yellow flowers. Friends of the Earth - Poland (Polski Klub Ekologiczny) has no mention of GMOs on their homepage.

The Greenpeace images are focused on showing Poland in the act of protest—particularly protests organized by Greenpeace. There is consistency with other countries, such as images of Greenpeace blockading ships of GM imports, as seen in the German campaign as well. These images also generate publicity for the organization itself, GMO protest becomes a "cause célèbre," and emphasized on the organizations websites.

Spain

Greenpeace and Friends of the Earth both have vibrant campaigns in Spain focusing on protest and images of fields.

Greenpeace's Spain online campaign contains ten images. The first features an aerial view of a rolling hillside with farmland with a "No" sign carved into it. The second features rows of corn with protest signs stuck into them. The third is also in a field and shows two men wearing gas masks hold up a sign reading, in French,

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[69] "Polska nie chce/ No!" and Blokada statku 'Hope,' transportujacego 25000 ton genetycznie modyfikowanej soi pochodzącej z Argentyny"

"GMOs are toxic agriculture. Protect us!" [70] Another picture of a field shows a Greenpeace worker wearing hazardous gear walking through a cornfield. There are protest pictures outside of fields as well. One shows several people dressed as the "scary corn" protesting in front of a Spanish government building.[71] They are wearing and holding signs with a "No" label on them. Another sign reads, in English, Protect Europe from Genetically Modified Organisms. In front of the sign sit two people dressed as mice. The caption reads "GM Foods: a threat to fertility. A study reveals that GM maize affects reproduction in mice."[72] Another picture shows a dark image of a person wearing a gasmask. The caption reads "Action against Moyresa in Cartagena in 2004."[73] Another sign shoes rows of corn, one of which is a grenade. The caption reads, "GMOS are a time bomb that threatens the overall health of the planet."[74]

Friends of the Earth Spain (Amigos de la Tierra) prominently displays their anti-GMO campaign on their website, under the broader heading of Agriculture and Food. It contains a Civil Society declaration against GMOs, which is consistent with the findings in Chapter Five that there is still an active effort to mobilize the Spanish civil society to be involved in the anti-GMO movement. There are a series of images. The one is a field with a tractor in it against a bright blue sky with "Transgenicos"

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[70] "OGM=Agriculture Toxique. Protégez-nous!"
[71] See Test 2b for further examples of the "scary corn"
[72] "Alimentos transgénicos: una amenaza para la fertilidad. Un estudio revela que un maíz modificado genéticamente afecta a la reproducción en ratones"
[73] "Acción a Moyresa en Cartagena en 2004." Moyresa is the largest producer of GM soybeans in Spain. There were allegations that the GM crops contaminated conventional crops in neighboring fields, leading to Greenpeace actions against Moyresa in 2002 and 2004.
[74] "Los transgénicos son una bomba de relojería que pone en riesgo la salud global del planeta."

written across the bottom. A banner labeled "GMO Free Europe" displays another set of images. On the banner, one picture displays people at a rally holding a sign reading "GM-Free Sussex." The next is a field with a sign with writing in German.[75] The third is also a picture of a rally with a sign that reads NO GMO with people standing in front. The final picture appears to show farmers in front of a GMO free sign, but this picture is also low resolution so the writing beyond GMO does not show up. The second set of pictures also depicts a protest. There is a banner of corn with a horror face in front of the Ministry of Agriculture building in Madrid. Another photo shows a close up of a banner with corn on it. An Amigo de la Tierra logo is on the corn, and next to it a man in a Guy Fawkes mask takes a bite out of corn. The next image shows a giant inflated tomato with angry teeth.[76] The third picture in the series shows a rally with people holding a sign that reads "We Want to be GMO Free." A final picture shows corncobs in various colors and says "No to GMOs." In smaller letters, it reads "Since it was approved in 1998, Spain is the only EU Member state to permit the cultivation of GM corn MON810 on a commercial scale."[77]

Three major themes emerge from both Greenpeace and FOE in Spain: protest, fields, and connections with a broader European movement. The heavy emphasis on images of protest models for Spanish citizens what has been successful in other countries, reminds them that the issue is contentious in the rest of Europe, and encourages them to act, as well as demonstrates that there has been anti-GMO action in Spain as well. Of course, the pictures highlight the protest activity of

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[75] The words are unintelligible—the image is too low resolution.
[76] This is the same tomato that appears in an aforementioned picture from Germany.
[77] "Desde que se aprobó en 1998, España es el unico Estado Miembro de la Union Europea quie permite el cultivo del maiz transgenico MON810 a escala comercial."

Amigos de la Tierra (Friends of the Earth) in particular. The Spanish visual culture communicates a sense of masquerade, of danger and edginess, attempting to market GMO opposition to youth by making it "cool."

United States

Greenpeace's USA page is also part of the larger "sustainable agriculture" campaign. The GMO page is mostly textual instead of visual, and highlights the failure of the ag-biotech firms. They write: "But the agbiotech industry's vision of life sciences has hit hard times. Originally, these companies promoted their agrochemical, pharmaceutical and nutrition divisions, while they jettisoned their failing chemical businesses. However, with worldwide rejection of GE food, many of the top life sciences firms have now dropped their GE crop divisions, forcing them to make their way as independent companies."

Friends of the Earth United States is focused on two discrete campaigns: GE Salmon (referred to throughout the page as Frankenfish) and celebrating the decision made by McDonalds and Gerber to reject GE apples. The informational briefing from Friends of the Earth seems sensitive to the claim that anti-GMO advocates are naïve and anti-science. They indicate specific scientific advances they *do* support, before highlighting the fact that commercially available GM products are not for any of these sources. The informational briefing critiques Roundup Ready crops in particular. One image proclaims "Victory! McDonalds and Gerber say NO to GM apples." The image shows a baby dressed as Snow White holding an apple. The anti-GE salmon campaign focuses on a diffuse set of images. One is of a giant salmon eating a smaller with the headline "Keep GE salmon off our plates!" There is also a

picture of a rally with a sign reading "Obama say no to GE salmon." Another picture shows a front page of *The Guardian* with the headline "Public needs information on GM salmon: advocates." Here, we see the familiar theme of protest and using other references to other countries as a means of articulating the critique.

Conclusions

There is no campaign from either Greenpeace or Friends of the Earth for the United Kingdom, but an active one for Spain. This is an indication that the organizations are targeting their resources at places where there is the most room for change. The analysis for Poland is perhaps skewed because there is no real website for Friends of the Earth Poland. The images produced by Greenpeace and Friends of the Earth focus on protests and fields, making visual one site of genetic engineering as well as the acts of protest. The third category includes images produced specifically as part of campaigns. Greenpeace has a campaign against McDonalds GM chicken feed in Germany and Friends of the Earth have a campaign against GM salmon in the US.

There are a few conclusions that can be drawn from my analysis of these images. First, they clearly follow the logic of argument—cause and effect, rather than the logic of association discussed below. The logic of argument manifests in terms of the use of other countries as examples—for instance, the Spain page shows protests in England, and the US page shows a British newspaper. These are subtle ways to indicate the success of previous campaigns. They also show the site of GM focusing on images of fields, rather than the laboratories depicted below. To what

extent are these strategies reflected in global anti-GMO imagery? That question is explored in the following section.

Table 5: Test One Images by Theme

	Protests	Fields	Other
United Kingdom	**0**	**1**	**0**
Germany	**1**	**9**	**12***
Poland	**2**	**2**	**1**
Spain	**10**	**6**	**1**
United States	**1**	**1**	**4**
Total	**14**	**19**	**18**
***This number is inflated by the number of McDonalds-related protest pictures**			

Tests 2a and 2b: Analysis of the Most Frequent Anti-GMO Images in Each Country

In this section, I trace the most popular images of GMOs that emerge from each country. I created a dataset of images based on the top 10 pages of images from Google's image search for the term "genetically modified organism" in each language, restricting results to those from Internet Service Providers (ISPs) within each country.[78] Then, I categorized the results first in terms of pro- and anti-GMOs, creating a dataset of anti-GMO images. I then classified those in terms of process, product, and implications. For Test 2a, I analyzed these images in terms of the story about GMOs that they tell without regard to a broader political context and without examining the source of the image.[79] In Test 2b, I then attempted to put the images back into a broader political and rhetorical context by tracing the origin of each image.[80] I find that doing so is impossible: unlike the Greenpeace and Friends of the

[78] See description of methodology in Chapter Two.
[79] All images referenced in Test 2a are cataloged in Appendix A
[80] All images referenced in Test 2b are cataloged in Appendix B

Earth images, the images produced here are memetic and occur on hundreds of pages, both within the specific countries and across international borders.

Table 6: Image Categories

Image categories		
Process	**Product**	**Impact**
Production: Needles Lab equipment Beakers Pipettes	*Physical changes* Plant-plant hybrids Creations with unusual physical characteristics Plant-animal hybrids	*Biohazards (Harm)* Biohazard sign Caution signs Hazmat suits
Patenting life (branding) Barcodes Tags Corporate imagery	*Horror (Masquerade)* Vampire teeth Blood Macabre Frankenstein/ Frankenfoods Aliens	*Animals (Testing)* Tumors Physical detriment

Table 7: Number of Images in each Country

Test Two: Imagery Dataset Number of images			
Country	**Total N**	**Anti-GMO**	**Percentage**
United Kingdom	149	58	39[81]
Germany	157	90	44
Poland	145	73	50
Spain	157	90	57
US	142	84	59
Total	**749**	**373**	**50%**

United Kingdom

The United Kingdom had the lowest number of anti-GMO images in the dataset; it also had the most conventional set of images. A major strategy embraced by the British anti-biotech movement was to mobilize discourse that constructed GM foods as un-natural and unsafe and that highlighted potential risks rooted in the unknowable nature of the technologies (Levidow, Murphy, and Carr, 2007). The metaphors of disease and contamination—such as "genetic pollution, "genetic contamination," and "Frankenfoods" were used by protestors, extending the argument that the foods were unnatural, unknown, and the risk was likely to spread.

[81] The number in the UK was the lowest—only 39%. This is in part because there was a significant overlap between the US and the UK's images, even when restricting the domains. It could also be because the debate over GMOs in the UK began earlier than in the other countries.

One strategy was to play on the idea of mutants and mutations. The anti-Monsanto campaigns labeled the company Monsatan, (a play on Satan) and a devil's tail is superimposed over Monsanto's logo (UK 5-1).

Process

The depiction of the process of genetic modification was dominated by the image of needles piercing apples, (UK 4-6),[82] corn (UK 3-16) and strawberry (UK 6-10). In a more complex picture, there is a needle piercing a tomato; above the tomato is a skull and crossbones made out of a fork and knife (UK 6-10). The repetition of needles piercing the fruit evolves into a message of warning, blending images of the process of genetic modification and images of eating (the fork and knife) with images of death.[83]

Product

Physical effects. British images display a wide variety of imaginary outcomes that are playful interpretations of the possible hybrids that may emerge because of genetic engineering. One shows a frog with an orange peel for a body (UK 2-10), and another shows a fish with a tomato sauce can for a belly (UK 4-9). Another shows a carrot with circuitry inside (US 2-11). The images that focus only on plants include a half red half yellow apple knit together by safety pins (UK 5-7), and a fruit-fruit hybrid - an apple with an orange slice revealed (UK 4-7). The sole picture of

[82] The images are referenced based on the country code, the page number, and the image number. Images that were found not as part of the original search are indicated by an x.

patenting life features two potatoes, one stamped GMO (UK 9-15). The stamp is a mark of ownership.

Horror motif. The surreal depiction of plant material hybrids is reinforced by images of horror. Images of mutations reinforce the major themes of protests across the UK. One image displays corn with an alien face; the caption reads: "Plant the real deal, not mutations" (UK 9-14). In another, the grim reaper stalks a cornfield with the caption "The **G**ri**M** reaper (UK 10-3). The grim reaper is a double pun: first, a play on the GM in grim. Additionally, the play is in the word "reap"—the harvesting of GM products is linked to death. This emphasis on mutants underscores the idea that the GM food produced is somehow "other"—particularly reinforced by the admonition to plant "the real deal." idea of mutants is visually extended to pictures of alien life. Though these images are playful, there is a sinister undercurrent as well. The idea that GMO crops are "other" is also found in the surrealist depictions of GM crops that show the potential physical effects of genetic engineering. There are a few images of biohazards, such as an image that depicts cornfields with biohazard signs that read "genetically modified" (UK 2-9) and another that depicts farmers in a field wearing hazmat suits (UK 3-13).

Conclusion

In the UK, the depiction of the process and the implication are understated, with the focus on generating questions about the product. The United Kingdom has unique features: an emphasis on images of death, such as the skull and crossbones and the grim reaper. There is also the focus on images of mutation, which uses a strategy of estrangement in order to convey the idea that GM crops are no longer

food, but belong in the realm of the unknown other. The issue of GMOs is more settled in the UK than in other countries, largely because there has been such a vigorous, long term, public debate.

Germany

German images depict a complex visual logic critiquing the dangers of genetic engineering. The process, product, and implications are all well presented and the themes that emerge are complex and nuanced. German images also employ humor and irony, such as a picture of farmland, where farmers are driving a tractor towards the edge of the cliff marked "Gentechnik" (G2-13). Germany frequently uses the biohazard symbol in images depicting GMOs. This symbol was invented by Charles Baldwin of Dow Chemical and Robert Runkle of the National Cancer Institute in 1967 in order to develop a symbol that indicated the possibility for warning of a biological hazard, most often attached to infectious disease research. [84] The use standards for the biohazard symbol stipulate that it "shall be used to signify the actual or potential presence of a biohazard and shall identify equipment, containers, rooms, materials, experimental animals, or combinations thereof which contain or are contaminated with viable hazardous agents." For the purpose of the standard, biohazards are defined as "those infectious agents presenting a risk or potential risk to the wellbeing of man, either directly through his infection or indirectly through the disruption of his environment" (Baldwin and Runkle 1967, 265, emphasis added). The frequent use of the biohazard label creates an

[84] See Baldwin and Runkle (1967) for a fascinating discussion of how the Biohazard symbol was derived and field tested).

association between toxicity and GM crops. As the analysis below indicates, the repeated use of the biohazard symbol becomes an icon, a symbolic shortcut that equates poison with the technology.

Process

Genetic engineering. Images of needles are frequently repeated; in this set of images, sometimes only a needle and a plant is shown, such as a tomato with 8 needles sticking out of it (G9-6), sometimes in a lab (G5-4), in other images, you see the act taking place as a gloved hand actually administers the injection (G10-3; G10-1); in other versions, there is a close up on the scientist in protective gear, holding the needle over the fruit (G2-14). Related are the pictures of the fruit being pierced by something else: one piercing image shows a DNA strand with a knife cutting through it (G5-7); another shows a pear/apple hybrid with staples in the middle (G1-5).

Patenting life. The German opposition uses irony to critique the idea of patenting life. In one political cartoon, children are sitting around in a circle and the teacher asks "Who can tell us something about the creation of mankind?" To which one of the children responds "Hey Mischa—your dad works in genetic engineering!" (G2-1).[85] Another shows a fat baby with an ear tag that reads "Patent 0815" (G9-4). The idea of patenting life is depicted in human, rather than plant or animal, terms.

Another version of this joke is a cartoon that shows two stalks of corn talking to each other about a man in a suit with glasses, carefully studying a plant. The first

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[85] "Wer kann uns denn einmal etwas uber die Erschaffung des Menschen erzählen." / "He Mischa! Dein Vater arbeitet doch in der Gentechnik!"

plant asks: "Who's that strange dude?" To which the second plant responds: "Maybe it's the farmer…genetically modified" (G5-13).[86] This cartoon plays on the unexpected image of a businessman in the middle of a field, jokingly suggesting this is the case because the farmer himself has been genetically modified.

Product

Physical effects.

A surreal set of images depict the physical effects of genetic engineering. One image depicts wormlike carrots tangled up (G8-7). A popular motif is changing the physical appearance of the fruit, such as making the fruits funny shapes or colors. Color changes include very, very blue tomatoes (G7-5); one version is square strawberries (G6-14); another showing a "normal" apple in the middle with a square apple on the left and a triangular apple on the right (G3-5). Another shows a tomato vine with 5 square tomatoes (G9-5). Another popular image that flirts with the macabre is a mouse cut into tiny pieces with a kiwi inside and kiwi green drops of blood on the table (G9-13). Another shows a piece of corn being unzipped to reveal red seeds (G10-1).

As with the process, German images put the products into context of production and manufacturing. One image depicts square melons on an assembly line [G4-7]. The hybridization also takes the form of a fruit/technological combinations, such as an image of a luminescent pear with a wire coming out of it (G6-10). Another depicts giant corn the size of trees being taken away on a truck.

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[86] "Was ist denn das für ein komischer Heini?!"/ "Wohlmöglich der Bauer…gentechnisch verändert"

(G7-9); in another a man holds up a giant potato that's bigger than he is (G8-6). Another shows a field with a giant potato stamped with a label reading BASF (the name of a major ag-biotech corporation) (G9-11).

Germans also use political cartoons to advance the critique of physical change. One cartoon depicts two talking bananas, one with bruises and a mustache; the first banana says "OMG! Why do you look like that?" to which the second banana replies "I was genetically altered" (G2-7).[87] A related image displays two potatoes with old, sad faces and says "Stop the black and yellow GM potato (G8-13)[88]. In another, a lemon is given eyes, a nose and a mouth with scissors and glue lying next to it (G8-5).

Implications

Biohazard. The most dominant message in German discourse is that GMOs are toxins or biohazards: this image is repeated 26 times in the top 150 German images. These images are strategically repeated across three categories: biohazardous food, biohazardous fields, and implied hazards.

Food. Most of the pictures of biohazardous foods show the biohazard sign piercing plants. Each picture of food that is not in the field is pierced, thus creating the association that the act of genetic modification destroys the crop. One such image displays a tomato cut open, being pierced by a biohazard sign that has

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[87] OMG! Wie siehst du denn aus?"/ "Ich wurde genetisch verandert." OMG (slang for "Oh my God!" is frequently used as a playful inversion of GMO in all languages in the sample.

[88] "Stoppen die schwarz-gelben GENKARTOFFELN" This image was created by graphic artist **Peter Hübner for the organization Mitwelt, and released freely onto the internet**

"GENFOOD" written underneath (G 1-10). G7-13 merely inverts the same image from G1-10 and zooms in on a different aspect of the shot: the picture shows tomato and corn in a lab with the corn being pierced by a biohazard sign that reads GENFOOD. In the background, there is a skull and crossbones on a poison sign (G7-13).

Another image shows corn with a radioactive label and a fork sticking into it, with green drops emulating blood (G1-12). Another image displays corn on the cob being pierced by a fork is accompanied by the words "Danger of genetic engineering".[89] These images show the piercing of the food itself—the destruction of the whole food.

In addition to images of pierced plants, there is also a magnifying glass motif. For instance, one image depicts, on the left, a glass of milk with a cow on it. On the right, there is a magnifying glass looking at the cow feed with a biohazard sign on it. The message, of course, is that GMOs exist in animal feed as well as in human food, and that biohazards can be lurking below the surface, out of sight (G3-10). This reflects the visibility/invisibility distinction discussed above.

Fields. Another motif shows fields that are labeled biohazards; one image shows a field with a biohazard sign in the middle with the sun setting, ominously, behind it (G3-11). A frequently deployed image shows a scarecrow hanging with barbed wire on a dead field with MONSANTOLAND written in ominous letters above it. (G9-12). Others combine the biohazard label on a field with the term GENFOOD or "**GEN**technish manipuliert" (G2-3; G4-3; G8-8). Another image has a field with a

[89] "Gefahr durch gentechnik"

biohazard sign in the middle and a crop duster flying overhead (G2-8). Depicting the crop duster equates an anti-GMO position with an anti-pesticide message.

The biohazard sign is sometimes implied but not present, such as a field with a giant sign reading "ACHTUNG! Genmanipuliert" (G3-15) Other Greenpeace images depict fields as crime scenes with messages like "crime scene: GM Field" (G8-3).[90] Greenpeace image depicts a man in a cornfield dressed in a hazmat suit. A warning sign reads "Greenpeace: Careful—GM Corn" (G10-6).[91]

Conclusion

Germany has a clear argument against genetically modified foods: that they are biohazards, toxic to fields and foods. This is depicted through the repeated use of field imagery: 25 of the images depict fields, as opposed to only nine lab settings. The biohazard trope is often repeated. The caution label also stands in place of the biohazard label; in one picture, a sign with a giant X is overlaid on a field. This is the same X as from the X-files (X-1)–referring back to the notion that GM is alien, mutant technology and appealing to an edgy, youth culture (G3-15). A similar image shows a farmer in a hazmat suit with a caution sign that reads "Caution: GM corn."[92] Another image shows a yellow sign in front of a field that reads "Caution! GM Corn out of control!"[93] A hand holds a needle in front of the sign (G6-5). Another shows scientists in a field, dressed in hazmat suits, examining what appear to be larger-

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[90] "Tatort: Gen-acker"
[91] "Vorsicht Genmais"
[92] Ibid
[93] "Achtung! Gen-Mais Ausser Kontrolle!"

than-life plants (G5-1).[94] In these images, the hazmat suits replace the biohazard sign. There is also an emphasis on cartoons to make the arguments in an ironic or funny way, or an emphasis on the absurd—such as the tiny people examining or bringing away giant crops. The products are shown in terms of irony instead of horror—there is no reference to Frankenfoods or mutations.

Poland

Process

Poland's images depict the process of genetic engineering in different settings. There are images of needles entering plants, but also other scientific equipment as well, such as pipettes and beakers. Some images display just the plant themselves, such as an image of three tomatoes, small medium large, needle going into the last, large one (P2-1). Other images display the setting of a lab, such as an apple that is half green and half red with staples in the middle (P4-15). On the side sit two beakers with fluid, one red and one green (P2-5). In another, a scientist, wearing gloves, smirks as he injects a needle into a lemon with two huge lemons to the side (P2-10). Another picture shows a wheat field and a disembodied hand holding the wheat, with pipette dripping something onto it (P4-16). A similar image shows a tomato on a vine, ripening as a hand injects a needle into the only red tomato (P4-1). Thus, the scientific, technological equipment demonstrates the logic of the process: the way in which genetic engineering is carried out.

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[94] The camera angle is key here: this photo is shot using a "Dutch tilt," first used in 1919 German Cinema, the Cabinet of Dr. Caligari (Bowen & Thompson 2013). It is used in cinema to convey madness or unease. Thanks to Jim Baker for this observation.

Patenting life. As was true in the German case, Polish images critique the patenting of life through political cartoons. In one picture, an old, grandmotherly figure is in the woods with a basket looking around. The trees, plants, and grass all say "Patented" in English. The caption underneath reads "Patented life will be owned by corporations" (P3-3).[95] Another variation of this theme shows only a man's arm, clad in a business suit, holding a shiny tomato with a sign that says BIOTEC ASSOCIATION (P8-14). Here, ownership is in the hands of corporations, rather than the people.

Product

Physical effects. Polish depictions of the physical effects of genetic engineering displays some of the standard physical changes, such as square oranges (P4-7) and a square watermelon (P1-10), or different colors such as a line of green strawberries with one colored red (P1-3). There are more ominous images too, such as strawberries growing green lumps that resemble tumors (P3-2). Another ominous image shows corn with black seeds (P1-12). A different image shows a tomato with a magnifying glass revealing green spores (p 7-6).

The distinction between fantasy and reality is emphasized. For example, a picture shows a plate of food with a fish in the middle. The caption reads: "GMO Menu? No Thank You! Dish of the day: carp and rice with human genes, salad with rat gene, tomato with fish gene. It's not fantasy, it's reality" (P 7-12).[96]

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[95] "Opatentowane życie będzie własnością korporacji"
[96] "GMO Menu? Nie, dziękuję! Danie dnia: karp i ryż z ludzkimi genami, sałata z genem szczura, pomidory z genem ryby. To nie Fantazja; to rzeczywistość."

Horror motif. The fantasy/reality distinction is extended with frequent horror pictures and imaginative scary images. For instance, a row of corn with a vampire faces hold signs that say "STOP GMOs" (P2-13). The scary corn, sometimes also drawn with vampire teeth, appears in Polish protest art as well, including a cartoon with signs in the background that say "stop GMO" (P2-13). A wall of graffiti shows a picture of the grim reaper with his scythe raised over a blindfolded man on his knees, with the words "Say No to GMO" written on the wall (P10-9).[97] Another shows a tomato with its tongue out that says "Let's say no! To GM foods" (P6-12).[98] There is also the use of children in the fantasy ads. In one, a little boy is winking, holding an apple with teeth. There is blood everywhere. The caption reads in English: "Hey Look! Frankenfoods are FUN FOODS (Monsanto)." In Polish, the little boy says "instead of biting the apple, the apple bit me!" (P1-14).[99]

Implications

Polish imagery focuses on the impact of GMOs on animals. One of the justifications Polish scientists gave for defying the European Union was that GMOs was harmful for bees. The ECJ ruled against them, but this argument comes across in one image that displays a bee wearing a gasmask in front of a field, holding up a sign with a skull and crossbones "Polluted! GM Maize" (P3-4).[100] As another example of commentary on current events, the image of the mouse with tumors from the Séralini experiment is repeated often, reinforced by pictures of skull and crossbones

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[97] "Powiedz nie dla GMO"
[98] "Powiedzmy: NIE! żywności genetycznie modyfikowanej"
[99] "Zamiast to ja ugryźć jabłko jabłko ugryzło mnie!"
[100] Skażenie! Kurkurydza genetycznie modyfikowana

(P 8-5). In another picture, there are 4 frames of a mouse getting injected; the mouse dies in every other one (P1-13). The message is driven home by the picture of the mouse and the text "Seriously??!? Are you sure???" (P4-6).[101] This is an example of visual propositioning—using images to refute the logic of their opposition, thereby underscoring the uncertainty of the technology.[102] The message here is clear: given the choice between believing what you see or believing the claims of the scientists, which do you trust? A final image shows rats in a cage, sweating and horribly mutated, and the headline reads "All rats fed our products lived!" (P3-15) [103] This image plays on the understatement of the idea that the rats "lived."

Conclusion

The Polish images adopt a critical, skeptical approach to GMOs. The critique is multifaceted, focused on the process and implications. The political cartoons that mock the patented nature of the crops connect the technology to larger critiques of western imperialism (both Europe and the United States). These pictures are part of the Polish narrative that situates GMOs within the larger discursive framework that

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[101] Poważnie??!? Jestescie pewni???

[102] Visual propositioning (Abraham 2003; Abraham and Appiah 2006) occurs when visual images are used (with implied information beyond that stated explicitly in the verbal text) juxtaposed with the explicit verbal statements to make a comment, proposition, or suggest new meanings. A message is a "material object" with a linguistic and visual component that collectively signify meaning, and the synthesis of the text and visual component collectively signify meaning (Oremod and Ivanic 2002). This also helps to overcome the textual bias in discourse analysis that focuses exclusively on the verbal to the exclusion of the visual (Pan and Kosicki 1993).

[103] "Wszystkie szczury karmione naszymi produktami żyją!"

equates rejecting GMOs to rejecting the west. Similarly, the focus on the potential implications of GMOs revives the meme of the mice from the Séralini study. This position of skepticism reinforces the political will to reject western technology.

These images of landscapes altered by GMOs can also be tied to the social construction of landscapes and countrysides, particularly in Poland, where rejection of GMOs is closely tied to protection of the agrarian class.[104]

Spain

Spain frequently redeploys images from other countries, and uses blunt, direct imagery to advance the ideas. The only time the words "playing God" are actually used is in a Spanish picture, where a big stalk of corn is captioned with "GMOs: Playing God" (S7-13).[105]

Process

There is the standard image of the needle going into various crops with the attendant physical changes. For example, there are pictures of corn on the cob (S2-3), apples (S2-4), and tomatoes with needle going in (S1-12). The needle pictures are often displayed with attendant physical changes: one shows an apple that is half red and half green with the needle going in; another picture shows three tomatoes of ascending size, with the needle going into the biggest one (The same image as US1-2, P2-1). Another depicts a scientist in a hazmat suit giving an apple, broccoli, and tomato an injection (S3-11, S5-9, S6-12). A cartoon displays a bunch of cartoon

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[104] See, also, the vast literature on Soviet propaganda and the farmer's collectives, e.g. Belov (2013).
[105] Transgenicos: Jugando a ser dios

vegetables dancing, while needles penetrate them. The words "GMOs: Experiments!" are written everywhere (S2-8).[106] A slightly altered version of the needle them shows a pipette dripping liquid onto a plant (S2-11). These images focus on the process of genetic modification, along with fantastical physical changes resulting.[107]

Product

Physical effects. In Spain, one major theme is hybridized fruits: an apple peeling away to reveal an orange (twice); an orange sliced open to reveal a tomato; A pepper peeled back to reveal a banana; an apple sliced with a lime inside; a bright blue strawberry; a banana peeled with a bird inside; a kiwi sliced open to reveal a mouse; a fish sliced in half with cantaloupe; an orange with a kiwi; an apple bottom pear top; a rainbow colored lemon; a pear shape colored as a watermelon with coconut inside; a strawberry with a kiwi inside; an apple with an orange inside; an orange with a kiwi inside. Another demonstration of the physical effects of genetic modification shows two tomatoes, the regular one with the organic sticker and a big purple one with a GMO sticker (S1-2); there are also multiple images of square fruit (S1-4, S1-7). In this vein are depictions of human-animal hybrids—a pig's head on a giant man with "Mosanto" (sic) written on the bottom (S10-11).[108] Another series of images show plant/animal hybrids, such as a tomato with a face, legs, and a crossed

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[106] Transgénicos: Experimenta!
[107] There is one image of patenting: An image of patenting life shows two peas in a pod with barcodes on them and "Monsanto" written under the barcode (S7-4).
[108] I believe this to be a typo.

beak (S10-9)[109], an evil looking corn/fish hybrid (S2-6), and a fish with papaya guts are all shown as well (S3-5). Another such image shows a banana peeled back to reveal a sparrow (S3-7).

The imagery surrounding GMOs reinforces the possibility of uncertainty; one image depicts a field of corn covered in black question marks (S4-4). In another, a wireframe computer rendering of the "ideal" masculine form stands next to a DNA strand covered with question marks (S8-9). In a third, cows stand in a field with DNA strands everywhere. The caption reads "GMOs: what are they made of?" (S8-1).[110]

Horror motif. The Frankenfood/horror motif was often accompanied by humor and irony. There is a heavy emphasis on tomatoes (S1-11) and apples (S6-1) having vampire teeth. One picture shows an apple with eyes and teeth biting a hand as the hand bleeds (S9-9). Another picture shows a bat with a vampire face (S7-3). In another image, you see a Frankenstein character with three eyes, an antenna, and three hands being interviewed. He says "I eat GMO foods without any fear—and nothing bad has ever happened to me!"(S7-10).[111] Another image shows a witch giving Snow White an apple with the caption "Don't tell stories. Don't buy GMOs" (S9-13).[112]

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[109] Although this image shows up in a search whether the ISPs are restricted to Spain, the image is for a Costa Rica anti-GMO ad. This further underscores the way in which these images travel across borders.
[110] "OMGs: como se hacen."
[111] "Yo como alimentos transgenicos sin ningun miedo...Y nunca me ha pasado nada!"
[112] "Que no te cuenten cuentos. No compres transgenicios." This idea of GMOs representing Snow White's "poison" apple is also found in the Friends of the Earth United States campaign.

Implications

Biohazard. There are multiple images of scientists in fields. In one, a scientist wearing a gas mask in a field holds a needle in one hand and lettuce in another (S10-1). A biohazard sign is getting entangled by corn. The caption reads: "GMOs are dangerous for life"[113] (S3-1). In another, a man in a hazmat suit sprays a room full of plants (S5-1). Spain, like Poland, also repeats the picture of the mouse with the tumors (S1-17, S3-13).

Conclusion

These images connect uncertainty with the genetic sequence and its modification, and then take the extra step of connecting that to the food chain. The explanatory nature of Spanish images, like the protests depicted in Test One, are aimed at educating and mobilizing the Spanish populous against GMOs. The message is clear: even if science is sure, there is room for doubt, and that doubt impacts what we eat. There is also an emphasis on fields, likely because of the heavy cultivation of GMOs in Spain. This is connected to the agricultural and images of land use in Poland and Germany as well.

United States

Process

The depiction of the process of genetic modification is pretty standard in US images. There multiple pictures of tomatoes and needles (US 1-15), and some display physical changes, such as a picture of small, medium, large tomatoes, with a

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[113] "Transgenicos peligro biologico"

needle entering the largest one (US 1-2). Another physical change shows green tomatoes on vines, with a giant needle going into the only red tomato (US 2-2) Along with physical changes, there are also illustrations of the process, such as an image of a stack of cucumbers and a stack of tomatoes, a gloved hand sticking a needle into the tomato (US 6-3). In another, there is a picture of DNA code above a tomato with a needle going into it, with the shadow of the needle displayed on the tomato (US 3-11). Another image depicts giant carrots next to a beaker with two needles sticking out—one blue and one yellow (US3-8).

Patenting life. Patenting imagery is common. One image contains three pictures. On the left, a white hand extends an empty plate to a shirtless African boy; the text reads: "Corporate totalitarianism rules through dispensability rather than exploitation! It treats communities, people, countries, ecosystems, species as disposable and dispensable." Below, a caption reads "Capitalism: Where you can **enslave** fellow humans and rape the planet – and be praised for your good business sense. Thinner than ever." On the right, an image of a wheat field with rolls of money instead of hay. The bottom of the motif features a hand reaching toward corn (US9-11). Another image shows two lemons, one of which has a barcode imprinted on it (US 6-6). In a third, a cartoon of a man is eating corn and a label appears reading "patent pending" (US 7-11).

Product

Physical effects. There are multiple depictions of the physical effects of genetic modification on animals, such as a zebra with white front and striped back (US 4-2). In another picture, there is an already-plucked chicken (US 4-12); in

another, there are giant chickens next to a tiny man. There are also animal-plant hybrids that show poisonous animals crossed with plants, such as a scorpion crossed with carrots (US 1-3) and a tomato with spider legs (US 4-10). In another, there is a bald mouse in a Petri dish with an ear on its back (US 7-2, also P3-5), and another image of the lab rat with the tumor (US 7-1).

Horror motif. There are various images that play on the macabre or fear of death, such as a scorpion poised to strike, made entirely out of carrots (US 1-3). One picture shots a tomato, a plus sign, a DNA sequence and an equal sign with a tomato making a horrible face. The caption reads "crop + unrelated gene=GMO" (US 1-4) Another image shows a banana with black eyes and reads "Genetically Modified Food: It's already in your local grocery store" (US 1-13). There is a disembodied hand holding an apple with vampire teeth, which is sticking out its tongue (US 3-1). In another picture, there is a creepy little girl with black eyes sitting in a grocery cart. In the cart are "MSG pizza" and "aspartame ice pops," behind her is an aisle of Monsanto produce, such as Monsanto corn and Monsanto bell peppers (US 7-13).

Implications

Biohazard. The biohazard sign appears repeatedly in the US images. For example, there are rows of tomatoes with biohazard stickers (US 8-7). One also shows a scientist in a lab bent over a Petri dish with a biohazard sign in the back (US 10-10). Another cartoon shows a farmer watering plants with a gasmask on. One of the plants asks "Do you also eat with that thing on?" (US 10-11).

Conclusion

The United States has a standard approach to GMOs. There are almost no depictions of physical effects involving just plants: instead, the focus is on depicting the process through a focus on animals. This is probably because genetic engineering of plants is already occurring in the United States; the next frontier is genetic modification involving animals. This also mirrors the Friends of the Earth Campaign against GE salmon.

Test 2b

The above analysis subjected the most prominent images from the five country to semiotic analysis, determining what form the critique of process, product, and implication took in each country. Appendix Two has a chart with all images and image counts.

These results are far more diffuse than the images used by Greenpeace and Friends of the Earth—more varied in terms of images, themes, and argument. To determine what is driving the meaning, the next step is to subject the anti-GMO images from Test Two to an additional round of scrutiny where I attempted to discern the providence of the images. The question is whether it makes sense to use traditional discourse analysis to analyze these images—that is, whether exploring the rhetorical context provides meaningful information about the image or about the larger politics of GMOs.

Procedure

I selected additional 29 images that represent each of the 5 counties and a sample of critiques of process, product, and implication, and went through the

process of tracing the images. I was particularly interested in the way images shifted or changed or moved across rhetorical context.[114] The 29 images I analyzed appeared on a total of 17,480 webpages.

Results

The first image I traced was Frankencorn: corn with a scary face of some kind. In one such example (UK 5-15), there is a picture of a little girl eating corn with a giant Frankencorn looming behind her. There are five signs in this image: the row of corn, the eye, the child, the DNA strand, and the Frankenstein corn. The image depicts a small child with blonde hair at the front. Her eyes glance to the right, and she is clutching the corn with both hands. The child is wearing a shirt where "genetically modified" can be read. In the background, a tall stalk of corn looms. The corn stalk has a Frankenstein face. Emanating from the corn are DNA strands that wrap around the child. In the background are rows of corn. At the top of the rows of corn is an eye. This image itself appears on 600 websites.

The Frankencorn motif appears in four of the five country samples: UK 5-15, (Frankenstein's face in a piece of corn, watching a little girl eat) Spain 4-4 (corn with question marks), Poland 2-12 (cartoon vampire corns with signs that say stop GMOs), Germany 2-5 (scary corn face in the woods). What is the providence of this image? Is it possible to trace back? To answer this question, I conducted a reverse image search, which revealed that a version of the Frankencorn image appeared on 2618 pages; I identified 27 versions of the image from each of the five countries.

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[114] Some of these results were obviously due to attempts at search engine optimization, or because of something unrelated to GMOs entirely. These cases have been omitted from the counts and noted in the table in Appendix Two

Examples of variations included Frankencorn emblazoned on a kite, a cartoon version eating a city, held up at protests, with a sign that says keep our food safe stop GMOs, on a French field, at a rally in India, with question marks and with Frankenstein's actual face.

I then traced a second image that appeared across multiple countries in my sample: a cross-sectioned tomato with something growing inside. I found that there were three versions of this image: a fetus (558), the question mark (431), and the Monsanto skull and cross bones (555), for a total of 1544 images.

I repeated this process with additional images. Monsantoland appeared on 831 websites across all five countries. I identified four versions of the "genfood" label with a biohazard sign were identified on 886 websites, also across all countries.[115] Images also traveled within countries. The Spanish cartoon of the girl with the apple (S9-13) appeared on 227 Spanish pages, and the alien conducting the interview cartoon (Spain 7-10) appeared on 201. The sparse "Do you know what you're eating?" (S2-14)[116] appears on 824 pages. The rat tumor pictures appear on 2303 websites, including the cartoon with the rat in the Polish analysis, which was originally a French cartoon. The "Hey Look!" kid poster appeared on 1180 pages in English and Polish. The GMO noose appeared on 458 pages.

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[115] Much of this relies on Google to estimate the number of pages, and assumes that Google is weeding out results. I am both certain there are similar, analogic images that the search algorithm didn't catch, and that a number of the hits are in some way doubles or are from photosharing sites. These numbers should thus be taken as rough approximations instead of as firm.

[116] A Greenpeace image

Analysis

These two tests—of the institutional images and the anti-GMO images—tested the question of whether there are different visual strategies at play. To this question, we can clearly answer yes. The images produced by Greenpeace and Friends of the Earth focus on protests and fields, making visual the site of the genetic engineering as well as the acts of protest. The third category includes images produced specifically as part of campaigns. Greenpeace also has a campaign against McDonalds GM chicken feed in Germany and Friends of the Earth have a campaign against GM salmon in the US. These images clearly follow the logic of argument—cause and effect.

The anti-GMO images extracted from top websites in each country are far more diffuse, following a logic of association.[117] They form the larger discursive context, as the images travel memetically both within and across borders. The analysis indicates that the images are memetic, rather than just argumentative. I argue that the power of the images lies in the fact that they are discrete both from discourse and from institutional images. There are two ways this is true. The first is that they are freed from a particular context and audience. The second is that they are permuted, freely traveling across borders and being adopted by different actors at different times. A traditional analysis that looks at images simply within the context of a single website would ignore the way that that images travel across boundaries, becoming inscribed into the broader, memetic thinking about GMOs.

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[117] See Chapter Two's discussion of purposive sampling.

Challenges to the Discourse of Sound Science: Risk, Scientific Uncertainty

The discourse of "sound science," then, embraces the singularity of truth and the rationality of scientism and neoliberalism, woven into a singular narrative. The challengers of GMOs reject the single narrative. They refute this narrative by redefining notions of risk, destabilizing the ground of scientific certainty, and creating a narrative of localism and economic justice. Thus, the unified defense of GMOs is refuted through a diffuse articulation of a multiplicity of challenges.

The pervasive mistrust of GMOs persists not solely because of the failure of the GMO experts to convince the public that there is no risk, but rather because there are objections to the "sound science" paradigm itself. Jarvis (2007) articulates Beck's notion of the risk society:

> Risk, fear, an increasing distrust of science and technology and its profit driven outcomes, a common perception that there are now limits to scientific progress…have become endemic features of late modern culture. Beck's thesis is an attempt to understand this remarkable transformation in social attitudes and fears, and an attempt to examine the interstitial forces at play between technology, science, political and social institutions, and the risk consequences of these both for the individual and society as a whole (1-2).

The problem of risk and risk assessment is a question of what society does with its unknowns: "what remains beyond the research of scientific risk assessment and how to adequately deal with the resulting unknowns has increasingly gathered momentum in social conflicts over new technologies and their possible consequences" (Böschen et al, 2010, 784). These unknowns are ubiquitous in the debate over GMOs: while the pro-GMO official discourse emphasizes the soundness of existing science, and rhetorically shuts the door, the anti-GMO voices are adamant

that what we don't know can, literally, kill us. Additionally, the process of genetic engineering, rather than just the product itself, becomes part of the narrative of GMOs. The process, like the product, becomes infused with doubt.

One of the major disjunctures in the debate over GMOs is that there are different standards of scientific and social rationality; what is considered an acceptable risk scientifically may not match what society perceives to be an appropriate level of risk (Herrick 2004).[118] As Charles (2001) writes:

> But for every danger that scientists dismissed, for every fear that they considered unfounded, an anxious public had one more question: What about the dangers that you haven't even imagined yet? What about the unforeseen risks? *What about mad cow disease, which the experts didn't think could possibly infect humans?* And to these questions the defenders of genetically engineered crops had no real response except to sputter than no one could possibly make any decisions based on the possibility of something not yet known. The whole debate, in fact, turned on the possibility of unknown dangers. When scientists said, as they often did, that they saw "no evidence" that genetically engineered food posed special dangers, their critics were fond of quoting an old saying: "The absence of evidence is not evidence of absence" (22).[119]

These doubts are at the essence of the unstable nature of risk analysis. Estimating risk is a fundamentally probabilistic, future-oriented endeavor: "the essence of risk is not that it is happening, but that it might be happening" (Adam and van Loon 2000, 2). As Herrick notes, the challenges to sound science are so devastating to

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[118] The fact that scientific uncertainty is a moving target is underscored by studies such Morris and Adley's (2004) survey of Irish scientists; A majority of Irish scientists are willing to eat bread made from transgenic wheat, but only 40% were willing to buy baby food containing GMOs.

[119] See also Virilio's (2003) discussion of how technology contains unknown ways of failing.

proponents of GMOs—and so hotly contested—because they break the scientific monopoly on truth:

> Labelling is directly related to conceptions or risk in that demands (or lack thereof) for labels on food effectively act as a statement about the standards that we, as citizens, expect and the risks we are prepared to tolerate. As such, labels also problematize the certainty of science. If the science of transgenic crops was certain, labels would be rendered either essential or obsolete, but not a matter of contention (2004, 287).

Thus the challenge to the discourse of "sound science" refutes the notion of scientific certainty. Insisting on the possibility of risk is a democratic act, wherein the public can assert their autonomy. Herrick thus frames risk assessment as a fundamental right:

> risk is a statement about how we want to live, our relations to nature and the standard we are prepared to tolerate as rights-bearing citizens. In the case of GM, the concept of 'risk' has bearing on food choice and retailing practices, normative notions of environmental standards, landscape and land use as well as complex ethical judgments on the role of biotechnology (2004, 287).

This notion of risk assessment as a collective, democratic right is far removed from the narrow, scientific risk assessment advocated by technocrats and scientists.

The active involvement of the public in risk analysis and assessment also means that risk can be strategically activated by cultural entrepreneurs.[120] Every phenomenon or technology contains latent risk. The question is how characteristics or potentialities of the technology become culturally activated in order to become or be considered "risky."[121] Risk is in the future, whereas trauma is making sense of a

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[120] See, e.g., "culture jamming" of the Yes Men or the activities of Anonymous discussed earlier in this chapter.

[121] Jeffrey Alexander's work on the constructivist approach to trauma presents it in a similar way to this conception of risk. An event may be traumatogenic, but trauma is a process that proceeds from the event.

past event (perhaps also in terms of its impact on the present/future). Risk is probabilistic, future oriented, and uses the past to make predictions of the present. Cultural explanations of resistance to GMOs occur frequently in the literature. These are primarily framed around the question of why there was resistance in Europe and not in the United States. Stephan argues that

> moral values and cultural identities create the essential, enabling conditions for political mobilization…these insights are used to theorize the *cultural politics* of agbiotech and to show how values and identity-based perceptions shape the opportunity structures for goal-oriented agents. Overall, European cultural contexts structurally enable [anti-GM] discourses based on moral claims to flourish, while American anti-GMO mobilization has mostly had to rely on less effective utilitarian narratives (2012, 105).

Herrick goes further, arguing that debates over biotechnology reveal fundamental social truths about the relationship between technology and society—what she calls 'cultures of GM':

As people naturalize the issues raised by biotechnology within their own cultural systems, this leads to the production of what I term 'cultures of GM.' …If GM is a uniquely metonymical argument, then labeling is one of the most effective allegories to illustrate the differences between the EU and US cultures of GM. Notions of 'risk' associated with GMOs are internalized and naturalized within popular and governmental discourse and, in the process, formulate distinct 'cultures of GM (2004, 287).

Critique One: The Process of Genetic Modification

One strategy of disrupting the narrative that GMOs are equivalent to conventional food is to argue that the process of genetic modification changes the "natural" relationship between food and humans: "GM food is a high-tech process,

based on esoteric, scientific knowledge; the crucial processes happen in laboratories rather than in fields or barns" (Peters, Lang, et al 2007, 197). Opponents of GMOs underscore the unnaturalness of the process of creating GMOs by displaying images of needles, laboratories, and lab equipment superimposed on natural images of fields. The needle entering the fruit is a visual shortcut that represents the process of genetic engineering. These images depict causality by showing both the process of modification and unnatural physical traits that emerge as a result. Additionally, process pictures depict actors: gloved hands, scientists with masks on, and settings with plants being doctored in laboratories. As the picture becomes more complete, you see the technological narrative merge with the unnatural narrative—mutations are produced within the sterile confines of the laboratory. These juxtapositions of unnatural images against the sterile environment of a lab reinforce the unnaturalness. One common image is of a needle going into fruit, which is sexually suggestive and a depiction of the violation and penetration by the technology into the natural. This core image is borrowed and appropriated into different settings—changing the color, size, or shape of the product, in a lab, in a field, on an assembly line.[122]

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[122] Greenpeace created media events that were made for visual consumption and played on the sexual innuendo as well. For example, they drove a truck filled with GM seeds to the front of the prime minister's residence and dumped it. The truck read "TONY DON'T SWALLOW BILL'S SEED." The sexual references—particularly in light of the Monica Lewinsky scandal—were unmistakable, as well as the directionality of the power relationship. (UK x-1).

Patenting Life

The second part of the critique of the process is an indictment of the process of patenting life. The connection between neoliberalism and sound science reflects deep dissatisfaction with the values of late capitalist society (Schurman and Munro 2006). Framed this way, the critique of GMO food goes beyond the objects itself to the cultural construction of food production and consumption (Stephan 2012). The critique of patenting life merges with a critique of the product itself. Thus, a two-step critique emerges: both the process and the ownership of life distinguish GMOs from the "natural" order (which is also culturally produced). Thus, the way that patenting is portrayed in imagery juxtaposes the natural with images of ownership, implicating the product of GMOs.[123]

Critique Two: The Product of Genetic Modification

The major claim made by proponents of GMOs is that there is no difference between genetically modified and conventional food. Opponents disagree, asserting GM foods are inherently unnatural, both in terms of the means of production and the product itself. This line of thought organizes around the dangerous possibilities associated with consumption of GMOs. The imagery associated with the uncertainties attendant to GMOs run wild plays on the theme of Frankenfood—horrors and mutations—while also emphasizing the unnatural, artificial nature of

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[123] Although beyond the scope of this project, the critique of capitalism is also related to the depiction of the corruption of the agrarian myth. Each country displays landscapes and fields corrupted by the technology. Although beyond the scope of this project, the connection between (see, e.g., Brass' (2000) *Peasants, Populism, and Postmodernism: The Return of the Agrarian Myth).*

the procedure of GMOs themselves. There are physical effects that subtly transform GM products into not-food. Most common are images of hybrid plants: kiwis inside oranges or apples with limes inside them. Also in this category are the physically changed plants: giant tomatoes, or blue strawberries. More surreal are the plant/animal hybrids such as a mouse with a kiwi inside bleeding green juice. As the analysis below indicates, these two ideas—that unregulated biotechnology is going to create "Frankenfoods," and that these Frankenfoods are frightening—create a rich array of images that act as a juxtaposition to the sterile images of hybrid plants. Children emerge in these images, most often as the consumers of the food; zombified children with blank eyes eating Monsanto labeled food, a fast-talking lawyer telling a boy that they don't need to disclose what's in breakfast cereal; one Polish cartoon reads "I used to bite the apple—now it bites me back!" with a small boy holding an apple and the apple bearing its teeth. The Frankenfood/horror motif employs humor and irony to deconstruct the seriousness of the pro-GMO stance.

Critique Three: Implication of Genetic Modification

Unnatural processes and products produce dangerous implications. Here, the rhetoric shifts to the use of metaphor. Root metaphors are symbolic frames "that provide an inferential base for understanding more discrete attitudes and behavior. They capture a fundamental, underlying world view, but are often unobtrusive with regard to their frequency of usage in ordinary discourse" (Smith and Eisenberg 1987, 370; see also Aronoff and Kubik 2012, p 70 on Sherry Ortner's concept of root metaphor). The root metaphor, then, proposes a logic—from the root, various branches grow—a war suggests a battle, with sides, winners and losers, offense and

defense, ammunition, etc. Rein and Schon point out that metaphors, as one they are followed to their logical conclusion, can also have recommendations embedded within them—prescribed courses of action—as they represent a "normative leap ... from data to recommendations, from fact to values, from 'is' to 'ought"' that can powerfully shape the preferences of decision makers (1996, 94).

Genetic Disease and Contamination

The discourse of biohazard communicates a logic of pollution and contamination (Stephan 2012). Blue (2010) argues that, in the mid-1990s, the politics of food shifted from a discussion of nutrition and equal access to a focus on risk as issues such as infectious microbes, chemical toxins, new technologies, and diseases entered the realm of public discourse. “The idea that genetically engineered plants would ‘contaminate’ the countryside through windblown pollen seemed, instinctively, to make sense. It became the central metaphor for environmental crisis posed by genetically engineered crops” (Charles 2001, 218).[124] Biohazards are a powerful visual theme that appears across the countries.

Conclusion

Comparing Test One and Test Two reveals two distinct strategies of image production. The images produced by the organizations operating within the country do not in fact operate according to the same logic as the images that are prominent on the country level. Thus, I find that there is a transnational memetic set of images that then get translated and strategically deployed on the country level. Thus,

images act as filters for both the global "sound science" narrative and the individual country experiences.

Even as these images travel across national borders, there are also discrete themes that emerge from each country, reflecting the national relationship between a country and the technology – a bridge between the global and the local. These themes are particularly powerful because of the extent to which they reflect the specific economic and cultural context described in previous chapters. The United Kingdom focuses on a message of Frankenfood. The fact that the fewest images come out of the United Kingdom, and the story they tell is pretty standard, makes sense given that the issue has less salience in the UK now than perhaps at any other time. The images that are produced reflect the theme of protests in the country. For example, Germany has a complex story that explains the logic of action in both the process and the product, and then focuses on the notion that GMOs are biohazards. The images are primarily located in fields, a reflection of the fact that the plants were grown in Germany until recently. Poland's images explore the fantasy/reality line with the repeated use of cartoons and humor, and reinforce the idea that those in power are lying. This is also seen in the underlying story of Polish resistance to GMOs and its distrust of the EU and western imperialism. The Polish critique is consistent with the distrust of Monsanto and the fear of ecocolonialism. Spain also underscores the uncertainty of the technologies, and interrogates the relationship between appearance and reality. This is important because there is an educational component to the Spanish images—in order to persuade the public to engage the issue of GMOs, there first has to be a sense of doubt injected into the debate. The

United States focuses on the process itself, particularly when the Monsanto images are introduced into the narrative. Together, these images form a narrative that destabilizes the certainty of sound science by injecting risk and fear of the unknown into the discourse, and establishes a story that disrupts the relationship between GMOs and food. When paired with the global level of analysis, there is a relationship between the national foundation for the rejection of the technology, embedded in a broader global narrative of resistance.

Chapter Three discussed the way in which "sound science" attempts to neutralize and eliminate arguments against GMOs. What this chapter has shown is that, although proponents of sound science may successfully subsume frames, the visual resistance is far more flexible. These images demonstrated a sophisticated blending of visual metaphors that moved in and out of figurative and literal language and representation. Visual images that operate within these realms that provide enough room to move and shift, enough room for doubt to grow. This is the doubt that allows the public to respond to "rational" attempts at education with a "yes but…" Whereas rational objections to the technology may be refuted and worn down over time, the associations between GMOs and uncertainty are reinforced each time a member of the public encounters an image.

Chapter Seven: Conclusions and Implications

The dissertation poses related questions: first, why are GMOs still objects of contention? The second set of questions asks: Why, and under what conditions, is opposition to GMOs successful? How does this vary across countries? What explains the variance? This final chapter articulates the answer to these questions. I first frame each of the questions within the broader context of the dissertation, drawing on material from each chapter. I use this material to explore why GMOs are still objects of contention, and under what conditions opposition to GMOs is likely to manifest itself. The second part of the chapter contrasts the discourse of the pro-GMO and anti-GMO factions, comparing the way in which each side presents the actors and the material nature of GMOs. The final part of the chapter explores the implications and contributions made in the project, and suggests avenues for future research.

GMOs in Context

To answer the above research questions, I examine the way in which GMOs are depicted as objects of contention on the global and local level. Part Two examined the global level of GMOs from an ideological and regulatory perspective. Chapter Three first examined the ideological component by exploring how sound science is projected in the United States and Europe. The narrative has three parts: it advances a neoliberal narrative of the technology, arguing that non-sound science approaches are in fact attempts to politicize trade. This establishes a relationship between science, free trade, and GMOs. The second part of the narrative posits that

failure to embrace GMOs will lead to a catastrophe. The third part of the narrative scapegoats the public, arguing that public ignorance will block GMOs, thereby ensuring the catastrophe. Additionally, this narrative works within three frames: controlling the public, controlling science, and controlling the narrative. This is important because it focuses on actors instead of content—instead of debating or defending the products themselves, the proponents of GMOs focus on the actors who propound the arguments on the other side.

The proceeding chapter also focused on the global level by examining the regulatory context in the European Union, as well as the trade conflicts between the EU and the US. I argue that the regulatory explanation requires an examination of culture and politics on the domestic level, which is further explored in Part Three. Part Three turns to the domestic, or local level, presenting five case studies of the United Kingdom, Germany, Poland, Spain, and the United States. These case studies compare the political, economic, cultural, and public opinion of GMOs across countries, establishing the variance across domestic contexts. I argue that each country follows a specific trajectory motivated by specific cultural contingencies as well as the trajectory of political institutions. In order to help explain the variance, Part Four looks at the images produced by opponents of GMOs. I argue that the images are a successful refutation to the "sound science" narrative because they provide universal symbols of doubt and critique that can be redeployed within specific cultural contexts. Thus, these images bridge the global and the local.

A conflict that emerges from this analysis juxtaposes the "sound science" and "anti-GMO" narratives. Proponents advocate an actor-centered account of GMOs

rooted in a logic of rationality, advancing logical arguments in favor of the technology. The narrative of "sound science" is a coherent, unified narrative of scientific certainty, a closed system of thought that offers a complete explanation about the safety and promise of GMOs. This narrative purports to be neutral and value-free, aligning itself with larger ideologies of neoliberalism. Projection of the ideology takes the form of controlling the public, controlling the science, and controlling the narrative—attempting to discredit any individuals that refute the story.

Opponents of GMOs adopt a "materialist" approach to their critique. Monsanto as an organization is indicted as a symbol of multinational corporations and Western neoimperialism. At its core the critique utilizes the distinction between the global and local level to destabilize the universal narrative that defends GMOs. Elements of specific cultural contexts, invoked in a multiplicity of narratives, allow the activists to disrupt the universalizing argument about the technology and leave it in a constant state of uncertainty and doubt. This exacerbates the risk perception of the technology, thus creating the context for rejection. The following sections explore the way that the dissertation findings play out across the five countries identified in the study.

Why Are GMOs Still Objects of Contention?

This question places the technologies within their broader political, economic, and cultural contexts, asking under which circumstances GMOs continue to be contentious within different countries. Additionally, this question draws attention to the misalignment between major actors in society: scientific elites, the

public, and the state. Over time, the alignments between these three factions have shifted. To answer to this question, a distinction between the logic of association and the logic of rationality needs to be considered and the way that competing global discourses on GMOs are filtered through local contexts needs to be analyzed. A constructivist and/or semiotic approach is necessary if we want to understand how GMOs are construed as contingent, symbolic artifacts. Interpreting images provides insight into the power of resistance to GMOs. That power is found, *inter alia*, within the logic employed by visual hegemony: the strategy of GMO resistance is to circumnavigate the logic of rationality of the proponents of GMOs and substitute the synecdotal reasoning—the logic of association—that in effect communicates a diffuse narrative of mistrust.

The two categories—the global and the local and the logic of association and logic of rationality—interact in different discursive permutations that shape the way GMOs are perceived and ultimately whether they are constructed as objects of contention. As the previous section discussed, contention is a continuum (Tarrow 2005): countries are not "pro" or "anti" GMOs, but instead resistance and support are articulated both globally and locally, and come into focus at various political points with various degrees of saliency and intensity. As Tarrow writes: "forms of transnational activism…do not float above the earth but are shaped by states' domestic structures and by the international institutions that they have created" (2005, xiii). This also contradicts the notion of static "cultures of GM" articulated by various authors: the domestic context of GMOs is dynamic and contingently dependent on a multiplicity of factors.

Table 8: Contrasting the Global and the Local

	Global	Local
Logic of Association: Pro-GMO	n/a	n/a
Logic of Association: Anti-GMO	Viral and memetic images	Grammar of protest imagery—images in local context
Logic of Rationality: Pro-GMO	"Sound science" GMOs are the same as conventional: food is safe. Universal standards should apply Depoliticize the process	Boosts to local economies
Logic of Rationality: Anti-GMO	Precautionary principle	Economic pressure on political and economic leaders Potential social impact.

Table 8 outlines the way that the logic of association and logic of rationality are deployed by pro- and anti-GMO actors across global and local contexts. The following sections contrast the strategies chosen by proponents of GMOs with the strategies chosen by opponents of GMOs.

Proponents

Proponents of GMOs almost exclusively operate in the global, rational realm. They advance a universal "depoliticized" defense of GMOs that advocates science and free trade as objective means to adjudicate disputes over the technology. This logic of rationality at times manifests itself locally as well, such as in response to attempts to label the products in the United States.

Proponents of GMOs do not engage in the logic of association on either the local or global level; as Chapter Three indicates, proponents of GMOs functionally cede the visual realm of the debate to their opponents, preferring instead to use "sound science" logical argument to support the technology. There are three key parts of the rationalist narrative identified in Chapter Three: 1: *Neoliberalism and scientism are rational and objective means by which to justify the technology of GMOs*; 2: *GMOs are capable of combating future catastrophes;* and 3: *The public's unwillingness to accept the first two premises is naïve and dangerous, based on a misinterpretation of science.*

Based on these premises, proponents of GMOs assert that a) GMOs are substantially equivalent with conventional foods, b) that GMO technology is safe and c) that failure to act on GMOs will lead to a global calamity. The bulk of their effort is not defending these premises, but attacking those who suggest otherwise—dissenting public, scientists, and journalists. The implications of not using GMOs are similarly articulated on a global scale: GMOs are the only products capable of staving off the negative effects of climate change and the population explosion. The economic story is part of a larger attempt by proponents of GMOs to frame the technology as an issue of free trade. Proponents of GMOs disguise the power of the technology by equating GM crops with conventional crops. In this way, GMOs are both part of the expression and the exercise of power. By "erasing" the difference between the two types of crops, this boundary work strives to normalize genetic engineering as not remarkable and just another part of the natural agricultural environment.

Opponents

Opponents of GMOs move far more easily between the global and the local and the logics of association and rationality. A critical part of this strategy is refusing to accept the boundaries of hard science that proponents of GMOs attempt to construct around the issue. They reject the totalizing narrative of sound science, instead infusing doubt into the process, product, and potential implications of GMOs. The multiplicity of narratives ruptures the monolithic sound science narrative and opens a discursive space for the multiple public expressions of risk and doubt. Visuals can transgress global and language boundaries and be interpreted within specific contexts without the intent of the sender. The globalization of images can in fact serve a unifying purpose; images become a least common denominator that can be used to convey an essential message about an object through a visual that unites movements across language barriers. Globalized technology can produce a local/global response.

Moreover, I show that the images are successful because a) as Test 2b shows, there is no original source whose credibility can be attacked b) they infuse doubt into the narratives of neoliberalism and the potential of GMOs and c) they do so by producing powerful visual (and thus tangible) images of GMOs—a medium which the proponents of GMOs avoid operating within. First, as the images are viral reproductions, there is no discrete source or "author" of the image.[125] Thus, the public does not internalize the attacks staged by proponents of GMOs on the credibility of the opposition. The public does not have to trust the reputation of the

[125] See Chapter Six's discussion of Barthes and the death of the author.

scientists or journalists in order to question the technology. Even if the public accepts the claim that they should be educated, there is a lack of visual evidence of the technology's safety: the lack of health problems or environmental damage does little to constrain the manufacturing of doubt (absence of evidence is not evidence of absence). Additionally, one cannot see or experience "harmless" GMOs: they are virtually absent from shelves across Europe, and not labeled in the United States, and so there is no visual evidence to the contrary. The success of the sustained level of doubt, I argue, is because of the viral, memetic, global success at manifesting doubts over GMOs visually and experientially. The "unnatural" process of creating GMOs is shown in fields with biohazard signs and in labs and with needles injected into fruit—or a blurring of fields and labs, which for many people is an unwanted, scary synthesis of the two. The product is made visual as grotesque, bizarre hybrid fruits. The implications are made graphic with the frightening, Frankensteinesque faces and the ruined earth.

At each step, there is doubt. In order for the public to be persuaded by the sound science narrative, they would have to accept the two premises: that GMO food is the same as conventional food and that it is safe. Additionally, this argument would have to be advanced through a logic by association: the association would have to exist between conventional food and GMOs and GMOs and safe, natural processes. Because there is no refutation to the association between GMOs and danger in the public sphere, the critical narrative of GMOs remains intact. This approach also challenges the narrative of the ignorant and naïve public. The reason that there is an inverse relationship between knowledge and support could be because "improved

knowledge leads to greater diffusion of knowledge, criticism of and skepticism toward science and its practitioners" (Allum et al 2002). In other words, the strategy of the GMO proponents could backfire, leading to increased opposition as a result of greater knowledge and education. There is not a direct correlation, in other words, between the facts of the matter and attitude toward the technology.

Why, and under what conditions, is opposition to GMOs successful? And how does this vary across countries?

As the case studies have shown, each country has a nuanced history and reaction to GMOs, driven by particular historical, political, cultural, and economic circumstances. It is difficult, then, to derive any sort of parsimonious explanation from the analysis or to point to the main cause or chief explanatory variable that accounts for differences in opposition to GMOs. As noted in Chapter Two, Peter Hall advocates researchers to design studies with "more extensive endogeneity" which will thus bring to the surface "the ubiquity of complex interaction effects" in their research designs (2003, 387). As this analysis indicates, the specifics of each domestic locality interact with the broader discursive field and global environment, producing distinct mobilization strategies and articulation of the narrative of GMO opposition. The lack of a clear causal relationship reinforces the utility of a constructivist, cultural approach to understanding the politics of GMOs. Indeed, in the accounts in Chapter Five, variables such as whether the crops are cultivated in country, whether the country had instances of mad cow disease or BSE, the strength of the civil society, the relationship of the country to the EU, the economic response of food manufacturers and producers in the country, the willingness of the

government to engage with the public, the degree of public mobilization, the strength and salience of GMOs in public opinion all emerged as possible explanatory characteristics. What follows, then, is first an attempt to determine the way a country's position on GMOs has changed over time, and then to determine what unique alignment of factors can explain the continuity or change over time.

As Table 9 indicates, the United Kingdom, Germany, the United States, have all changed their position on GMOs over time. Poland and Spain, on the other hand, have been consistent, albeit on opposite poles. If we imagine a Likert-type scale ranging from Strongly Pro-GMO, Somewhat Pro-GMO, Neutral, Somewhat Anti-GMO, Strongly Anti-GMO as the categories, the countries would be categorized like this:

Table 9: Change Over Time

	1998	**2015**
UK	Somewhat anti-GMO	Somewhat pro-GMO
Germany	Neutral/ leaning anti-GMO	Strongly anti-GMO (with the exception of the Christian Democrats)
Poland	Strongly Anti-GMO	Strongly Anti-GMO
Spain	Strongly Pro-GMO	Strongly Pro-GMO
US	Strongly Pro-GMO	Somewhat Pro-GMO

In 1998, the continuum ranging from Anti-GM countries to Pro-GM countries looked like this: ***Poland****, United Kingdom, Germany, United States,* ***Spain****.*

By 2015, the continuum was ordered differently ***Poland****, Germany, United States, United Kingdom,* ***Spain****.*

The UK public has moderated its position, which provides an opportunity for the government to begin growing GM crops. In Germany, the public solidified its opposition of the technology, as did political parties from both sides.

The fact that the Christian Democrats support GMOs has re-introduced the debate into the German public, but seems to have only reified opposition to the technology. In Poland, the issue remains a third rail. In Spain, there has been an inability to marshal resistance among the population, and so the country still remains pro-GMO. Finally, in the United States, public opinion has turned against GMOs, which has caused a series of state ballot level initiatives and considerable concern among the economic sector.

Looking at these five cases in aggregate, there was, as of 1998, a considerable level of public concern. In Germany and the UK, this pressure created the conditions that forced domestic politicians to take action. As of 2015, we see that, although there is a considerable level of contention, there is a distinct shift in position. In the United States, Germany, and the United Kingdom (three countries that changed their position regarding GMOs) this change was catalyzed by the public change in position—in the United Kingdom from opposed to neutral, and in the United States and Germany from neutral/conflicted to opposed.

The role of the European Union is particularly difficult to discern in the debate over GMOs. It is clear that countries use GMOs as a means through which to articulate their relationship with the EU. It's peculiar, however, because GMOs are one of the few issues that can be used as a symbol of both support and rejection of Europe. In Britain, growing crops is a way of resisting the EU and expressing Euroskepticism. In Poland, *not* growing crops is a way of resisting the EU and maintaining independence. Germany does not grow GMO crops and is pro-EU, and Spain is the European leader in GM crops but they have been increasingly

Euroskeptical since the recession. Thus, based on this sample, the relationship to the EU does not predict whether or not a country supports or opposes the technology.

Local Politics

There is no clear political story that emerges from the case studies; there is not a clear relationship between specific political parties and the country's stance on the technology. In the United Kingdom, Poland, Spain, and the United States, policy has been relatively constant even as different parties have gained control of the government. In Germany, although the Christian Democrats support GMOs, when they had parliamentary power they have been unable to gain traction on the issue due to the opposition both from other members of the ruling coalition and from opposition parties. Thus, GMOs are not a stable political marker.

Economics

The domestic economies of countries play a role in determining whether the country will support or oppose GMOs. However, the analysis has shown that the ag-biotech industry has been surprisingly responsive to public pressure. Targeted consumer campaigns in the UK and Germany led to companies voluntarily taking GM crops off their shelves. This is increasingly happening in the United States as well. The intensity of the early protests caught economic actors off guard, leading to increasingly skittish economic actors.

In England, there is moderating public opinion and this seems to be giving the government room to begin passing legislation, but it's unclear whether the public will again mobilize or there will be a market for crops. For example, in

Germany there is a split between Merkel's Christian Democrats and the Social Democrats, but the Christian Democrats do not have enough political clout to change German policy. As the new EU legislation decentralizes decision making authority, it will be interesting to see whether successive Polish governments continue the unanimous opposition to GMOs once they can no longer frame it in terms of opposition to the agricultural policies of the European Union. In Spain there is substantial pressure from professional NGOs, and cautious opposition from the public, but it's not salient enough to make a big change. In the United States, there is significant public opposition, economic backlash, and political concern that seems to be split along geographical instead of party lines—and there seems to be reason to expect there will eventually be movement in terms of labeling. Here, it makes sense to pay attention to economic signals as leading indicators. Additionally, there is the potential for public mobilization or re-mobilization in if the public perceives an upset in the balance of power—overly cozy relations between the state and external actors (like Monsanto).

What explains the variance?

The analysis above shows that there has not been a convergence of countries either in favor of or against GMOs. What explains the variance in a country's orientation toward the technology? This section explores the way in which the factors identified above have manifested themselves across each country.

United Kingdom

In the United Kingdom there has been a shift from being somewhat anti-GMO

to somewhat pro-GMO. The United Kingdom was the first country in Europe to receive GMO products from the United States in 1996. Before Monsanto's shipment of GMO soybeans arrived, Zeneca's GM-labeled tomato sauce sold quite well in British supermarkets. However, the Monsanto shipment came unlabeled and mixed with conventional crops. The fact that this occurred at the same time the country was managing the government's failure to adequately protect against or warn about mad cow disease (BSE) exacerbated the public's reaction to the crops, which gave the social movement organizations and NGOs critical momentum. The public reaction of Prince Charles to GMOs also played a pivotal role in creating the context for opposition.

The pressure applied by consumer and environmental movements to both the government and to economic sectors was highly successful, and created the context for a Britain-wide moratorium as well as the eventual EU-wide moratorium. Although then-Prime Minister Tony Blair and successive British prime ministers have been in favor of GMOs, they have been historically unable to gain sufficient traction on the position to overcome public opposition.

The United Kingdom thwarted Monsanto's attempts to "quietly" introduce GM crops to Europe. The ag-biotech giant, despite warnings from its European counterparts, expected that GM crops would be accepted and ignored by the British public. The fact that this wasn't the case created the stage for a prolonged conflict between the ag-biotech corporations and the European opposition. Ultimately, the corporations ended up acceding to labeling in the EU as a way forward past the blockade of the moratorium. The analysis of imagery reflects the general story of

moderation. In both Test One and Test Two, there were fewer anti-GMO images in the British set than from any other country. The anti-GMO images in test two show a focus on the product, conveying a sense of oddity around the product.

However, today there is a universal sense of moderation on the issue in Great Britain. The British government has signaled its intent to begin cultivating GM crops in 2015 in response to the new EU rules that decentralize decision making power, which has not yet led to significant outcry from the public. The decision to take greater authority over the production of crops is also a signal of distance from the rules of the European Union. The major environmental NGOs—Friends of the Earth and Greenpeace—do not have active anti-GM campaigns. Public opinion toward GMOs has also moderated.

In sum, in the United Kingdom, we see a genuine opening for the "sound science" narrative to take hold. There is currently little sustained anti-GMO energy or mobilization, and there has not been, as of early 2015, mobilized opposition to the government's intention to authorize the cultivation of GM crops. However, the British public has shown its ability to mobilize against GMOs before, and if the issue is mishandled, or there are any food-related scandals, there is a likelihood for there to be renewed, sustained opposition to the technology. The causal story here is a bit muddled: there is not a clear story as to why the British public are less engaged in the issue of GMOs. One reason, perhaps, is that major NGOs like Greenpeace and Friends of the Earth are not mobilized, which means there are no actors trying to make the issue salient for the British public. Also, the public was initially mobilized by crisis: the fact that there have been no further crises, and the state took the

concerns of the public seriously with GM Nation, could mean that the trust concerns of the public are sufficiently assuaged so as not to demand sustained opposition.

Germany

In 1998, Germany was more-or-less neutral on the issue of GMOs. By 2015, the country had shifted to a strong opposition to the technology. As in the United Kingdom, the BSE scandals at the turn of the millennium had a major impact on agricultural policy generally, and orientation toward GMOs specifically. Germany initially embraced genetic engineering, cultivating a small amount of crops and heavily investing in GM technology. However, in 2000, as the first case of BSE was diagnosed in the country, the Green-Red coalition government announced "Agrarwende," a major shift in the country's agricultural policy. The professional civil society in Germany began an intense mobilization campaign against GMOs. This included both pressure on the government as well as direct action campaigns. Farmers have also organized against GMOs, creating GMO-free cooperative regions. In 2004, protestors organized against the end of the EU moratorium, demanding action from the German government. In 2009, Germany banned the cultivation of MON 810 corn, the only GM product that was cultivated at the time.

The images from Germany reflect this disciplined approach to resistance: the majority of the pictures depict an emphasis on fields (reflecting the fact that the crops were cultivated in German soil). The theme of biohazards permeates the anti-GM visual discourse. Unlike in the other countries, there is a sustained, disciplined message that emerges from the German images.

In response to the EU's decision to decentralize decision making about GM

crops, Germany has announced its plan to ban the cultivation of all crops. This is in spite of the fact that Angela Merkel's Christian Democratic Party supports the technology; however, they have not been able to gain enough political traction to change the German orientation on the issue. The major social movements in Germany remain fully engaged on the issue, indicated by Greenpeace's 2014-2015 campaign against GM crops in animal feed at McDonalds. Public opinion against GMOs still remains high.

The major explanation of Germany's position on GMOs seems to be the strength of its professional civil society to sustain pressure and opposition on the issue of GMOs. The close working relationship between the professional civil society and the government, particularly the Green Party, means that the issue has become incorporated into civil society platforms. The focus on the agrarian aspect of the issue—fields, farmers, and cultivation—is reflected in the imagery, the mobilization of farmers, as well as the crop trashings of the late 1980s and the early 1990s.

Poland

Poland has remained consistently strongly opposed to GMOs. In Poland, the story of GMOs is also one of doubt and distrust. However, unlike in Germany and the United Kingdom, where the doubt was over whether the government and the European Union could protect the public against BSE and other food-related threats, in Poland the distrust has been of western agricultural technology itself. Poland joined the European Union in 2004, the same year the moratorium on GM crops was lifted. Along with pressuring the EU to open its markets to GMOs, the United States had been directly applying pressure to Poland to restructure its agricultural sector

away from small family farms in favor of larger-scale industrial farming. Thus, in 2004, there was a sense in Poland that the agrarian sector was under threat from the United States and Europe. The public and farmers mobilized against GMOs, and each of the successive Polish governments has consistently upheld the ban on the crops. Poland's position on GMOs has been one of the strictest in Europe, refusing to import even approved GMO products. This led to a repeated struggle between the European Union and Poland, where Poland was brought in front of the European Court of Justice for violating EU regulations on GMOs. This tension between Poland and the EU has proven enormously popular among the Polish public, and become an issue that allows the government to express its independence from the European Union and its support of the agrarian sector. Although there is pressure from the high-tech sector in Poland to embrace GM crops as a means to compete with the broader European economy, this position has not swayed Polish opinion on the topic. The long history of Polish opposition and mobilization to foreign elements also means that it is easier for the Polish public to be mobilized against GMOs (Ekiert and Kubik 1998). The images coming out of Poland do not have a defined theme; rather, there are depictions of the process, product, and implications of GMOs that reinforce the sense that the technology is foreign. There is also use of dark humor in the Polish imagery.

Thus, opposition to the technology has predominantly sustained itself by trading in opposition to EU and US stances on GMOs. As of 2015, the new European rules allow each state to make its on laws on GMOs. It remains to be seen, then, whether this level of unified opposition will sustain itself without having the

European Union as a scapegoat. When the topic becomes a question of domestic policy, will the same levels of opposition sustain themselves?

Spain

Despite the almost universally heightened levels of resistance to GMOs across the European continent at one time or another over the past twenty years, Spain has remained the quiet, steadfast supporter of the technology. This is particularly surprising, perhaps, because they do not have a high-tech ag-biotech sector to speak of, so most of the support has come from the agricultural sectors. There have been considerable attempts to mobilize the Spanish population against GMOs. Indeed, the Spain anti-GMO imagery focuses on creating the sense of uncertainty, demonstrating what GMO crops could look like, and mobilizing doubt. However, this seems to have been relatively unsuccessful. Spain itself, then, is a bit of a puzzle: why have they remained relatively unconcerned about the threats of GMOs? Perhaps this is because Spain, more than any other country, *has seen* GMOs in action. They are grown in Spanish fields, and, because of European Union-wide requirements, all approved GMO crops bear labels on Spanish shelves. Thus, the Spanish public consciously live among the technology—even more so than people in the United States—and thus the visualization of the process, products, and implications of the technology are not unknowns. Given that Spain is still protected by the regulations of the European Union, there has been no precipitating event that might lead to mobilization.

United States

In 1998, there was considerable consensus that the United States was the most pro-GM country in the world and the issue was considered settled. By 2015, as of this writing, the issue of GMOs has become a focus on considerable contention. What explains this change? This analysis shows that the changes in the United States were the least predicted by most scholarly analyses of GMOs, particularly those that depended on static cultural explanations for country orientations toward the technology. GM crops originated in the United States, and the US government continues to invest enormous resources and political capital domestically and internationally into supporting and promoting GM crops. However, there is significant evidence that the unified position of the executive branch of the federal government and the ag-biotech industry is not sufficient to stave off an increasingly skeptical public. The major debate in the United States is not over the approval process but over the lack of mandatory labeling. Indeed, because there is no mandatory labeling in the United States, there is considerable room for the opponents of GMOs to visually distort the products. As a result, there has been a voluntary movement away from GM products by major agriculture producers and manufacturers who cite public demand for GM-free products.

The United States, then, also remains in a state of flux and uncertainty. Unlike in Europe, there has not been a precipitating event to cause the public to mobilize against the technology. Instead, there has been a series of more minor events that have increased distrust in Monsanto over time. Indeed, mandatory labeling seems from this vantage point like an inevitability, particularly because the alternative has

been the decision by major economic actors to source GM-free materials. Although proponents of GMOs continue to win battles against labeling on the state level, these only serve to reinforce the perception that there is something to hide in the minds of the public.

On the global level, this analysis shows that the opposition to GMOs has been staggered across time, with major events precipitating in 1996 in the United Kingdom, the early 2000s in Germany, 2004 in Poland, and more recent resistance in the United States. The fact that proponents of GMOs have constantly been on the defensive has meant that it has been difficult for them to gain any sort of traction or positive momentum.

On the local level, we see a different story and set of variables emerge from each country. In the United Kingdom, there was early mobilization catalyzed by pervasive distrust. This has given way to a sense of moderation as the country slowly reapproaches the possibility of growing GM crops, perhaps because of the twenty years without a food scandal, or the government's attempts to reestablish trust with the public. In Germany, there has been a solidification of the anti-GMO stance characterized by sustained, focused pressure from professional NGOs working in consort with the government. In Poland, there has been consistent opposition that has been marked by support of traditional agriculture and resistance to the European Union and the United States. Spain, on the other hand, has maintained high levels of support for the technology due to its consistent success with GMOs. Finally, the United States, as of 2015, is undergoing the most significant shift in terms of its orientation toward the technology; this resistance is

manifesting itself in a sustained debate over labeling GM ingredients, and is categorized by pervasive mistrust of GM producers and manufacturers. Thus, the variance across countries is multi-causal, and is a reflection of the way that a country's orientation toward global actors such as the European Union are filtered through local, culturally contingent events as well as domestic issues.

Putting the Global and Local in Conversation

Chapter Three established that there are three frames through which the pro-GMO narrative operates. There are additionally three categories of imagery. How do these exist in conversation with each other? This section synthesizes the debate over the actors and the objects of GMOs.

Contesting the Actors of GMOs

Contesting the public

The proponents of GMOs argue that rejection of the technology comes from a place of fear and ignorance. They thus offer a specific program of education and correct information in order to combat the fear and ignorance. If the public continues to oppose GMOs, they warn of disastrous consequences. This process of controlling the public is part of a larger phenomenon of excluding the public from scientific or technocratic debates.[126]

The struggle over defining the public is particularly strong in the United States; whereas labeling of products containing GMOs is required in all European

[126] Two countries did stage public debates over GMOs, Germany and the United Kingdom. See chapters three and five for more discussion of these debates.

countries, it is not required in the United States, and has been vehemently opposed by political and economic actors. The sole argument against labeling is that the public, in its naïveté, will reject products labeled as containing GMOs out of (a misguided) fear.

In response to this depiction of the public, one of the most effective social movements in recent memory emerged in Europe, forcing first the moratorium on the product and then, in its place, a stringent Farm-to-Fork regulatory model. The US public seems to be increasingly mobilized against the technology; although ballot initiatives requiring labeling have failed in each of the four states where they've been on the ballot, the Vermont legislature recently passed a bill requiring labels. Additionally, there is significant evidence that major producers and manufacturers are voluntarily switching to GMO-free ingredients.

Finally, the imagery chapter shows that the public can harness its power to change the tenor of the conversation through the use of viral, memetic images. By defining and controlling the visual terrain surrounding the GMO debate, they have asserted their power to change the conversation over the technology. Thus, the debate over whether public is "correct" misses the larger point about their power. The public has largely bracketed the question of sound science while asserting their right to be full participants in a dialogue over the technology.

Contesting the science

The second strategy deployed by the proponents of GMOs is to contest any scientific findings that imply the technology is unsafe for humans or animals. The two most high-profile cases are the Pusztai affair of 1999, and the Séralini scandal of

2012. In both cases, scientists claimed that mice grew tumors when fed genetically modified foods. In both cases, the journals, but not the authors, retracted their findings and the scientific community condemned the methodology.

The fact that these studies have been retracted holds little sway over the public. Indeed, images of the mice with tumors have gone viral. As discussed in Test 2b images from the Séralini study appear on 2303 websites: this is obviously an instance where seeing is believing. The proponents of GMOs argue that the scientific record is pure: that there is no uncontested scientific study linking GMOs to any negative effects. However, even if the studies have been stricken from the academic record, they still exist in the public record. The images of mice with tumors who ate GMO corn create the association between GMOs and cancer, and they establish doubt in the minds of the public.

Contesting the narrative

Finally, the story of sound science is defended through an attempt to control the narrative itself. This is done through a similar fashion as controlling the science: journalists who publish anti-GMO articles are maligned and discredited. However, as Chapter Six indicates, the viral nature of the anti-GMO message transcends the reputations of specific journalists. That is, the nature of the argument—the doubt over the product—exists beyond a specific source. Thus, the attempt to keep journalists from writing about why GMOs seems to be having the opposite effect as intended, driving those arguments into cyberspace where they exist without particular referents and are not subjected to rigorous testing via an expert debate.

Most importantly, the proponents of GMOs attempt to control the narrative through an actor-centered approach. Rather than focusing on arguments alone, they depict their opponents, both the public and the scientists, in a specific light., framing them as naïve, dangerous enemies of GMOs. By shutting down opposition or criticism, the universal good of GMOs can stay intact. The following sections explore the way in which the debate plays out in terms of the process, product, and implications of GMOs.

Contesting the Materiality of GMOs

Contested process: "Safe" versus "Unnatural"

The first aspect of the material debate over GMOs concerns the process: how the technology operates. The proponents of GMOs assert that the technology is safe. Little time is spent explaining to the public what the process consists of—only that there are no deleterious effects. In order to support this argument, they point to the myriad scientific studies that have found no harm from the process of genetic engineering (and, as discussed above, critique the studies that have found evidence to the contrary). In response, the opponents of GMOs illustrate in great detail what the process conveys by transposing images of food and labs—this creates a jarring, dissociative effect. The images go both ways. One meme involves food brought into lab, and being injected with needles. Another shows scientists in the fields, doing experiments in agricultural settings. Both types of images are aimed at visually depicting the process of genetic engineering.

Contested product: “Same as conventional” versus “Frankenfood”

There is also contestation of the product itself. The proponents of GMOs argue that the technology is, quite simply, the same as conventional products—but with the added benefits. There is no way, visually, to distinguish between GMO and conventional foods. In Europe, GM foods are carefully labeled, a practice that is rejected in the United States. So, opponents of GMOs creatively visualize the products of GMOs, presenting hybrid fruits such as blue strawberries, apples with kiwis inside. The notion of Frankenfoods is also a visual and rhetorical challenge to the notion that the products are substantially equivalent.

Contested implications: dueling stories of catastrophe

Each side offers competing narratives of extinction. Monsanto argues that they are the only ones who can save us from extinction, but opponents argue that it is actually GMOs that will drive us to the brink of extinction. Here, then, is the question over the ending of the story. Both the proponents and opponents of GMOs focus on potential for catastrophe—they use apocalyptic rhetoric and possibilities as the ultimate impact for their arguments. Chapter Six demonstrated the way this is done by proponents of GMOs: the technology is the only way to save the planet from global hunger caused by population explosion and climate change. Indeed, Monsanto makes no apologies for wishing to commodify the salvation of the human race.

My overall argument, then, is that GMOs will continue to be global objects of contention that carry with them the stigma of doubt as long as the advocates of GMOs continue to cede the visual ground to the opposition and insist that the debate

is purely over the veracity of scientific claims. Put simply, the arguments that the pro-GMO side makes are dismissed by the audience in the debate—those with the power to put pressure on economic and political elites. GMO opponents can ignore all of the arguments—grant all of the battles—and still win the contest over doubt. Thus, there needs to be a genuine engagement on cultural, political, and economic levels.

Implications and Contributions

This section reviews the substantive and theoretical implications to this project. There are four contributions: First, I show the importance of medium-N case studies; second, the importance of a closer scrutiny of GMOs as a political subject; third, I make a case for increased visual analysis in comparative politics; finally, I make a case for the larger examination of the relationship between science, the public, and politics within political science.

1. First, I have shown that there is a need for multi-level analysis of the topic of GMOs. Rather than focusing either on the US-EU comparison or on single case studies, putting multiple countries in comparison with each other allows for a more nuanced understanding of how the resistance to GMOs changes across time and space.

2. The second implication is the instability of GMOs as a political subject. Unlike other environmental or scientific issues, the position on GMOs is not determined by political party, ideological orientation, or orientation toward the European Union. Whereas it is fairly predictable on the issue of climate change, for example, that the conservative, pro-business parties are more likely to oppose restrictive climate

change legislation, this is not the case on the topic of GMOs. The issue, then, is one that eludes easy categorization and requires a more nuanced examination of particular domestic contexts, and the way they interact with the broader global context.

This is particularly relevant when it comes to the analysis of the United States. Whereas the scholarly consensus has been that the United States and the European Union are diametrically opposed on the topic of GMOs, and that fundamental cultural issues are the root cause of that opposition, I have in fact shown that there is significant, salient opposition to the technology in the United States, and that the opposition has risen to the level of contentious politics.

3. Visuals: This project has made an argument for a research agenda of visual analysis in political science in general, and comparative politics in particular. As I have shown, visuals are a bridge that connects people across linguistic boundaries, providing causal mechanisms that are perhaps undetected by traditional discursive analysis. Images also operate by insinuation and association and repurposing. They can attack discourse without confronting language barriers. Studying these artifacts provides a means to expand the ability to unpack denotative political meanings, enrich discourse analysis, and provide a more complete explanation of the of cultural phenomena in politics.

4. Finally, the project builds on previous understandings of the relationship between science, politics, and society. When there is a mismatch between scientific consensus and public opinion, what happens? The analysis here suggests that the state is pulled in various directions, depending on the strength of the public

opposition. This is the foundation for future studies that explore the power dynamics at play when there is a conflict over questions of science.

Future Research

The politics of GMOs are evolving incredibly quickly. It's an exciting time to watch the evolution of the topic, as well as for political scientists to focus on the subject not just as a relic of the food wars of the 1990s, but as a pivotal subject that exists at the intersection of science, the environment, and politics. The implications of the dissertation present exciting avenues of future research. I sketch a few of them here.

First, the potential for adding more cases, both in Europe as well as on other continents, obviously presents itself. For instance, this research provides opportunity for multiple medium and large-N studies that test the findings of these case studies. For example, a large-N study of the position that political parties have taken, and their orientation toward the European Union, would test the assumption that political parties and EU orientation are poor indicators of a country's orientation toward GMOs.

Second, there is the potential for myriad follow-up studies that would construct comprehensive databases of anti-GMO images and analyze their political import within specific contexts and campaigns. Focusing on specific imagery used in anti-GMO campaigns and comparing it to the global imagery would be a fruitful line of inquiry as well. How are images deployed globally? Do the same images that cross European borders translate within other cultural contexts, or is there a unique visual language that has emerged?

Third, a comparison of images used offline—such as in pamphlets and protest signs—would provide insight into the way images spread virally on and off the Internet.[127]

Fourth, there is more work to be done on competing deployment of mythmaking and iconic imagery in two realms. The first is the way that the opponents of GMOs depict the technology as rupturing landscapes – as a corruption of the agrarian myth. The second direction for this thinking is an examination of discourse of catastrophe and the implications that crisis and catastrophic thinking have on policymaking. This rhetoric, which is often deployed in conversations ranging from nuclear power to climate change, is intimately related to debates over science and policy. Future research that focuses specifically on the way metaphors of nuclear war and disease are used in the discussion of GMOs could reveal interesting cultural and rhetorical implications of the debate over the technology.

Fifth, a fruitful line of analysis would place this research within the larger conversation in global environmental politics and food security. Debates over GMOs are increasingly conducted at the intersection of questions of food security, environmental protection, and politics. How does this topic become integrated into domestic conversations? How do pro-GMO policy initiatives advance the goal of increasing food security? Where do ideas of food security and food sovereignty come into conflict?

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[127] There is also an increasing visual presence of the pro-GMO side; after the data collection stage of the dissertation research, images were added to the GMOanswer.com page. However, these images are just depictions of fields, and seem not to compete in the logic of association. However, watching the way these evolve, and including these in the comparison would provide a more nuanced understanding of the role images play in the pro-GMO campaign.

Finally, one fascinating new development in the politics of GMOs is that the last two products approved—a modified apple and potato—eschew the traditional model of genetically engineered products. They are each manufactured by small, boutique biotechnology firms, and have benefits for the consumer. They are being marketed at a point where major corporations are being persuaded to move away from GM crops. This presents a unique challenge both to GM opposition and proponents. The way that each product is perceived by the public, and the extent to which they are adopted, will be instrumental in determining the future of the technology.

This project has addressed the question of why there is sustained resistance to GMOs by examining the way they exist as symbolic objects on a global and domestic scale. The dissertation explores the competing narratives of GMOs on global and local levels, contrasting the United Kingdom, Germany, Poland, Spain, and the United States. I have also examined the visual imagery that emerges from each state as part of the anti-GMO campaigns. I have demonstrated the way that the opponents of GMOs successfully infuse doubt into the process, product, and implications of GMOs, thus keeping alive the contentious nature of the technology.

Appendix A

All images referenced in text and their sources.

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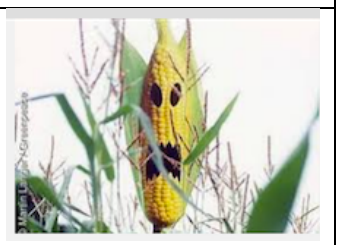
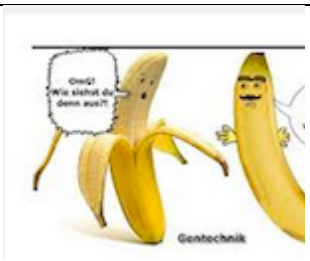
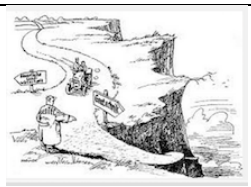
G2-3		G2-5	
G2-7			
G2-8		G2-13	

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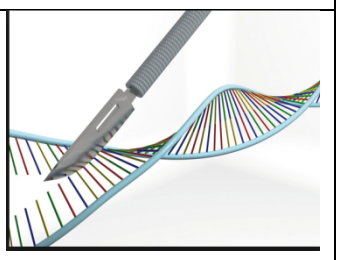
G5-4		G5-7	
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G6-14		G7-5	
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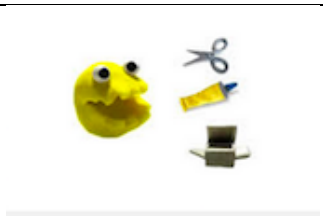
G8-3		G8-5	
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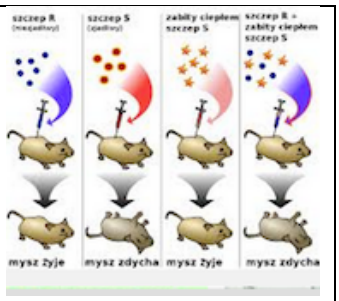
P1-12		P1-13	
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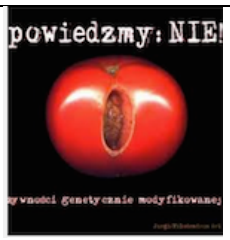
P6-12		P7-6	
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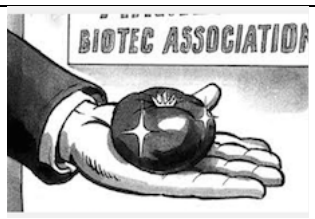
P8-14			
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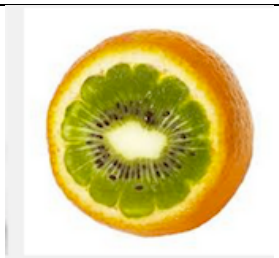
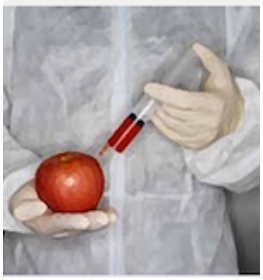
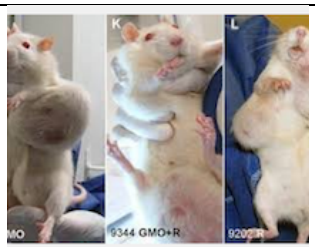
S3-8			
S3-9		S3-11	

S3-13		S3-17	
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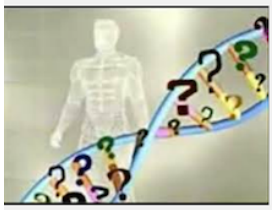
S8-9		S9-9	
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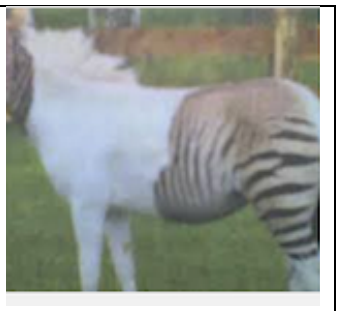
US 3-11		US 4-2	
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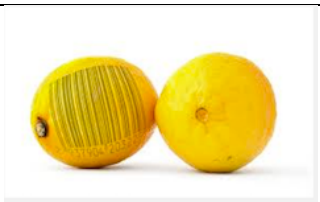
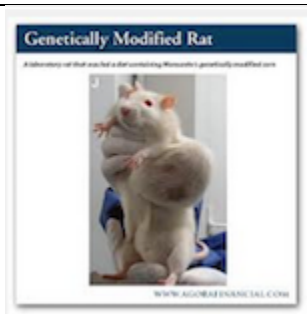
US 6-3		US 6-6	
US 7-1		US 7-2	
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US 10-10			
US 10-11		X-1	

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S9-9 http://protranstercero1vesp.blogspot.com/2011/06/equipo-3-proyecto-de-geografia-impacto.html
S9-13 http://www.vidasencilla.es/etiquetas/greenpeace/ (GREENPEACE)
S10-1 http://www.ecoosfera.com/2013/06/carta-abierta-de-800-cientificos-que-solicitan-terminar-con-la-produccion-de-alimentos-geneticamente-modificados/
S10-6 http://ideaa.eu/cat/agricoltura-allevamento/organismi-geneticamente-modificati/page/2/
S10-9 http://www.lagarbancitaecologica.org/garbancita/index.php/transgenicos-no-no-y-no/366-zonas-libres-de-trangenicos-luces-y-sombras
S10-11 http://despiertaalnuevoorden2012.blogspot.com/2014/02/ORGANISMOS-GENETICAMENTE-MODIFICADOS-PROBOCAN-DEFORMIDADES-EN-LECHONES.html
UK 2-9 https://www.causes.com/campaigns/4637-join-the-non-gmo-tipping-point-network-pledge-to-boycott-genetically-modified-organisms-gmos
UK 2-10 http://greensideupveg.blogspot.com/2011/11/gm-ticking-time-bomb.html
UK 2-11 http://www.joabbess.com/tag/genetic-modification/
UK 2-14 http://www.ascensionwithearth.com/2012/10/grassroots-victory-against-gmo.html
UK 3-13 http://3rdeyevision.org/2013/01/13/genetically-modified-organisms/researchers-with-genetically-modified-corn/
UK 4-6 http://panacea-bocaf.org/geneticallymodifiedfood.htm
UK 4-7 http://www.oxbridgebiotech.com/review/featured/gmo-debate/
UK 4-9 http://www.encognitive.com/node/10285
UK5-1 http://www.cafepress.ca/mf/65879478/the-great-monsatan_sticker
UK 5-7 http://www.gmeducation.org/faqs/p149248-a-brief-history-of-genetic-modification.html
UK 5-15 http://chemtrailsuk.co.uk/GMO-Genetically-Modified-Organism.htm (in montage)
UK 6-10 http://www.jri.org.uk/redcliffe/gm-crops/

UK 9-14 https://streetdemocracy.wordpress.com/category/food/genetically-modified/

UK 9-15
http://www.theecologist.org/News/news_analysis/340410/gmfree_europe_how_we_could_still_ban_gmos.html
UK 10-3 http://www.dailymail.co.uk/sciencetech/article-2205509/Cancer-row-GM-foods-French-study-claims-did-THIS-rats--cause-organ-damage-early-death-humans.html
UKx-1 http://news.bbc.co.uk/2/hi/uk_news/politics/658927.stm
US 1-2 http://guardianlv.com/2014/05/genetically-modified-organisms-and-dangers/
US 1-3 http://www.treehugger.com/green-food/do-you-know-what-you-eat-strikegreenpeacesstrike-ads-against-genetically-modified-organisms.html
US 1-13 http://www.greenprophet.com/2009/09/frankenstein-falafel-israel-gmo/
US 1-15 http://www.progressivegardens.com/category/blog/genetically-modified-organisms-gmo/
US 2-2 http://www.thelibertybeacon.com/2013/03/14/the-effects-of-genetically-modified-foods/
US 2-11 http://listverse.com/2008/04/01/top-10-bizarre-genetically-modified-organisms/
US 3-1 http://www.elephantjournal.com/2012/12/are-genetically-modified-organisms-gmos-safe-to-eat-ericka-abrams/
US 3-8 http://www.123rf.com/photo_12695119_genetically-modified-organism--ripe-carrot-with-syringes-and-laboratory-glassware-on-white-backgroun.html
US 3-11 http://impressivemagazine.com/2013/08/30/genetically-modified-organisms-good-or-bad/
US 4-2 https://bio4esobil2009.wordpress.com/2010/04/05/pictures-videos-of-genetic-modified-organisms/
US 4-10 http://www.organicauthority.com/blog/organic/genetically-modified-corn-messes-with-mouse-reproduction/
US 6-3 http://ultimatesurvivaltips.com/gmos-genetically-modified-organisms/
US 6-6 http://www.defenselitigationinsider.com/2012/08/16/are-california-food-manufacturers-prepared-for-proposition-37-imposed-labeling-mandates-for-genetically-modified-organisms/
US 7-1 http://beantownmagazine.com/genetically-modified-organisms-part-i-is-your-food-agent-orange-toxic/
US 7-2 http://www.smashinglists.com/10-mutant-and-genetically-modified-organisms/
US 7-5
http://www.durangoherald.com/apps/pbcs.dll/article?AID=/20121212/NEWS01/121219851/
US 7-11 http://www.blackriverroasters.com/genetically-modified-organisms-in-food/
US 7-13 http://www.nytimes.com/2014/01/05/us/on-hawaii-a-lonely-quest-for-facts-about-gmos.html?_r=0

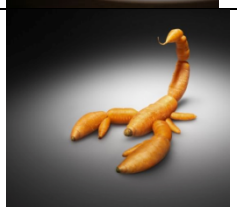
US 8-7 http://inhabitat.com/vermont-set-to-make-mandatory-gmo-labeling-a-state-law/
US 8-15 http://www.ourfoodfuture.com/1141/gm-companies-control-gm-research/
US 9-11 http://www.seattleorganicrestaurants.com/vegan-whole-foods/gmo-harms-dangers/

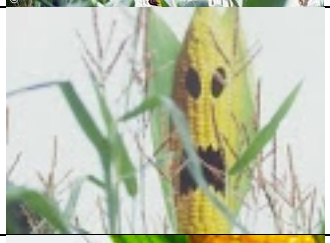
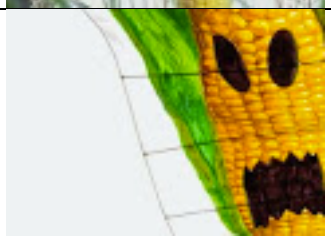
US 10-10 http://greatmysterypublishing.blogspot.com/2012/03/kfcs-new-genetically-engineered.html
US 10-11 http://grizzom.blogspot.com/2013/12/gmo-foods-genetically-modified-organisms.html
X-1 https://www.pinterest.com/homerdawg/i-want-to-believethe-x-files/ (search term 'THE X FILES')

The following images were not possible to find a url for as of April 5, 2015: G2-7;G8-5; G8-7; P7-6 ;P10-9 ;S3-7; S3-11; S4-15 ; S7-3; UK 3-16; US 4-12

Appendix B

Images referenced in Test 2b and their sources

Image	Number hits	Variations	Other Comments/Source
	1090	Multiple – different numbers/ sizes of tomatoes	(US1-2)
	457	Multiple – Color of inside fruit	(UK4-7)
	650	Orientation of plate, only one strawberry half red and half blue	(S4-15) (S1-8)
	650		(US1-3) This one seems to be from a contest entitled "visual metaphors"- it is on many best of photography sites, not just sites related to GMOs.
	71		(US6-6) Most of these also seem to come from a photography contest
	21		(G1-11) A lot of these hits are available to be purchased

			– seems to be used on 15 GMO-related pages
		Variations exist including with the fork reversed, red blood, words across the image, etc[128] However, there are images that Google can't recognize that are still variants of this, such as this image: 	(G1-13) Specific to the Campact.de websites for their demonstration Also used on Russian pages
	114	three versions show up in the "visually similar images"	(G2-5) Greenpeace image
	97		(G2-5)
	21		http://www.morgenweb.de/nachrichten/welt-und-wissen/furcht-vor-der-ruckkehr-des-

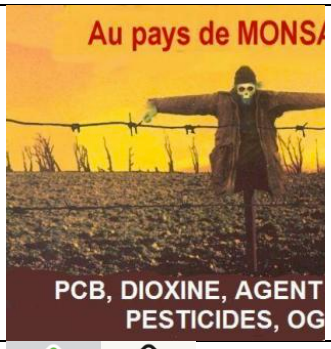
[128] Note: The "visually similar images" algorithm is unstable. Searches done on January 12 and January 13 produced different images findings. However, the "search google for this image" produced the same search results, so that seems to be stable.

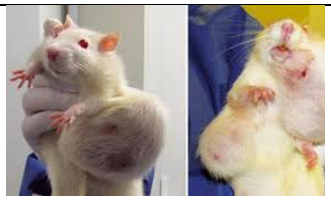
			genmaises-1.1703484
	22		http://archive.longislandpress.com/2010/08/12/gmos-in-food-genetically-modified-food-and-our-kids/
	157		http://www.livehealthyforless.com/dont-eat-the-corn-if-gmo-90-grown-in-u-s-is-gmo/
	122		http://www.livehealthyforless.com/dont-eat-the-corn-if-gmo-90-grown-in-u-s-is-gmo/
	419		http://www.forbes.com/sites/jonentine/2012/09/20/scientists-savage-study-purportedly-showing-health-dangers-of-monsantos-genetically-modified-corn/
	43		https://www.theparliamentmagazine.eu/articles/news/new-gmo-legislation-would-put-power-hands-biotech-

			companies
	70		http://wtfrly.com/2014/04/13/us-corn-exports-to-china-drop-85-percent-after-ban-on-gmo-strains-industry-report/#.VSKn7xPF-Vs
	40		http://wtfrly.com/2014/04/13/us-corn-exports-to-china-drop-85-percent-after-ban-on-gmo-strains-industry-report/#.VSKn7xPF-Vs
	23		http://thewe.cc/weplanet/news/genetically-modified/gm_engineered-food-war-bioweapons.htm
	124	India	http://viacampesina.org/en/index.php/actions-and-events-mainmenu-26/stop-transnational-corporations-mainmenu-76/1322-north-indian-farmers-destroy-monsantos-gm-

			corn-field-trials
	43		Mirror image
	129		
	34	Poland	(couldn't relocate)
	20	France	(couldn't relocate)
	22	US	https://www.theparliamentmagazine.eu/articles/news/new-gmo-legislation-would-put-power-hands-biotech-companies
	20	Brandenburg Gate	http://www.greenpeace.org/international/en/multimedia/photos/an-organic-banquet-to-protest/

	305		http://phys.org/news/2011-08-gmo-corn-falls-prey-bugs.html
	607		http://www.catalysthouse.net/just-say-no-to-gmo-frankencorn-now/
	32		http://www.richardcyoung.com/lifestyle/listen-up-here-why-americans-are-dying/
	95	Spain	Couldn't re-locate
	19	Poland	P2-12
	359		https://derhonigmannsagt.wordpress.com/tag/genfood/
	210		G7-12

	253		http://www.non-gmoreport.com/articles/march2011/gmbiofuelcornthreatensfoodsupply.php
	64		http://www.healthfreedoms.org/800-scientists-demand-global-gmo-experiment-end-2/
	831		https://action.sumofus.org/a/vermont_monsanto/
			http://www.dvorak.org/blog/2012/06/27/texas-cattle-die-after-eating-genetically-modified-grass/
	French		http://nyulocal.com/city/2012/03/07/gmo-goliath-crushes-organic-david-in-brooklyn-court/
	391		http://www.ohnegentechnik.org/metamenu/downloads/
	227		S9-13

	846	Some were false flags discussing the controversy over the strawberry kiwi flavor	S1-5
	636		UK1-8
	201		S7-10
	824		S 2-13
	531		http://www.frazpc.pl/b/301582
	1120		http://beforeitsnews.com/alternative/2012/09/russia-halts-monsanto-gmo-corn-imports-on-rat-cancer-study-2471990.html
	652		http://consciouslifenews.com/dirty-details-behind-attacks-seralinis-notorious-gmo-rat-study/

	54		http://katalogi.pl/213884-gmo-organizmy-modyfikowane-genetycznie.html/page-7
		It's really a French cartoon	http://pierrealain.blogs.nouvelobs.com/archive/2012/09/20/un-mais-ogm-de-mosanto-soupconne-de-toxicite.html
		False flag – apple os stuff and a photoshop tutorial	S6-1
	385		UK 1-8
	558		UK1-11, S4-5
	555		http://www.undergroundhealth.com/monsanto-an-overview-of-the-most-hated-company-in-the-world/

	431		US 8-12
			http://zdrowiedlaniej.pl/gmo-polsce-czy-to-mozliwe-czy-jemy-salate-z-genem-meduzy/
	408		UK 2-6
	401		http://sustainablepulse.com/2013/10/21/global-scientists-issue-gmo-safety-warning-breaking-news/
	1180		http://www.phawker.com/2008/11/21/junk-science-frankenfood-for-dummies/
			http://nowaatlantyda.com/2010/02/14/gmo-genetyczna-ruletka/

	458		http://www.the-open-mind.com/pro-gmo-industries-increase-spending-launch-attack-to-discredit-world-famous-environmentalist-in-an-effort-to-thwart-gmo-labeling-in-the-us/

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