

**WORLD OF “OUR” MAKING: A SOCIO-MATERIAL
CONSTRUCTIVIST ACCOUNTING OF THE DEBATE
OVER GENETICALLY MODIFIED ORGANISMS IN
THE EUROPEAN UNION**

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DECLARATION

I hereby declare that no parts of the thesis have been accepted for any other degrees in any other institution. This thesis contains no material previous written and / or published by another person, except where appropriate acknowledgment is made in the form of bibliographical reference.

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ABSTRACT

Scholars of international relations have increasingly questioned and problematized the historical theoretical attunement to materiality in social and political analysis, particularly as it concerns the conceptualization of matter as passive vehicles inscribed with meaning or as raw sources of material power that determine the actions of individuals and political entities. The “materialist turn” has instead shed light on the ways in which the world is the ever continuing product of processes of materialization in which matter agentially shapes political action. These approaches too though encounter their own limitations on account of the fact that they tend to bracket off history, situation, and context and conflate the properties of different types of matter (e.g. human/non-human). This dissertation aims to provide an interjection into these discussions through the development of a *socio-material constructivist* approach. This perspective draws on Karen Barad’s agential realism and its emphasis on the constituting of phenomena through the interplay between discourse and matter, but differentiates itself in the recognition that although agency is performed through “intra-actions”, the entanglements themselves – and consequently their effects – also emanate from positions of differentiation in terms of the specific types of enactment of agency that can be and are performed by different types of matter.

Recognizing that meanings are conferred both through the relations between discourse and matter and the incisions enacted by matter itself, the dissertation unpacks four modes of action in which material entities engender effects on the world, including through resistance, displacement, gatekeeping, and symbolic action. Employing an abductive research methodology attuned to intermaterial exposure, this conceptual development and an evaluation of its added value is facilitated by an engagement with the field of practice with regard to several field sites within the debate over genetically modified organisms in the European Union, including the constituting of the biotechnology sector and agricultural agential landscapes that publicly framed the issue in the EU and the political mobilization of farmers/beekeepers and the nuances therein, deemed crucial to issue outcomes, specifically within the region of Bavaria in its debate over becoming a GMO-free region.

The socio-materialist constructivist perspective is argued to provide added value to our understandings of politics by clarifying gaps in knowledge left unexplained by rationalist and

constructivist narratives of phenomena through the highlighting of the socio-material work put into constituting interests and identities, channeling these interests and identities into specific actions and mobilization decisions (in some cases and not others), and enabling these actions to come to make a difference or not. The stories narrated here elucidate the fragile and complex relations and overlooked sites of power in particular entanglements between material-discursive practices, including between recalcitrant genetic technologies, local topographies, farmer address databases, insects and pollen, industrial meat demand, and neo-liberal political economy, shedding light on how the capacities of different material entities and the shifts in the coming together of these relations engender different patterns of phenomena emergence. Improved understanding of these processes is consequently argued to be crucial if we wish to better inform social and policy intervention.

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LIST OF ABBREVIATIONS

ANT	Actor Network Theory
BEUC	European Consumer Organization
BBV	Bavarian Farmers Association / Bayerischer Bauernverband
CDU	Christian Democratic Union / Christlich Demokratische Union Deutschlands
CEE	Central and Eastern Europe, Central and Eastern European countries
CEO	Corporate European Observatory
COGECA	General Committee for Agricultural Cooperation in the European Union
COPA	Committee of Professional Agricultural Organisations
CP	Confédération Paysanne
CSU	Christian Social Union / Christlich-Soziale Union
EFSA	European Food Safety Authority
EP	European Parliament
EU	European Union
FDP	Free Democratic Party / Freie Demokratische Partei
GE	Genome Editing
GM	Genetically Modified
GMO	Genetically Modified Organism
IBD	Inflammatory Bowel Disease
IFOAM	International Federation of Organic Agriculture Movements
IP	Intellectual Property
IR	International Relations

MEP	Member of the European Parliament
MP	Member of Parliament
NGO	Non-Governmental Organization
NKZ	Neue Kronen Zeitung
OEBV	Austrian Mountain Farmers Association / Österreichische Bergbauern- und - bäuerinnenvereinigung
R&D	Research and Development
RSPB	Royal Society for the Protection of Birds
SME	Small and Medium Sized Enterprise
SPD	Social Democratic Party of Germany / Sozialdemokratische Partei Deutschlands (SPD)
STS	Science, Technology, and Society Studies
WTO	World Trade Organization

INTRODUCTION

Scholars of international relations and political science have in recent years increasingly questioned and problematized the historical theoretical attunement to materiality in social and political analysis, particularly as it concerns the conceptualization of matter as passive vehicles inscribed with meaning or as raw sources of material power that determine the actions of individuals and political entities (Aradau 2010; Barad 2007; A. Barry 2013a; Bennett 2010; Connolly 2013; Coole 2010; Coole and Frost 2010; Erika Cudworth and Hobden 2015a; T. Mitchell 2002, 2011; Mutlu 2013; Sheller 2014; John Smith and Jenks 2005). These scholars have instead shed light on the ways in which the world is the ever continuing product of processes of materialization in which matter actively shapes political action through enactments of agency. This dissertation aims to provide an interjection into these discussions – the “materialist turn” - through the development of a socio-material constructivist approach that provides novel intelligibility in terms of understanding how matter comes to matter through both its relations with discourse and its own inherent materiality. The dissertation further unpacks four modes of action in which material entities differentially enact particular entanglements that then in turn engender certain effects in the world. Through this conceptual development, facilitated by an engagement with the field of practice with regard to several field sites within the debate over genetically modified organisms in the European Union, added value is argued to be availed to our understandings of politics in terms of (1) contributing to existing rationalist and constructivist narratives through an understanding of the constituting of interest and identities, the channeling of interest-identity constellations into strategies/actions, and the coming to matter (or not) politically of these actions, (2) the development of theoretical knowledge regarding how particular entanglements between matter and discourse come to be enacted and further how these relations come to make a difference, and (3) the elucidating – through the above processes - of overlooked sites of power that constitute phenomena through boundary drawing practices, not in any linear causal manner but rather through relations with other entities and discourses. Such intelligibility, in turn, is argued to be crucial if we aim to better inform social and policy intervention to construct a better world.

The conceptualization of matter and discourse have indeed long been at the core of theoretical and empirical endeavors in the fields of political science and international relations. As part of a

rationalist structural logic, realism conceived of matter as the pre-existing brute forces that determine the distribution of power in the world, which in turn is understood as motivating the decisions of states (Hopf 1998). Such views on materiality were largely sustained in liberal perspectives although the importance of ideas and beliefs and institutional rules on rational calculus were also incorporated into analytical frameworks (Krasner 1983; Schimmelfennig 2002). Over the past couple decades though, constructivist approaches have challenged the rationalist premise of the existence of a mostly transcendental and stable order, instead holding that interests, rules, and identities are contingent and malleable and importantly constituted through shared meanings (Adler 1997). With a view of material things as passive vessels that are inscribed with meaning by humans, the constructivist turn in particular has brought to the forefront the significance of language and social interaction in the putting together of the unconscious presuppositions that the rationalist approaches take for granted (Onuf 1989). Norms and identities are especially important concepts for constructivists, with an understanding that it is “who we are” or “where we are” that first enables an understanding of what is possible in any given situation (Eric Ringmar 1996). In this regard, constructivists, in shedding light on the “world of our making”, have provided added value by highlighting an important site of power and agency, namely the social processes that constitute interests and delineate the range of actions that are feasible in any context (Onuf 1989).

In yet another shift, as alluded to above, a novel scholarly view of materiality has recently emerged, constituted by perspectives that put into question both realist and constructivist conceptions of matter and the analytical ramifications engendered from these understandings. These approaches draw on the actor-network theory (ANT) perspective from the work of Bruno Latour (2005), Michel Callon (1986), and John Law (1999) and a related philosophical tradition often referred to as “new materialism” emerging from a range of scholarship in social and political theory (Mutlu 2013). Rather than conceiving of materiality in instrumental terms as raw power or as vessels inscribed with social meaning, these different approaches have conceptualized objects and non-human things as capable of enacting agency beyond the discursive inscriptions to which they are often attributed. They reject mechanistic conceptions of matter in terms of cause-effect relationships, but also challenge what is perceived as the reduction of objects to discourse. Instead, matter is recognized as lively, dynamic, agentic, transformative, and self-organizing (Connolly 2013; Coole and Frost 2010). The perspectives generally understand matter as being fundamental

to the constituting of phenomena, highlighting the many ways in which technological and material instruments and processes, for example, themselves pre-structure and delineate the range of possibility for society. The 2003 electrical blackout in Canada and the northeast United States, for example, has been seen as being constituted and made possible by “very active and powerful nonhumans: electrons, trees, wind, fire, electromagnetic fields” (Bennett 2010: 24). And British parliamentary discussions over a Baku–Tbilisi–Ceyhan, meanwhile, have been explained as being shaped and guided by the very materiality of pieces of the pipeline (A. Barry 2013a). In shedding light on such agency, new materialists have problematized orthodox political accounts of phenomena, uncovering overlooked practices that perform power in significant ways.

While providing added value by honing in on the agency of material entities and the networks in which they are constituted, the materialist turn also raises crucial questions regarding the place of language and human agency in politics. If a central contribution of social constructivism was in denaturalizing the world and specifically illuminating the many ways in which societies can reconstruct and transform political orders through language and social interaction, then what is to become of such interjections? Do we now simply, for example, neglect the power of discourses and all the intersubjective work put into maintaining them? And do we neglect, the role of language and critique, employed by human beings after all, in denaturalizing and transforming hegemonic rule and norm structures and reconstructing orders anew?

In this vein, this dissertation recognizes that ANT and new materialist approaches too encompass various shortcomings that mitigate their explanatory power. In particular, as has been noted elsewhere, ANT and new materialist approaches tend to bracket off history, situation, and context, neglecting the role of historical discourses in both maligning and uplifting, in shaping the trajectories of societies for better and worse (Aradau 2010; Barad 2007; A. Barry 2013b). They underestimate the role of historically constituted political economy practices in shaping the meaning of particular material performances and the broader constellations of which they’re a part, which in turn go on to constitute specific practices and outcomes. In doing so, similarly to social constructivists and their relationship with language, rather than adequately illuminating possibilities for material agency, these narratives often conceal the significant enabling and constraining conditions put upon such agency, thereby rendering an inadequate understanding of the politics at play. ANT and new materialist perspectives, in other words, fail to coherently

provide a framework that can make sense of the limits and possibilities of material agency and the ways in which material entities come to perform agency and matter through their relations with particular discursive practices. Moreover, this dissertation also takes note of the fact that many perspectives of the materialist turn, in their general presumption of *a priori* symmetry between all types of matter, provide a problematic non-differentiation between human and non-human possibilities of agency. This dissertation, in following Erika Cudworth and Stephen Hobden (2015b), instead holds that phenomena are constituted in contexts of inequality in which species and objects vary in their distinct features, with implications on the types of agency that they can practice. Consequently, relations are necessarily unequal in nature, with Cudworth and Hobden (2015b) pointing, for example, to the precarious lives of non-human animals that are dependent on human beings for their survival and direction. Importantly, while humans are capable of struggling over resources and rules and making decisions that constitute the social organization of political orders, the capacities for this type of agency are seldom found in non-humans (Erika Cudworth and Hobden 2013). In not approaching the field with certain understandings about how different types of matter can or cannot perform agency, significantly, the ANT and new materialist perspectives are constrained in the types of analytical conclusions that they can draw and further the lessons that they can impart in terms of better explaining and preparing for particular circumstances.

In recognition of the added value and noted shortcomings of both social constructivism and new materialism and in taking note of how the two literatures speak to one another, this dissertation identifies fertile space for the development of a syncretic approach that I call *socio-material constructivism*. This approach is premised on the notion that minds and matters, rather than acting on their own, do things together in constituting particular outcomes, whether the construction of new rules, practices, or policies. In this regard, socio-material constructivism is importantly not simply the idea that both discourse and materiality matter, but rather that *how they come to interplay* in the field of practice matters for the construction of the world. In understanding policy outcomes, unlike the discourse coalition approach of constructivism that emphasizes the power of storylines in constituting issues or the new materialist perspectives that put a spotlight on the power of material entities, a socio-material constructivist approach suggests an interrogation of coalitions comprised of discursive-material practices and both human and non-humans and the ways in which these entities come to mutually constitute action with one another through their relations.

In developing a socio-material constructivist framework, this dissertation in particular enlists Karen Barad's (2007) notion of agential realism, which itself draws on the work of Niels Bohr and the quantum model of the atom. Barad's work provides a variety of useful concepts that I employ, including the conceptualization of "phenomena" as particular effects or articulations that emerge through complex intra-actions between different material-discursive practices known as apparatuses. "Apparatuses" refer to boundary-drawing practices or "specific material reconfigurings of the world" that come to matter in intra-actions with particular material entities and other material-discursive practices (Barad 2007, 142). They are the conditions of possibility that include and exclude through their cut-producing effects. In being *discursive practices*, they are importantly not simply the constituting effects of language or speech acts, but themselves phenomena and the agential product of other material-discursive practices. The concept of "intra-action" in turn denotes the processes in which different material and non-material things become entangled and consequently become meaningful and perform agency in that context, in the process mutually constituting specific outcomes or phenomena. As such, for Barad, agency is not something that is possessed by humans or non-humans, but rather it comes through when it is enacted or performed. Agency, moreover, is in a constant process of being re-articulated in agential intra-actions. This means that no phenomena or apparatus is ever static and permanent, but rather they are engaged in continual processes of becoming through relations with other discursive-material practices. This is to say that in a practical sense, intra-actions can be seen as constituting the construction of particular discursive-material practices that can, in turn, guide and shape actions in subsequent entanglements.

In the laboratory, for example, it is the interplay of such things as laboratory equipment, materials, and devices and the object of study (e.g. genetic material) with material-discursive practices such as those relating to scientific knowledge/expertise or agricultural and technological demands that confer the specific character of agency that is exhibited and its effects. It is not that the laboratory objects define the concepts that matter or that concepts determine the meaning of laboratory objects, but that in intra-acting together they become determinate and constitute phenomena. The agential realist framework has been employed to examine a variety of different phenomena, including the development of health epidemics, the securitization of infrastructure, digital self-imaging, and primary school bullying (Wilbert 2006; Aradau 2010; Højgaard and Søndergaard 2011; Warfield 2016). Claudia Aradau (2010), for example, highlights how the securitization of

infrastructure is not only constituted through speech acts, but also through the capacity of certain types of matter to, for example, rupture and corrode and the coming to matter of these processes through their entanglements with discourses on civil engineering, legal practices of responsibility, emergency planning, and building design.

With Barad, in this dissertation and its socio-material constructivist framework, I share the conviction that the act of agency is a process performed in the intra-actions of different discursive-material entanglements. And it is important to note that this conceptualization of agency provides added value in putting an emphasis on the relations and coupling of the discursive/material (i.e. what the relations do together) as opposed to only treating such entities as separate processes. Nonetheless, I make a departure from Barad in my conceptualization of differentiation in types of matter and the role this inequality plays in constituting power relations and agentic possibilities that in turn too shape phenomena as part of these intra-active processes. Although Barad's agential realism has been attributed added value for providing intelligibility in terms of understanding entanglement effects, it has been pointed out that it doesn't speak to the inequality in relations within entanglements, that is, to the ways in which particular configurations are differentially enacted (Aradau 2010, 510).

While recognizing that agency is indeed something that is enacted or performed, this dissertation takes the position that we can still characterize different human and non-human things as being constituted by particular (indeterminate) capacities, abilities, and traits that come to constitute an enabling/constraining role in how agency can be performed. In other words, while phenomena emerge as the constitutive effects of boundary drawing practices between matter and discourse, this dissertation also takes the view that particular material entities demarcated in these intra-actions are at the same time also separate entities capable of certain capacities and not others. Thus while a handler and a conscripted dog in the posthuman military, as one example highlighted by Cudworth and Hobden (2015b), come to mutually constitute and confer different meanings upon one another through their reciprocal relations, the pairing is also one of inequality. Significantly, beyond their war role, while animals conscripted into war may come to convey particular impressions of companionship and constitute the meaning of success, they still operate from a position of vulnerability compared to the human handler for whom they are dependent for their survival. Both human being and animals are constituted by certain material capacities that allow

them to do certain things and not others (e.g. use language, identify land mines, etc...). In this regard, in terms of responsibility, while the animal of war may affect its human master and the terms and methods of conflict, it is only human society that can transform the practices in which such animals are made to experience their lives. Regardless of the entanglement space in which a horse, camel, or dog is embedded, it will never be able to enact the type of transformative agency that is performed through language and imagination, instead being constituted by other capacities of potential difference-making power.

Engaging with these capacities of matter is particularly significant when we approach the field of practice with the presumption that the continued reiteration of intra-activity in the world gives rise to certain relatively stable expectations that resemble a (socio-materially constituted) order, as contingent and malleable in nature as it might be. In this regard, it is analytically possible to examine how different material entities engender particular effects in their relations with certain discourses and material practices, to make sense of their capacities and the ways in which the very material fabric of matter renders differences in the types of actions that are possible in this shared space. This dissertation, in particular, at the broadest level, identifies the ability *to constitute* different processes, to enable/constrain action, as a common attribute of all things, human and non-human. A broad range of different objects and things, from laboratory equipment to nuclear weapons, are characterized, for example, by the capacity to put other things into contact with one another or change the nature of such relations, in the process hindering/facilitating the attainment of goals, displacing interests, and transforming views.

The approach of this dissertation is importantly particularly targeted toward going beyond existing approaches in the new materialist literature through the conceptualization and unpacking of the capacities and modes of action through which matter comes to make a difference, through an understanding of the boundary-drawing enabling/constraining meanings conferred upon agency through both the (1) inherent materiality of matter itself and (2) in its entanglements with other discursive-material practices. This move, significantly, opens up opportunities for better interrogating and understanding – through empirical analysis – the conditions of possibility for different types of matter to come to matter and further how both humans and non-humans influence one another in their reciprocal relations. This engagement, in turn, is necessary if we wish to

understand the analytical space for human intervention within dense and complex socio-material settings.

Although Barad (2007, 178) warns that “Holding the category "human" ("nonhuman") fixed (or at least presuming that one can) excludes an entire range of possibilities in advance, eliding important dimensions of the workings of agency”, this dissertation holds that the decision not to recognize the differential *a priori* capacities of humans and non-humans also forecloses analytical opportunities to examine how different capacities (e.g. language) make a difference or not in the field of practice. In engaging in empirical analysis with the understanding that human beings are capable of articulating speech acts and frames, it should be pointed out that social constructivists have been able to study these particular capacities as enacted in the field of practice and consequently develop understandings about how and the conditions under which social constructions make a difference, imparting particular lessons for the future. With the understanding that material entities too engage in the intra-actions that constitute the phenomena of the world, the dissertation takes the position that it would be equally useful to begin identifying the capacities – the boundary drawing practices that are inherent in matter itself - that such things too may enlist in these construction processes and how such entities further enact agency in specific entanglements with other material-discursive practices. This recognition of the capacities that enable and constrain possibilities for agency is a difference that makes a difference. In particular, in taking this move, analytical opportunities are availed that can enable scholars to better understand the limits and possibilities of particular material entities and thus the power dynamics that are constituted in any intra-action. It becomes plausible, for example, to identify patterns with respect to how certain modes of material capability constitute intra-action processes, that is, how matter comes to matter.

Using an abductive research approach that involves moving back and forth between the analytical framework and the field of study, four of these meaning conferring capacities or modes of action are unpacked both conceptually and empirically through an engagement with the theoretical insights of other scholars and an empirical analysis of the case studies of this dissertation focused on different sites of the debate over genetically modified organisms in the European Union –

discussed in more detail below¹. Through an examination of the boundary drawing cuts enacted both by matter itself and the material-discursive practices in which such matter intra-acts, this dissertation captures how pre-enacted incisions (e.g. resistance of multi-gene complex to being modified) make a difference while also not losing sight of other possibilities of agential emergence articulated in intra-activity (e.g. resistance of multi-gene complex to being modified in its relations with particular scientific knowledge practices and consumer preferences).

One mode of action involves the constitution of entities as *gatekeepers*, a capacity that is marked by the ability to regulate access to any particular entity or practice. In enabling/constraining access, the performance of gatekeeping by humans (e.g. chief of staff of a politician) or non-human objects (e.g. address databases, technological instruments) can constitute the types of possibilities available to a range of entities, thereby reconfiguring power relations and the strategies pursued by individuals with or without access to them. In situations when certain actors attain access, but not others, thereby rendering the gatekeepers as *privileged access sites*, it can be expected to give these entities advantages or disadvantages in the completion of the tasks. A second mode of action highlighted is the enactment of *resistance* (opposite to *compliance*), conceptualized in terms of the imposing of barriers and obstacles that come to enable/constrain the types of relations that are possible with that particular entity. The notion of human populations resisting particular political orders is well-established, but this dissertation shows that non-human things like genetic sequences too can function in recalcitrant (or compliant) ways, putting up hurdles that make a difference. These acts of resistance or compliance, importantly, constitute the types of actions that are possible, rendering certain pathways – each with their own implications – more plausible than others. A third identified mode of mediating action is the power of *displacement* (opposite to *reification*), referring to the ability of entities to change and shift the nature of relations between other actors. In this dissertation, this is demonstrated, for example, in the movement of pollen between two farms, agency that binds different farmers, who might otherwise maintain separate relations, into contact with one another. Finally, a fourth mode of action elucidated is the ability of material entities to convey impressions and perform *symbolic action*. This is not new to our conception of human beings, especially relating to the symbolic interactionist turn of constructivism, but this dissertation also highlights the ways in which non-human material things

¹ The abductive methodological approach of this dissertation is spelled out in more detail in chapter four.

(e.g. bees in intra-action with societal views of the species) too can imprint certain notions and shape the views of their audiences through the conveying of impressions.

To interrogate the intelligibility provided by a socio-material constructivist perspective, the dissertation proposes, as noted above, to examine multiple sites associated with the debate over genetically modified organisms (GMOs) in the European Union. This is an issue phenomenon that in the EU case has been defined by the non-translation of technology into use in practice. The genetic engineering or genetic modification of plants has rather arisen as an issue defined in the EU by (relatively) stringent regulatory oversight and heated public debate over the past several decades. As of today, only one genetically modified crop is cultivated in the EU on around 150,000 hectares of land, a regulatory framework mandates strict risk assessment and monitoring over GM crop cultivation, and nearly no GM food products are marketed on supermarket shelves in Europe (James 2012; Jasanoff 2007; Devos, Lheureux, and Schiemann 2010; European Commission 2015). Given the differences with other contexts (e.g. Argentina, Brazil, Canada, the United States) where agricultural biotechnology has been more widely adopted, the issue overall has perplexed researchers who have sought to explain the differentiation in responses to the issue.

The case of plant genetic engineering in the EU indeed provides an especially compelling opportunity to examine the added value of a socio-material constructivist approach on account of the fact that the political outcomes of the process have already been widely discussed in the academic literature, especially from conventional material-rationalist and constructivist perspectives that have been devoid of discussions of the materiality of transgenic crops and the technologies that constituted their possibility – and consequently the debate - in the first place. An opportunity, therefore, is provided to examine whether the socio-material constructivist approach can indeed add intelligibility to this already inundated field of research. In terms of the existing research, some scholars, for example, have situated EU policy outcomes within discourses centered on European food culture, democratic deficits, and the precautionary principle (Hayes 2006; Sassatelli and Scott 2001; Jasanoff 2007; Lynch and Vogel 2001; Vogel 2012). Others have emphasized the role of discourse coalitions and advocacy coalitions in framing and performing the issue (Schurman and Munro 2010; Heller 2013; Stolle and Micheletti 2013; Ansell, Maxwell, and Sicurelli 2006). In particular, there has been an emphasis on the make-up and actions of the field of actors constituting the issue debate, with the American company Monsanto attributed power in

mobilizing dissent through its perceived aggressive marketing of its commercial products (Schurman and Munro 2010; Toke 2004). The anti-GM coalition, meanwhile, comprised of environmental activists, consumer organizations, anti-globalization groups, and small-scale and organic farmers, is argued to have effectively framed the issue in terms of concerns about biodiversity and farmer autonomy in light of the mad cow crisis and the rise of globalization (Ansell, Maxwell, and Sicurelli 2006). The mostly either indifferent or anti-GMO view among European food retailer and farmer groups has also been deemed significant in terms of the rejection of the technology in the EU (Ansell, Maxwell, and Sicurelli 2006). The specific crop varieties – generally herbicide and insect-resistant crops – have also been attributed a major role in mobilizing environmental groups on account of the perceived negative environmental effects of these types of crops (Levidow and Carr 2009; Bauer 2015; Toke 2004; Sinha 2009).

Interrogating particular moments and sites of the issue constitution process enables a better understanding of how specifically a socio-material constructivist approach can provide added value in light of rationalist and social constructivist alternatives. In the context of the existing literature highlighting the significance of the configuration of and power relations between the field of actors that contested and shaped the issue construction, one focus of my engagement concerns how different socio-materially constituted entities, human and non-human, joined together in various background processes and performances to pre-figure and enable these field constellations to emerge in the first place. A particular concentration is on understanding the socio-material work involved in the development of the biotechnology sector agential landscape, including the empowering of Monsanto in its predominant position compared to small and medium sized enterprises and public sector scientists that plausibly may have conveyed a different image of the technology among European populations. With regard to the populating of the field, a second focus is on the development of the mobilization patterns and power relations between different entities in the field of agriculture, including especially the notable largely non-involvement of conventional farmer groups in support of transgenic crops in the EU in contrast to their pro-GM lobbying stances in the United States and other contexts. Another area of inquiry relates to understanding how the particular interest constellations emerged within regional settings and how they further came to matter or not through their socio-material channeling into specific strategies and mobilization decisions. Scholars have, in fact, made note of the national dimensions of the issue, with different processes shaping different areas of the EU in different ways, but nonetheless

overall coming to be incorporated into EU political processes (Jasanoff 2007; Toke 2004). Given the importance of regional and national actors in shaping the debate at the EU level and differentiation among and within regions, this is an area in which the socio-material constructivist approach can be further evaluated for its ability to develop incisive stories. In this regard, this dissertation puts a particular focus on exploring the region of Bavaria, Germany, selected as a region in which the issue was particularly contested and in which the regional government – led by the same political party throughout the relevant time period - shifted its position on the issue in the course of an over two-decade debate. The aim here was to interrogate the processes in which particular coalitions of environmental activists, farmers, and beekeepers came together or failed to come together in Bavaria through the intra-actions between different entities and further how these coalitions came to leave a political imprint on the process through further socio-material performances.

The findings indicate that a socio-material constructivist approach contributes in several key ways to understanding the issue construction process. It is important to emphasize especially that in analyzing politics socio-materially, the point is not simply to say that “everything matters”, to add more elements to a potentially never-ceasing laundry list of explanatory factors, but rather to complement existing narratives by clarifying gaps in knowledge that these perspectives inadequately address. In this regard, throughout the empirical chapters, at key sections, the socio-material constructivist approach is juxtaposed alongside mainstream interest and identity-oriented approaches in explaining particular phenomena. It is found that the perspective contributes in closing certain gaps in case narratives not captured through an emphasis on identity or economic interests alone, including particularly related to the highlighting of the complex (and fragile) relations and overlooked sites of power involved in the constituting of interest/identity construction, the channeling of interests and identities into action in some cases (and not others), and the further mattering or not of the actions that emerge from these processes. These phenomena instead rather benefit from being unpacked with regard to the complex relations between relatively stable and contingent moving parts, discursive and non-discursive, that constitute them. These conceptual contributions of the approach can generally be synthesized into three categories.

First, the perspective complements constructivist and rationalist explanations of the issue debate by shedding light on how the agential landscape - comprised of the various actors that contested

the issue publicly - that these approaches reify emerged in the first place. In understanding these field constitution processes, the socio-material perspective especially complicates the interest and identity-oriented approaches, showing how the unconscious presuppositions that they take for granted were the contingent work of constitutive background processes comprised of material-discursive elements. These moves, in turn, reroute our understanding of power in the process, highlighting contingent relations that emerged between particular material entities and social practices as instrumental to the populating of the field of entities that contested and framed the issue. That large biotechnology companies became a central part of the constellation of actors providing GMO applications to the EU market, but not public research institutions and small and medium sized enterprises, in a pivot from historical patterns, is, for example, shown to have been constituted through the interplay of such things as genetic material, enabling and trait technologies, scientific knowledge, intellectual property rights, and agricultural/crop practices and demands. Such processes also steered applied research toward the development of certain types of crop varieties derived from plant genetic engineering, namely those involving herbicide- and insect-resistant crops, and not towards others, namely those involving valued added traits such as improved nutrition or food quality.

The very genetic material of life, whose manipulation was crucial for allowing scientists to develop particular crop varieties is shown as enacting agency as both a *site of resistance* and *compliance*, enabling scientists to make certain modifications with relative ease (e.g. gene coding for herbicide tolerant soybeans) but constraining them from developing other, perhaps more awe-inspiring practical applications (genetic sequences coding for omega-3 enhanced camelina). As such, in intra-action with corporations and scientists, whose research goals were themselves constituted in their entanglements with socio-material apparatuses related to epistemic research practices and industrial farming practices, trait technologies (i.e. the genetic material of various organisms) are shown to have enacted agency, shaping the trajectory of research and the contours of the public policy debate. The process of interest generation was also constituted in the intra-actions of enabling technologies – defined as discoveries that allowed scientists to introduce new genes into plant cells – with these scientists and companies. The enabling technologies, similarly to the agency enacted by trait technologies, through their scientific function constituted the types of modifications that could be made to plants. But they secondly, moreover, became *privileged access points*, through their pairing with intellectual property rights regimes on biological life that

emerged in the 1980s and the subsequent ownership patterns of these patents. These entanglements, in particular, are shown to have limited the access of public research scientists and small and medium sized enterprises to the technological tools of research, thereby hindering them from developing particular research applications and consequently shaping how the technology was framed in public debates.

As indicated above, societal discourses and material entities became intertwined with one another in these processes of “scientific” development. This was the case in, for example, how the research goals of industry scientists were constituted by agricultural and political economy practices, themselves of their own socio-material origins. One such practice that emerged as significant was the high levels of societal demand for maize and soybean (and the associated energy/food sectors in which they are used), among the most profitable crops in the world, and the historical development of knowledge regarding material pests such as the European corn borer and various species of weeds that threatened their production. These once distant processes would come to intra-act with trait and enabling technologies and other processes that seemingly at the surface level at least revolved more closely around the laboratory. Together they socio-materially constituted the possibility that herbicide and insect-resistant crops would be among the first applications provided to producers, crops that would be contested in public policy debates for their purported harm to the environment.

Beyond biotechnology companies and public research scientists, my field research also reveals that farmers and beekeepers became swept up in socio-material processes of interest construction through constellations of entities and material-discursive practices including pollen and bees that entangled neighboring farmers/beekeepers through their movement, the political economy of supermarket branding, the development of regulatory regimes on labelling in Brussels that applied across the EU, and topographical and climate-oriented characteristics of European farming regions. In the Bavarian regional debate, for example, the mobilization of beekeepers into the Bavarian GMO-free alliance was perceived as crucial owing to beekeepers’ connections with the Christian Social Union (CSU) ruling political party in the region and their perceived *symbolic performative* role as experts on bees. The dissertation yet shows the fragile nature of their mobilization. It was specifically that bees through their ability to move around and collect (GMO-contaminated) pollen, only in consort with the apparatus of EU labelling regulations and court

rulings, came to perform a *displacement role*, altering the interests of beekeepers and enrolling them into the anti-GMO movement. Similarly, the specific character of farmer mobilization toward GMOs in Bavaria – against transgenic crop cultivation but permissive of the use of GM animal feed – and the economic interests that shaped these decisions is shown to have been constituted through the geography of the region and materiality of soybeans and their intra-actions with scientific practices, EU labelling rules, EU and global meat demand, and transgenic crop practices in other countries.

A second contribution revealed from the case studies is in the power of a socio-material constructivist approach in highlighting how particular interests-identity constellations are channeled into strategies, actions, and mobilization decisions in specific situations through socio-material relations. This is to say that rather than automatically being translated into particular outcomes, the case studies show that particular practices were rather complex and fragile achievements brought together not only through rational calculus or made possible through historically constituted identities, but also enabled or hindered through the banal objects, material/technical processes, and mundane practices of everyday life. As an example, the material and discursive structural determinants that might have constituted the decision of particular farmers to politically mobilize against GMOs weren't enough on their own to generate this interest, but instead became tied up with things like access to farmer address books, activist leadership charisma, the spatial distribution of farmland, and the social habits of farmers.

As one specific site of the process, the dissertation takes up the cases of Augsburg and Rosenheim counties of Bavaria, Germany, two proximate localities that shared similar agrarian profiles and regulatory environments and were exposed to similar storylines and framing, but nonetheless where farmer/producer groups mobilized in different ways on the issue. In examining the mobilization of farmers into the anti-GM coalition that occurred in Rosenheim, but not in Augsburg, the dissertation finds that farmer mobilization was constituted through assemblages comprised of both relatively stable elements like topography, characteristics of agriculture in the area, and political economy factors and more contingent and less stable entities such as leadership personality style and the number of people at meetings. In Augsburg County, for example, environmental activists struggled to open up communication channels with individual farmers who were dispersed throughout the county. In this case, a farmer address catalog – a seemingly banal

material thing - became a privileged access point in the intra-actions between environmental activists and farmers, with lack of access to such an intermediary constraining environmental activists in the first place from contacting farmers and persuading them to join their GMO-free alliance movement. In Rosenheim County, on the other hand, the presence of a central figure in the farming community as a leader in the GMO-free movement enabled the GMO-free alliance to broaden outreach to farmers in various towns and expand their alliance. The two counties were, in other words, cases in which interests and identities of farmers came to matter or not through constellations of entities and material-discursive practices that mutually through specific configurations of intra-actions channeled these interests and identities in particular directions.

A third contribution of the framework relates to the intelligibility it offers in terms of understanding how particular alliances, once socio-materially configured, come to enact specific effects that matter in terms of altering viewpoints through further socio-material performances. In Bavaria, for example, the shift in the government position on transgenic crops was contingent on not only the membership of Bavarian farmers and beekeepers in anti-GM coalitions and the frames on contamination and environmental harm employed by these groups, but also the continued articulation of this opposition and visual performance of these frames through demonstrations that garnered media coverage through entanglements involving dense material relations between bees, balloons, wind, tractors, costumes, and humans. While anti-GM activists, in other words, put the issue of GMO cross-field contamination in farming and beekeeping in the spotlight through the organization of protests, the success of such demonstrations importantly was constituted socio-materially, with wind and balloons, for example, joining together with activists to convey particular impressions about what wind could do with pollen comprised of transgenic material.

In examining the case of genetically modified organisms in the EU, furthermore, this dissertation also makes an original empirical contribution toward understanding this issue debate. The empirical analysis incorporates my own interviews (thirty nine in total) with individuals involved in various aspects of the process, including a symbolically representative range of individuals from environmental organizations, corporate watchdog groups, agricultural organizations (small-scale, organic, and conventional), the food sector, the biotechnology industry, the scientific community (both university and government-affiliated scientists), civil society activists, Bavarian political parties, and EU political institutions. The analysis also includes my examination of scientific

publications and texts related to research on transgenic crops and agriculture. The current literature has largely focused on the role of identities and social contestation in shaping the trajectory, but my socio-material constructivist analysis indeed shows that there was much more at play in terms of the enactment of power and agency, aspects that have been overlooked by conventional studies. It adds an extensive interrogation to the role of non-human materiality in the process, generally neglected by mainstream approaches, thereby rendering new interpretations and explanations to the process and how it could have turned out differently. In honing in on the regional debate in Bavaria, the empirical analysis also helps elucidate how global, supranational, national, and local processes intersect with one another and how the mundane practices and banal things of the everyday come to shape politics. The Bavarian site analysis further sheds light on how local actors (e.g. individual farmers, local environmental scientists) especially come to be included in politics in the context of entanglements between local and global discursive-material practices and powerful material processes.

The implications of this dissertation are certainly not limited to the individual case studies that I examined though. Now that research has accumulated showcasing the significance of socially constructed interests, rules, and norms on the one side and the power of dynamic and lively materialities on the other, this dissertation shows that there is more to be gained by understanding how discourses and matter intra-act in different cases, how these entanglements are differentially enacted, and how the nature of these relations make a difference in terms of the agency that is performed in the constituting of particular phenomena. One criticism that has been lobbed at new materialist and hybrid approaches is that they minimize the agency of the human being, erasing the central figure that has continuously reimagined the world (Jasanoff 2015). However, what this dissertation shows instead is that by taking into account the socio-material construction of interests and identities and their subsequent channeling rather than simply their social construction, we, in fact, gain a better grasp on the limits and possibilities of human agency and language use and how such processes are pre-structured and later maneuvered toward particular actions or not. We learn, for example, that even though biotechnology corporations and anti-GM farmer activists may have been instrumental in framing and constituting the debate, their mobilization was not inevitable, instead itself steered by intra-actions between material things like genetic sequences and socio-materially constituted practices such as those relating to the political economy of agriculture. We learn that visions of scientific progress and the feasibility of achieving such imaginations are

constituted by the possibilities availed by certain technologies intra-acting with various discursive practices (e.g. current knowledge understandings, public/consumer attitudes, and intellectual property rights). We come to terms, in other words, with the imprinting function that language has in conferring specific ideas about material things (e.g. what crop varieties should be developed from genetic material) while understanding how such frames come to be made possible in the first place (e.g. the materiality of herbicides and soybeans) and further how they come to gain meaning. And we better elucidate potential facilitating or hindering entities and practices (e.g. farmer address databases, spatial distribution of farmland) that can enable or constrain certain interest-identity constellations (e.g. the material-discursive configurations constituting the plausibility that farmers would oppose transgenic crops) from enacting tangible effects.

In problematizing conventional accounts of power, these different contributions are all significant in concrete terms if we wish to be able to intervene to steer the process in different ways. In terms of lobbying and persuasion campaigns, for example, if we take into account the materiality of these processes in terms of gatekeeping as one entry point, that is, how privileged access points impose constraints and facilitating effects on framing efforts, we can prepare for other situations and contemplate the desirability and feasibility of solutions to such inequalities in access. The socio-material constructivist narratives told in this dissertation further find that beyond tinkering with particular frames or speech acts, a different outcome in the debate over transgenic crops in the EU may have also been contingent on the transformation of broader material-discursive practices, including neo-liberal political economy practices and (GM) animal feed/intensive meat consumption habits that conferred meaning upon particular material entities and in the process made particular issue outcomes (e.g. the biotechnology sector takeover by Monsanto, the continued use of GM animal feed) tenable. In this regard, the socio-material constructivist perspective, in interrogating material-discursive entanglements, puts a spotlight on alternative pathways that are, in fact, intertwined with the more commonly recognized surface level factors that are typically emphasized in explanations of the issue trajectory.

At the broadest level then, this dissertation contributes to discussions regarding one of the fundamental themes of politics, namely understanding and explaining particular phenomena in the world. And in doing so, it suggests a revisit of how and where we conceptualize power and agency in these accounts. This dissertation suggests that power, the perhaps quintessential concept of

international relations, in fact, lies not entrenched in discursive structures that may be only unhinged through the often difficult terrain of language contestation, but in often banal everyday material sites and objects – and the mundane practices that often emerge with them - and their ahistorical and historical entanglements with language and socio-materially constituted practices. At the same time, while emphasizing the relations between matter and discourse and humans and non-humans as meaningful, it recognizes the human responsibility and unique capacities for transforming systems of exploitation, oppression, and faulty policy even within these complex environments. As a world of “our” making, constituted by both humans non-humans and discourse and matter, understanding and engaging with power, including the boundaries and constitutive conditions for human intervention in dense technical settings, as this dissertation seeks to do, is crucial if we wish to better rescue our own place in the construction of the world and constructively improve our politics.

Having now provided an introduction to the dissertation, the upcoming structure will revolve around six chapters and a conclusion. Chapters one and two aim to put constructivist and new materialist approaches in dialogue with one another. This is done by engaging in literature reviews of both paradigms with a focus on highlighting the value-added and shortcomings that constitute each of the perspectives. The chapters take note of key differences in terms of the assumptions and concepts of the approaches, especially with respect to the treatment of discourse and matter, and how these differences make a difference in constructive and destructive ways. In light of this scholarly engagement, chapter three proposes and conceptualizes a *socio-material constructivist approach* as a framework for understanding politics conceptually and as a method for empirical study and unpacks four of the capacities from which material entities can make a difference. Chapter four, meanwhile, introduces a methodological approach for conducting socio-material constructivist analysis, an abductive approach premised on the notion of exposure by reading different sources intermaterially through one another and then examining these narratives alongside alternative explanations, argument, and counterfactual reasoning. Chapters five and six then present the empirical case analyses of the EU field configuration constitution processes in the debate over GMOs and the regional debate over GMOs in Bavaria. After reviewing the theoretical and empirical contributions of the socio-material constructivist perspective developed in the dissertation, the conclusion provides final reflections on areas for further theoretical and empirical inquiry and opportunities for employing the approach for political analysis.

CHAPTER 1. THE LINGUISTIC AND SYMBOLIC UNDERPINNINGS OF THE CONSTRUCTIVIST RESEARCH TRADITION: AN ASSESSMENT OF VALUE ADDED AND A NEW MATERIALIST CRITIQUE

In contextualizing the development of this dissertation's socio-material constructivist framework, this chapter is an endeavor to engage with the social constructivist research tradition, examining both the new intelligibility that constructivist approaches have provided to understanding the world and the shortcomings of the perspective. This review should be viewed with two contexts in mind. The first is the origin story of constructivism, emerging at a time when realist and liberal theories had cemented ideas that emphasized objective reality and largely underemphasized human agency in explanations of policy decisions. Prior to constructivism, humans were generally seen as vessels that made rational decisions in a world governed by anarchy or limited institutionalism. The possession of raw materiality like gold and weapons was understood to determine the relative power of different actors and also shape threat perceptions, in turn guiding rationality calculations (Hopf 1998). Constructivism transformed these views with its emphasis on the power of human agency, highlighting how society can establish rules and norms with the potential to transform the meaning of matter itself and change relationships of enmity into those of amity (Onuf 1989; Wendt 1992).

In not taking the world "as is", constructivism took a political move toward denaturalizing the existing order, highlighting its contingent and pliable nature, including particularly the human role in shaping it through language and interaction. The constructivist epiphany that the world, both domestic and international, is not necessarily anarchical or destined, but rather constituted through our actions and ideas has brought forward a significant contribution toward political and social analysis, opening up space for interventions to improve society. Constructivism has contributed analytically to our frameworks for understanding the world, making sense of why nuclear missiles, for example, are not necessarily always treated as a material threat (Wendt 1992). For constructivists, the meanings of the world are inherently contested and negotiated by actors participating in shared social spaces. Consequently, constructivism has highlighted how the policy responses to various problems such as environmental issues have been constituted through the speech moves, frames, and tropes that have been employed in public debates (Hajer 1993).

Constructivist perspectives have also drawn attention to the reciprocal interactions between countries as constituting social structures, highlighted how relationships of enmity and amity between different countries are achieved, exemplified, for example, in changing Cold War relationships between East and West (Fierke 1998; P. A. Chilton 1996; Duffy and Frederking 2009).

It should be noted that rather than presenting a singular focus on the constitutive power of language and interaction, constructivist research has become increasingly rich and more complex over the years, with especially more of a prominent role given to understanding the relevance of history, identity, and context in the making of the world. History has been seen as crucial for shaping contemporary identities and ideas, which in turn shape the range of policy options that are possible in any situation (Ringmar 1996). Contextual research has also demonstrated that the types of frames and tropes that are uttered are not limitless, but rather constituted through experiences and practices with different effects depending on the audience (Balzacq 2005; Ciuta 2009; Salter 2008). This broader research agenda has helped elucidate the conditions under which speech moves may succeed or fail, thereby improving knowledge on the politics of change and continuity.

The second context is the changing landscape of the field today, where constructivism has been increasingly challenged by a novel view on materialism, one that emphasizes matter's agential potential, not as brute materiality, but rather as things that resist meaning imposition, displace interests, mediate the types of interactions that are possible, stabilize participation in political interactions, interact with other actors, and perform particular ideas. Although certain strands of constructivism have acknowledged that there is a material world "out there" that is distinct from the social world and that there are material limits to rules, constructivist research has generally conceptualized the social content as "dominant" (Onuf 1989). To the extent that the material world is incorporated into constructivist empirical research, matter is mostly viewed as passive material largely constituted by discourse. As with realists, things like weapons exist, but for constructivists their potential depends not only on their mere existence and the ways in which they are amassed, but also international rules and the identities of the relevant actors. While indeed capturing the human capacity to imprint shared ideas on objects, constructivists do miss out on the many modes of action through which material things enact agency that don't rely on social constructs. In other

words, there is much more happening with matter outside the meanings inscribed in it, an insight highlighted by new materialist scholars (Bennett 2010; Coole and Frost 2010).

In light of the added value of constructivism, this chapter suggests reflecting on the ways in which it may be possible to also incorporate into frameworks the material and technical relations that also function as key conditions of possibility in the formation of particular coalitions and ultimately political outcomes. The core of a new constructivist research field should be aimed at understanding these points of intersection, the ways in which coalitions and issue constructions emerge through the necessary relations between different human and non-human actors, which come together in contingent ways to assemble particular policy outcomes. By taking into account these contextual and process constituents, we can better account for various political processes and understand the limits of both language and materiality, consequently reinforcing the mission of critical constructivist work to illuminate possibilities for human agency and change by teasing out ways situations could have or could not have turned out differently.

With these initial thoughts in mind, the chapter proceeds as follows. After introducing constructivism and its positioning toward materiality, I turn toward outlining the philosophical underpinnings and empirical body of research of two important strains of constructivism employed in international relations research, language constitutive constructivism and symbolic interactionism. The key purpose of these sections is to highlight the intelligibility that has been gained from constructivist research, but also to illuminate the limits of the perspective, including particularly when a constructivist “all the way down” position is advanced. In reflecting on the new materialist critiques of constructivism, the chapter sets the context for the subsequent two chapters in suggesting that through incorporation of certain new materialist tenets, we can hold onto the notion of a constructed world by recognizing that the world has been of a socio-material making.

1.1 Constructivism as a disruption to materialist-dominant theorizing?

Grappling with material reality has always been a central concern of international relations. Neorealist and neoliberal institutionalist approaches, which dominated the field before the emergence of constructivism, viewed materiality as a brute force that constituted the most important source of power in the world (Hopf 1998). In realism, the international system is seen

as anarchical and comprised of material structures defined by the distribution of wealth and military resources. The implications are that states should pursue the strategy of self-help or security independence, including through the attainment of economic and military material power, in order to ensure survival. The conditions of the international system, in other words, come to encompass the identity of all states as self-interested actors (Hopf 1998).

Neoliberal institutionalists, meanwhile, conceive of certain international institutions as being part of an otherwise anarchical structure. These institutions are considered important by state actors as they allow states to solve collective action problems and reduce transaction costs (Krasner 1983). As such, they have a material basis and are abided by when perceived as rational by states. The institutions are not treated as constituting international society, but rather simply as intervening variables that reorient material interests and cost-benefit calculations and consequently political practices (Schimmelfennig 2002).

In contrast to materialist-rationalist approaches, constructivism views actors' policy actions as derived not from raw material interests within a pre-defined and transcendental international order of anarchy, but rather from rules and norms that are socially constructed through interactions and individual identities constituted through history. For constructivists, discourse, defined by Maarten Hajer (1993) as the "ensemble of ideas, concepts, and categories through which meaning is given to phenomena", is what provides context to phenomena and structures particular courses of action. As Emanuel Adler put it, "identities, interests, and behavior of political agents are socially constructed by collective meanings, interpretations and assumptions about the world" (Adler 1997, 324). For constructivists, it is possible, in other words, to overcome the conditions of anarchy when actors agree on alternative relationships that are reinforced through routine practice.

While sometimes criticized for being "unrealist" or idealist, constructivists stress that "both material and discursive power are necessary for any understanding of world affairs" (Hopf 1998, 177). Onuf (1989) similarly acknowledges a material world out there and the constraints that materiality may impose on meaning construction (e.g. a constructivist wouldn't argue that a pen can fulfill the functions of a piece of paper simply because people confer meanings on it). Constructivists recognize the existence of things like rivers, mountains, and clouds outside of discourse, but perceive most of the major work in the political world as being done through social

interaction. R.B.J Walker (1984, 3), in defending the analytical value of constructivism, further points out that “it is important to recognize that ideas, consciousness, culture, and ideology are bound up with more immediately visible kinds of political, military, and economic power”.

For most constructivists, social content is dominant though and the prevailing narrative is that material things need to be understood through the social concepts that make them meaningful for human life (Onuf 1989). As Wendt argues, “people act toward objects...on the basis of the meanings that the objects have for them” (Wendt 1992, 396–97). Constructivists argue that for the most part, this perspective on materiality better captures the ways in which objects matter through the mediating role of socially constructed identities, norms, and interests. While realist approaches, for example, struggle to explain why British missiles present less of a threat to the United States than a North Korean stockpile, constructivist frameworks capture the different identity constructions that the US maintains of each country, which shape the policy strategies of the US toward those countries. Once these meanings are taken into account, US foreign policy toward Britain and North Korea on the issue of missiles is rendered comprehensible. Similarly, Price and Tannenwald (1996) situate the non-use of nuclear and chemical weapons within the framework of historically constituted prohibitory norms and cultural meanings that have in turn constituted the weapons as unacceptable weapons of mass destruction. These social meanings help explain how the weapons can come to be perceived as tools of deterrence rather than ordinary instruments of warfare.

Materiality then is sometimes very present in constructivist accounts, but its power is often seen as constituted by the meanings inscribed in it. Analytically, constructivism is particularly concerned with understanding the mechanisms through which society attaches certain ideas to material objects and structures more generally. Constructivism focuses on tracing the origin stories and development of different norms and identities that shape the types of actions and policies that are possible. In the next two sections, I lay out two of these mechanisms of “world making” and discuss some of the theoretical and empirical added value engendered through their incorporation into conceptual frameworks. The first is constructivism’s emphasis specifically on language as something that not only allows actors to represent reality, but also perform and create it. The second mechanism is related, but focuses more generally on the recognition that interactions of all kinds, including language, physical action, and practices, shape the meanings that are stabilized in

relatively static social structures. Following this interrogation, in the section that follows these two, I return again to consideration of materialism, including specifically the intelligibility lost through constructivism's neglect of materiality outside of the social constructs of human beings.

1.2 The power of language

Language tends to be at the core of constructivist research approaches owing to the understanding that language has the power to constitute the social world by enabling and sustaining the social construction of norms, values, and identities. Constructivism draws particularly on the idea of speech act theory from J. L. Austin, including the notion that language is both representative and performative, and the language games theory from Wittgenstein, including the idea that language is a game that permits certain usages within the confines of particular grammars and rules (Zehfuss 2002).

According to Austin (1975), words are capable of representing reality (i.e. constative words), but they're also capable of performing reality (i.e. performatives). Nicholas Onuf (1989, 82) points out that "people use words to represent deeds and they can use words, and words alone, to perform deeds". An example of the latter is a declaration in a will such as "I give and bequeath my watch to my brother" (Austin 1975, 5). In making this statement, the speaker is understood to make a performative utterance or what Austin calls an illocutionary act since there are social consequences and expectations that arise from the utterance. Through an ongoing pattern of speech acts, IR theorists postulate that rules may arise that "fix preferences and expectations" and thereby create constraints on action (Onuf 1989, 177). This is analogous to a chess game in which players are allowed or not allowed to make certain moves depending on the rules of chess. In this regard, any particular policy action can be explained as being possible first of all because of rules that are constituted through language.

Rather than answering "why" questions, constructivists tend to ask "how-possible" questions. Constructivists argue that understanding rules and games and the language use that constitutes them should matter for social scientists, as the particularity of a social phenomenon can be explored by situating it within the rules of a game or discourse, thereby explaining how an outcome was possible (Fierke 1998, 20). The use of particular speech, for example, can be seen as bringing meaning to the world and structuring the type of action that is possible by shaping expectations of

behavior. Although they are not laws, rules are followed as a matter of course based on shared language meanings, as agreement about their meaning allows communication to be possible. Once language use is contradicted through action (i.e. the rules of the language game are broken), the actor is exposed to critique and resistance that could topple a regime (Fierke 1998). Furthermore, Iain Johnston (2001) positions “social influence” as something that ensures rule conformity through the distribution of rewards such as recognition and status and punishments like shaming and shunning even when a particular actor opposes an intersubjectively accepted rule.

The speech act theory of language is exemplified in the Copenhagen School securitization framework of Buzan, Waever, and de Wilde (1998), which makes note of the ways in which specific issues become securitized as existential threats (i.e. an issue is elevated from the realm of normal politics into the space of emergency politics). According to the approach, this happens when certain utterances of speech connect particular issues to security concerns, including societal, economic, political, military, and environmental security (Salter and Mutlu 2013). Illocutionary speech acts are the key to these securitization moves, as without them, actors wouldn’t be able to make these threat and danger connections and reach resonance with a wider audience. Words allow actors to “underpin or undermine the construction of our social world” (Skinner 2002). Once shared understandings are achieved, these intersubjective meanings are understood to bear consequences, enabling or constraining particular courses of action.

In elucidating the social construction of security concerns, focusing on the “discursive ability to effectively endow a development with such a specific [security] complexion”, the Copenhagen School of securitization distinguishes itself from realist approaches that identify objective security threats (e.g. war) in the materialistically defined international system and then see states as acting rationally to fend off or balance these threats (Balzacq 2005, 179). It has provided added value to these classical security approaches in widening our purview of security by considering how security is a practice driven by articulations and norms and importantly by the processes involved in stabilizing or contesting these norms. Overall, the securitization approach has opened up a broad research field focused primarily on the questions of: “who securitizes (Securitizing actor), on what issues (threats), for whom (referent object), why, with what results, and not least, under what conditions” (Buzan, Waever, and de Wilde 1998, 32).

The securitization approach has shed light on a variety of issues, including the securitization of the environment, transnational crime, HIV/AIDS, migration, and the war on terror (Floyd 2010; Emmers 2004; Elbe 2006). The framework has been particularly well-noted for its added value in identifying and tracing the elasticities in societal views on security through “the emergence or disappearance of a particular linguistic schema” (Salter and Mutlu 2013, 114). In the Chinese context, for example, Juha Vuori (2013) has examined how certain significant signifiers of securitization – “counter revolution”, “turmoil”, and “well-planned plots” – have been used not only to securitize issues but also legitimize leadership shifts and foment a more cohesive society. While the particular language tropes used by Chinese leadership have remained largely stable in nature across time, Vuori finds that the arguments have, nevertheless, changed from Mao’s China to post-Mao China. Significantly, during Mao’s rule, securitization moves were made to mobilize Chinese society against potential threats, but more recently they’ve been used to suppress mobilization. By examining shifts like the aforementioned case, scholars can make sense of the ways in which language can be used to denaturalize and transform security.

Scholars have also engaged with analytical and normative questions regarding the implications of securitization and desecuritization, thereby illuminating the politics inherent in any effort to frame an issue. Researchers examining the issue of asylum and migration, for example, have highlighted the social consequences of the issue’s construction as a security problem (Balzacq, Léonard, and Ruzicka 2016). Huysmans (1995) raises the issue of the potential for violence between different national communities, while Van Munster (2009) highlights the damage that can be done in terms of a downgrading of political status for migrants. Elbe (2006, 119), meanwhile, draws attention to the two-sided nature of the securitization of health issues like HIV/AIDS, which may result in more resources and attention being devoted to address the issue, but also shift vital resources and authority from civil society groups to the security sector, which hold the power to “override the civil liberties of persons living with HIV/AIDS”.

Early constructivist research on securitization was, nevertheless, criticized for its sometimes narrow focus on the performative role of language maneuvers themselves and not on the background political and social contexts that condition the success or failure of particular normative and identity constructions (McDonald 2008). These noted shortcomings consequently sparked a range of research focused on incorporating this context into broader frameworks,

including approaches attuned to history, institutional settings, and socialization patterns that enable certain discourses to become possible and gain resonance. Mark Salter (2008), for example, examined the ways in which speech acts may resonate differently depending on speaker-audience settings. And Balzacq (2005) and Ciuta (2009) highlighted the need to situate security moves within the sociocultural contexts in which the texts are embedded in order to understand the success or failure of particular speech acts. These developments overall have improved the explanatory power of the securitization framework and enhanced our knowledge regarding the conditions under which critical interventions may be likely to gain resonance.

Beyond the Copenhagen School, constructivist frameworks premised on the significance of language have been employed in a variety of issue fields. With respect to US foreign policy in the post-9/11 era, Peter Howard (2004) situates US foreign policy action within the rules of the game designated by language use. Although arguably the greater threat, North Korea's nuclear program was framed as manageable while the Iraq regime wasn't. These framings consequently mattered in US policy decisions regarding how to address each situation. Richard Jackson (2005), meanwhile, demonstrates how public language, including words, assumptions, metaphors, and myths, by the Bush administration was used to legitimize the global War on Terror.

Constructivists have also sought to make sense of Cold War norms and changing security relations at the end of the Cold War by examining the language that constituted rules and established the contexts under which a range of actions and strategies became possible. Duffy and Frederking (2009), for example, note that speech acts employed by elites served a fundamental role in institutionalizing and stabilizing the rules of the Cold War between East and West - namely norms regarding spheres of influence and mutually assured destruction. These rules in turn channeled agents of the superpowers to act in generally predictable ways. Paul Chilton (1996) similarly takes up the theme of language, in examining the role of metaphors such as "containment," "common house," and "architecture" deployed to construct the Cold War and post-Cold War security discourses in Europe.

Drawing on Wittgenstein, Karin Fierke (1998) focuses on understanding how changes in East-West security relations became possible over two decades, from the Helsinki Final Act to the signing of the NATO-Russia Founding Act in May 1997. She provides attention to the underlying

political circumstances and language use under which a different range of actions, many of which were originally considered unrealistic, could be possible. Fierke's findings are particularly insightful in fleshing out some of the strategic tactics through which language can be used successfully by resistance movements. She weaves together the role that social and emancipatory groups such as Charter 77 in the East and the peace movement in the West had in denaturalizing, critiquing, and besting the dominant realist discourse based on two distinct family structures with threatening neighbors. Fierke finds that success of the social movements was aided through immanent critique, by their ability to point out contradictions in the morality of the deterrence game of the superpowers that was meant to provide security, but that actually arguably heightened insecurity.

In demonstrating the important role of social movements in critiquing dominant discourses, constructivists show that language use matters, that in fact language is not cheap. We see that language use and intersubjective rules entangle actors within webs of structured meanings and behavior, as contradictions can be used for the mobilization of opposition movements that aim to break down existing structures. Frank Schimmelfennig (2001), in interrogating the example of EU enlargement to Central and Eastern Europe (CEE), for example, highlights the role of language in entrapping the EU into accepting the eastward expansion of the EU based on their previous communicated commitments and promises. In this instance, the CEE used language to put a spotlight on the contradictions of the EU's rhetoric and its policy action, thereby placing pressure on the EU to admit the countries into the EU. These cases, in fact, illustrate the power of rules, but also the possibility for rules to always be reconstructed anew.

The Discourse Coalition Framework has been a particularly prominent constructivist approach to analyzing public policy. In discourse coalition approaches, actors are presumed to develop story lines that frame problems and issues in particular ways (Hajer 1993). Ordinarily, the story line of one actor does not sit alone but rather shares affinities with other story lines in conceptualizing problems and issues. The concept of a discourse coalition is the embodiment of these affinities. Like a cast and storyline in a theatrical play, a discourse coalition is comprised of an ensemble of a set of story lines, the actors that perform these story lines, and the practices that conform to these story lines. Through processes of argument between different discourse coalitions about problems, certain discourses or shared understandings become dominant and institutionalized when they

achieve resonance within particular settings relevant for policymaking. The discourse coalition framework has been effectively employed to illustrate the various discourses that operate at different levels within any policy debate and the quandaries that political groups encounter in terms of deciding which level to operate on. The framework also highlights the stable nature of many discourses, which while pliable, can be difficult to destabilize.

Maarten Hajer (1993), for example, illustrates the ways in which British action against acid rain, including specifically SO₂ emissions, was subject to an argumentative debate in which different eco-minded actors were forced to make decisions about how to construct the issue, whether a one-time problem requiring a one-time solution or a broader symptom of industrialization that necessitated a shift to an alternative ethos of sustainable development and ecological modernization. In this case, Hajer notes that the competing storylines all took place within the prevailing pragmatist discourse on environmental issues, which implied that each environmental issue should be treated independently with a single solution, as opposed to sweeping change to industrialization. Ultimately, he finds that a coalition of environmental, scientific, and expert groups framed the issue as a problem that inflicted harm on British architecture and iconic wildlife. Despite their inherent preferences, he argues that this was done strategically on the part of the ecomodernist discourse coalition in order to persuade reluctant elements of society, including the Royal Commission, that there would only be minimal costs to address a specific problem and that they were speaking from the standpoint of science rather than radical change. Nevertheless, Hajer stresses that discourses, while strongly institutionalized, remain open and therefore storylines of ecological modernization may still become institutionalized in later debates.

Beyond viewing language as an instrument or tool that can perform and articulate visions of the present and future, scholars have also engaged with language texts as historical artifacts that reproduce social structures and shape decisions. Discursive analytical approaches have unearthed the linkages between representations of historical identities – as articulated in webs of interlinked discourses – and contemporary policy. In these cases, “preexisting discourses and linguistic structures affect policy by shaping the range of possibilities” (Sterling-Folker and Badie 2011, 108). In an examination of Western intervention in the Bosnian War, Lene Hansen (2006), for example, presents a narrative that connects available discourse, knowledgeable practices about the Bosnian people, and possible courses of Western action. She highlights the competing discourses

centered around genocide, historical feuds, human rights, and Western responsibility that shaped the evolution of Western perceptions of Bosnia and ultimately Western policy action. Similarly, it has been argued by Amy Skonieczny (2001) that trade policy between the US and Mexico has been guided by particular historically constructed myths regarding Mexico, identifying the country as both an “equal” and “inferior” partner. And US counterinsurgency policy in the Philippines was presumed plausible and preferable on account of identity constructions of the Philippines as an inept country (Doty 1993).

Throughout all these different approaches, constructivism has brought to light the role of historically constituted discourses, taken as shared understandings and rule/normative social structures, in delineating the range of options feasible in any situation. In this regard, through an examination of how these discourses come about through language and how they impinge on action in the field of practice, constructivism has contributed in providing rich description and constitutive explanations of particular phenomena.

1.3 Constructivism as constituted through symbolic interaction

In addition to a focus on language in fostering the development of shared understandings that structure action, some constructivists have specifically placed emphasis on the importance of performance and interaction in the process. This includes especially an examination of the ways in which different actors influence their interpretations of one another and consequently establish certain negotiated rules or understandings through their routine actions and practices.

The symbolic interactionist approach draws on the work of numerous sociologists, including particularly the work of George Mead and Herbert Blumer. Like the language-based approaches to constructivism, symbolic interactionism is human-centric, emerging at a time when the predominant perspectives in social psychology and sociology had for too long neglected a human-oriented account of life. The traditional social science perspective emphasized a stable-man view, which viewed humans as possessing a permanent nature that is either inborn or learned (Warriner 1970). The major works of psychology attributed human behavior to social settings that triggered particular behaviors or individual attitudes and identities that inclined people to behave in specific ways. In this equation, humans seemed like pinballs, bouncing around without any ability to change their fates. These accounts, nevertheless, seemed incongruent with our history. It almost

seemed like everyone had forgotten that the industrial revolution and all the advances that came with it could not have been possible without individuals taking an active role in shaping society. Mead and his later followers, therefore, sought to reverse this direction in scholarship, and to do so, they drew on science, philosophy, and sociological empirics to construct a radically different type of framework that would finally capture the role of human minds in determining their own courses of action.

Symbolic interactionists consequently see individuals not as passive, destined animals, but rather as active and dynamic participants who engage with their social environments. They emphasize human uniqueness, which resides in our capacity “to see things not as they are but as they have been or might be in the future” and to communicate with others through symbols, including notably the tools of gestures and language (Warriner 1970, 9–10). Individuals have the ability to think, define their immediate situations, and use language to communicate with other humans. Their minds are reflective, creative, responsible, self-conscious, and critical (Morris 1967). On account of these capacities and the social relatedness of humans, individuals influence each other through communication and interaction. This capacity to influence, in turn, constitutes individuals as unique organisms who can construct and reconstruct society, identities, and histories through social interactive processes. Humans, in other words, possess an “I” character that makes a morally better world possible (Mead 1967).

From a theoretical and empirical point of view, symbolic interactionists “give an account of the impact of meaningful interactions in the construction of society” (Balzacq 2002, 487). Symbolic interactionists examine various mutually constitutive processes that involve reciprocal interaction between different actors and examine the ways in which these exchanges constitute identities and social structures (Maines 1977; Strauss 1978; Farberman 1979). They capture, for example, the role of the “give and take” in many situations in life from the swimming pool to a workplace organization (Scott 2009). In these social settings, actors – known as alter and ego - constantly adapt to and modify social structures (Fine 1984). The rules and norms that constitute a particular setting are seen as open to negotiation, including stretching or fudging, between the relevant concerned actors (R. Day and Day 1977).

Scholars analyze interactions in a variety of different ways, with one of the central frameworks being the dramaturgical analysis perspective developed by Erving Goffman who drew on the terms of the theater to present a dramaturgical understanding of life. Goffman (1959, 32) defines a performance as an “activity of an individual which occurs during a period marked by his continuous presence before a particular set of observers and which has some influence on the observers”. Within any social interaction, Goffman conceives that there is a dynamic in which characters perform presentations of self before audiences, thereby conveying certain impressions upon their audiences and redefining social situations, a process that Goffman calls “impression management”.

If an individual wishes to direct the activity of others, regardless of their power position, Goffman (1959, 204) tells us, then they must take into account that “power of any kind must be clothed in effective means of displaying it, and will have different effects depending upon how it is dramatized.” Control, in other words, is achieved through the defining of the situation in such ways that others act in accordance with the performers’ goals. In one of his many illustrations of this theatrical dimension, on the Shetland Islands, Goffman observes that restaurant managers carefully manage the impression that they convey to customers by ensuring that the unsanitary practices of the backstage kitchen area are concealed away from public view, while seemingly sanitary practices are performed in the public “front”.

Contemporary dramaturgical work in the symbolic interactionist tradition has proceeded with a common core emphasis on the reconstructive potential of performance, underpinned by the notion that society, through ongoing social interaction, is always in the process of becoming something different (Perinbanayagam 1982). Among the canonical texts of constructivism in international relations, symbolic interactionism features most importantly in the work of Alexander Wendt (1992), who explicitly draws on the structuration theory of Anthony Giddens and the symbolic interactionist framework of George Mead. The approach taken by Wendt shows a fondness on such notions as identity and interest formation, role, and social structure that supplement the traditional symbolic interactionist toolkit encompassing such concepts as the defining of situations, interpretation, negotiation, reciprocal interaction, and the looking-glass self. For Wendt, the international system presents a dualistic structure; it is both the outcome of symbolic interaction processes between states and the force that structures and constitutes the specific actions of states.

In Wendt's framework, social structure takes the form of relatively stable institutions such as the principle of "self-help" or "collective security" that define the condition of anarchy for states. It is also reflected in the role identity and interest positions of states and in the relationships of amity and enmity that develop between states. Rather than just focusing on the ordering effects of rules and norms though, Wendt also gives attention to the mechanisms and processes through which norms, rules, institutions, and social structures are constituted. He provides a window into understanding how a particular international system might develop to be friendly or coercive and how certain states might develop such a role identity as "isolationist," but later see it changed to "alliance leader."

The central idea to Wendt's approach is that identities, interests, and social order are negotiated through social interaction on an ongoing basis. States are always engaged in reciprocal interactions with other states, with these interactions influencing the impressions that each state forms of its "conversational" partner. In a diplomatic exchange, one state – called "alter" by Wendt - first signals certain pertinent information about their intentions and goals to the other state. In turn, the other state – named "ego" - responds taking into account the performance of alter. Alter will then respond based on its new interpretation of the situation and so on, with each state influencing the behavior and response of the other. Wendt makes the pertinent conclusion that these interactions allow for the emergence of stable institutions such as self-help, if the interactions proceed poorly, and friendship, in more successful cases, after a period of continued exchange.

When examining the Cold War through a symbolic interactionist lenses, Wendt treats the acrimonious relations that seemed to dominate not as a permanent natural condition, but rather a temporary state that could be denaturalized and transformed. These poor relations were formed through competitive social interactions, which would need to be transformed in order for more productive relations to develop. The Soviet Union – wanting to be seen as a "New Thinking" state under Gorbachev – therefore needed to turn to stage management and self-presentation tactics to convince the West that it was no longer constituted by its old antagonistic identity. It successfully enacted this performance by withdrawing from Afghanistan and Eastern Europe, imposing asymmetrical cuts in its armed forces, and other confidence-building measures. The United States would respond, in kind, and it became possible for accomplishments such as START 1 and the re-emergence of Russia and other former countries of the Soviet Union in the international

community. In this case, through active intervention and symbolic acts, the Soviet Union and the United States demolished a competitive international security system and built a new one in its place resting on a more cooperative foundation.

Other empirical studies have demonstrated the role of face-to-face interaction in interstate diplomatic matters in constructing images of self and consequently manipulating counter responses, which otherwise might have been different. Michio Kitahara (1986) applies Goffman's dramaturgy to the case of the Perry Expedition to Japan in 1853 and 1854, which was intended to open up trade between the United States and Japan after three centuries of Japanese isolation, and finds compelling evidence that self-presentation mattered throughout the episode. Despite encountering stiff initial resistance from Japanese officials, the American Commodore Perry was able to successfully manipulate the Japanese to support a trade agreement with the United States by presenting and successfully conveying an impression of the United States as a powerful country. This was done, for example, through the careful management of appearance and "personal front", as witnessed by the American display of military force, the incessant refusal of Commodore Perry to meet with Japanese officials of lower rank, the presentation of documents to the Japanese in specially-designed rosewood boxes with gold mountings, and the continued threatening demands of Perry for the right to engage in negotiations at the port of Uraga, which was located near the important city of Edo.

Schimmelfennig (2002) argues that the dramaturgical framework of Goffman functions particularly well in understanding politics in environments with high interaction density and where there are community ethos. In the context of the debate over the CEE accession into the EU, he points out that the CEE countries could "engage in strategic presentations of self and framing on the basis of the community values and norms" of the EU (Schimmelfennig 2002, 428). They highlighted their long periods of European belonging and resistance during the Cold War. And they also emphasized the democratic aspects of EU membership, while seeking to down-frame the elements related to economic performance and military capabilities. Through this analysis, Schimmelfennig shows that the accession was indeed relational, with the performances of the CEE, for example, being constituted by the identities of the European community, but also the interests of member states such as France being redefined in the process as other European countries moved toward acceptance of enlargement.

In addition to contributing to our understanding of how self-performance matters in the construction of everyday life, symbolic interactionist research has further enhanced its explanatory power in providing tools that enable the researcher to make sense of how particular institutional settings impact the success or failure of these performances. Interrogating the discursive response of the Amsterdam government during the Van Gogh assassination crisis, Hajer and Uitermark (2008), for example, provide deference to the influence of different institutional settings such as talk shows, mosques, city council addresses, press conferences, and improvised mass meetings on the reception of symbolic acts. Specific actors – Mayor Cohen, Alderman Aboutaleb, right-wing MPs, and fringes of the Dutch cultural elite - were presumed to be involved in symbolic struggles to capture the meaning of the assassination and impose their view of reality onto others. Authority over the public response was not only dependent on what was said but also on who said it, how, and in what particular context.

1.4 Constructivism and its added value: intelligibility gained and/or lost?

Overall, in an IR field that previously expected states to act rationally based on their self-interest either within an anarchical international system or an international order based on some limited institutionalization, constructivist research has denaturalized the existing order and empowered humans, opening up space for emancipatory politics. Constructivist research has put much needed attention toward the idea of society and its role in shaping the political order in which we live. The securitization framework, for example, has been lauded for “capturing the importance of discursive interventions in positioning issues as security threats” and consequently moving beyond staid understandings of security that presumed people as helpless (McDonald 2008). And the language games framework has highlighted how dissenting voices in society can speak and be constitutive actors in the process of change, illuminating the non-dominance of dominant meanings and the role of marginalized voices in society. This in turn has broken down realist views of a necessarily static world shaped by material power.

The power of constructivism is not only in emphasizing the significance of human-meaning construction, including through physical action, language, and symbols, but also in providing a toolbox for analyzing the contexts and institutional settings that shape the outcomes of any public interaction. This is especially crucial in light of an understanding that discourses can become

deeply entrenched in particular societies and consequently difficult to unhinge. Given limitations centered around understanding the conditions under which speech acts or frames succeed, symbolic interactionism has itself been effectively bridged with language-constitutive constructivism to specify the mechanisms and processes through which language is rendered meaningful (Salter 2008). In particular, we can see how different *situations* empower different types of actors to speak and inform what can be said with influence. Despite active intervention, certain speech maneuvers will fail. The symbolic act of the performer and the response from the audience, of course, both reciprocally impact the course of an interaction, but so too does the specific circumstances and settings of the interactions.

The broader implication for international relations is that practices cannot be understood unless looked at within the contextual prism of the subjects of study engaging in interaction, that while actors in one context might view security as a zero-sum game gained through deterrence, in another context security might be viewed as a positive sum game under which there is a process of cooperation and dialogue. While often not intending to provide universal explanations (the “why” question) for particular political outcomes, various case studies have spotlighted how discursive structures can be instrumental in delineating the range of possible options in any situation (the “how possible” question) (Doty 1993). Through our study of discourse, we can make sense of how certain actions became possible in the first place such as actions to combat climate change in the EU or US counterinsurgency policy in the Philippines (Van Schaik and Schunz 2012; Doty 1993).

While adding this intelligibility to our understanding of politics through an emphasis on the social dynamics of world making, there has also been a growing recognition of the need to go beyond frameworks that examine language and performance as constituting social action. Ringmar (2016) criticizes constructivism specifically for what he perceives as a general view of meanings as simply being socially constructed “all the way down”. Drawing on cognitive theorists, Ringmar (2016, 111) notes that “the world is made meaningful not as a result of explicit interpretations but through our direct bodily experiences of it”. Ringmar’s (1996) earlier examination of Sweden’s intervention in the Thirty Years War is emblematic of such an embodied approach. He attributes Swedish intervention to the country’s self-conceptualization of its own European identity, rooted in its sense of historical belonging in the European political system under the Holy Roman Empire.

Other scholars, meanwhile, drawing on Bourdieu's sociological concepts, have similarly drawn attention to "habitus" or "the system of enduring behaviors and discourses of the agents that populate a given field" (Balzacq, Léonard, and Ruzicka 2016, 505). This field is understood to represent the social and economic relations between different actors and the shared understandings of meanings of problems and rules. Consequently, our routines and practices are shaped by the very world experiences we encounter. Focusing on the role of history and social context in constituting discourse and practice, Iver Neumann and Vincent Pouliot (2011, 106), for example, trace Russia's repeated clumsy and quixotic diplomatic practices back to "deep-rooted, historically-inherited dispositions" centered around Russia's quest for equal status in the international community. Didier Bigo (2002), meanwhile, examining securitization, emphasizes that in addition to language, it is also constituted by administrative practices such as population profiling and risk assessment. Bigo (2002, 66) conceives of security professionals who act based on habitus with an "ethos of secrecy and concern for the management of fear or unease". It is not only language and performances that constitute power then, but also the routines of "insecurity professionals" who circulate particular dispositions (Bigo 2002).

A more central focus of this dissertation, meanwhile, is the critique that constructivism has overlooked the role of materiality in the constituting of phenomena, that constructivism has neglected the material instruments and processes that are argued to underpin particular meaning construction processes. While only the most radical constructivists would take the view that everything is defined by discourse, constructivist approaches have still tended to underappreciate the ways in which material and technical relations have escaped human inscription and exercised agential power. Diana Coole (2010, 92) has criticized constructivism for the view that matter is "essentially passive stuff, set in motion by human agents who use it as a means of survival, modify it as a vehicle of aesthetic expression, and impose subjective meanings upon it". As Karen Barad (2007, 132) emphasizes, "The linguistic turn, the semiotic turn, the interpretative turn, the cultural turn: it seems that at every turn lately every "thing" - even materiality - is turned into a matter of language or some other form of cultural representation." Diana Coole (2010, 92) further adds: "...is it not possible to imagine matter quite differently: as perhaps a lively materiality that is self-transformative and already saturated with the agentic capacities and existential significance that are typically located in a separate, ideal, and subjective realm?"

While some constructivists have noted that they simply focus on language on account of the fact that material centric accounts can be found elsewhere, this dissertation takes the view that the conceptualization of the ways in which the material and social are intertwined is crucial for understanding not only the limits of the social world, but also how the social comes to be channeled in specific situations. In overlooking the socio-material construction of discourses and practices, constructivists inadequately explain the emergence of the contexts that are, in turn, vital to what the perspective purports to contribute in understanding empirical phenomena. Furthermore, as a perspective focused on the “how-possible” question, constructivist approaches are limited in their capacity for understanding how particular normative or rule constructions come to be channeled and matter or not in specific situations. If particular technical characteristics of entities enable certain actions to be possible but not others in specific situations, then this too needs to be accounted for in understanding how policy or societal discourses are constructed and within these discourses how specific actions are constituted. While discursive practices such as the EU precautionary principle, for example, have arguably constituted EU action on climate change, this principle itself could be examined in terms of the material-laden controversies (e.g. mad cow crisis) that have co-constituted its possibility and further with respect to how specific technologies (e.g. solar power) confer meaning on it by enabling/constraining particular solutions (Van Schaik and Schunz 2012).

In this vein, practice-based approaches have shown that the material world can impart certain dispositions on actors, pre-figuring and emerging alongside language use in the construction of particular phenomena. In the field of security, Jef Huysmans (2006, 8) specifically points out that the “development and implementation of technological artefacts and knowledge, such as diagrams, computer networks, scientific data...often precede and pre-structure political framing in significant ways.” As an illustration, Huysmans argues that technological practices involved in the securitization of migration are intertwined with language constructions, with language and practice mutually constituting one another. Guittet and Jeandesboz (2010, 232), meanwhile, argue that there is an interrelated process between political framing and technology, with practices playing “an important role in the framing, developing and promoting of technological systems”, while at the same time “technology frames, shapes and channels security practices”. Guittet and Jeandesboz (2010, 237) further draw attention to the ways in which “security technologies contribute to shape relentless expectations regarding a future always thought of as catastrophic”.

Mimi Sheller (2014) elucidates some of these processes in exploring the role of aluminum in the shaping of modernity, putting a spotlight on its constituting of modern infrastructure, technology, and everyday applications and practices, but also the ethical quandaries that have emerged from coping with resistant entities. Aluminum has generally been readily compliant in its industrial and technological uses, especially compared to other metals, owing to its light weight, malleability, and versatility. With a natural oxide layer, it has also not been prone to rust and corrosion, rendering it more durable than other metals. On the other hand, as Sheller points out, the recalcitrance of the bauxite ore, extracted through an open pit process, necessary for its production has brought to bear the often unacknowledged ecological consequences, including polluted waterways and damaged forests, and destruction of the way of life of indigenous peoples which must be endured if this access is to be maintained. These processes are revealing of the fact that while the application of aluminum is embedded within particular visions and imaginaries of the future and various practices of political economy, including warfare, development, nation-building, and industrial revolution, the very material qualities of aluminum have also fundamentally shaped the development of and channeled these practices. An accounting of numerous phenomena, including the very shape of nations, market structures, and banal everyday routines, is crucially tied in with the ways in which aluminum – also as nondiscursive matter - makes a difference in these settings.

Timothy Mitchell (2011), meanwhile, traces the evolution of democracy through the socio-technical worlds of carbon, highlighting the ways in which political agency became tied up with different material and technical networks of carbon energy production. As one illustration, while coal through its materiality is argued to have empowered worker claims through its dependence on a large concentrated workforce for extraction, the very different carbon nature of oil, including the smaller workforce and grid-like structure engendered through its extraction and flow, is argued to have instead enabled companies to better exert political agency and simultaneously hinder protests. The practice of democracy, in other words, has been constituted by the material flow of energy and technical details of its extraction rather than simply shared understandings and contestation processes.

Andrew Barry (2013a), similarly by way of the phenomenon of the Baku– Tbilisi–Ceyhan oil pipeline, highlights the ways in which the pipeline can be seen as not only socially constructed by

international actors, but also as itself fundamentally shaping the interactions between policymakers outside the realm of any pre-defined discourse. Following the failure of previously used coating material on the pipelines, the British House of Commons surprisingly came to deliberate not the possibility of civil war or Britain-Georgia relations, but rather the type of synthetic material that joined the pieces of pipe together (A. Barry 2013a). A purely language accounting of the pipeline issue would have missed out on the ways in which the story was indeed about more than policy and issue framing, but also the material objects that interacted with particular political practices in mediating the types of discussions that took place in the first place. In examining the securitization of critical infrastructure, Claudia Aradau (2010) similarly highlights the limitations of approaches focused solely on securitization through speech acts (e.g. the Copenhagen School approach), instead underlining the added value in engaging with the materiality of infrastructure itself (e.g. the plausibility that it might corrode or leak) and its entanglements with societal discourses and practices related to building design, civil engineering, emergency planning, and neo-liberal economic development. It is from this perspective that it becomes sensible how certain types of infrastructure (e.g. nuclear power stations) become deemed as critical while others (e.g. toilets) don't.

A parallel argument could be made with respect to Hajer's narrative on acid rain, where there was space for a more socio-material story about the discursive contestation over the SO₂ problem in the UK in the 1990s. Rather than simply being "best understood in the context of a struggle for hegemony between two competing discourse coalitions" (Hajer 1993, 53–54), the debate was arguably also shaped in significant ways by the scientific nature of SO₂, including the tendency for SO₂ emissions to drift from one country to another in the form of toxic acid rain that constituted a threat to wildlife and forests and the availability of FGD scrubbers that could solve the problem with a one-time remedy. In this regard, SO₂ functioned as a mediating node, putting political actors like Britain and Sweden unintentionally into contact with one another in the debate and channeling the process to take place as a policy discussion within the overarching pragmatist discourse rather than as a broader debate between competing pragmatist and ecomodernist discourses. Hajer routinely hints at material agency, pointing, for example, to the invisible nature of SO₂ as a contaminant, an insight that could lead to a narrative about the socio-material constituting of symbolic performances between material entities and entangled societies and the implications of these processes in the (non-)constituting of the generation of public interest. Such notions as the

material characteristics of SO₂ though are buried in the political analysis. Instead of being about “technical facts”, it becomes a story about discursive politics and framing that conceals the socio-material constituting of action in the case (Hajer 1993).

These limitations of constructivism are further explored in concrete terms empirically through the case study of the politics of genetically modified organisms in the European Union in Chapters five and six. Specifically, while that case has generally been explored through the framings employed by environmental and consumer groups on environmental protection and the threat of neo-liberal globalization, my case analysis reveals that these processes were, in fact, pre-figured by technologies and material processes of biology that constituted the types of crop varieties – and the corporate institutions behind them - that comprised the agential landscape of the debate. Moreover, while agricultural identities and strategic framing are shown to constitute the mobilization of particular key actors (e.g. farmers), these identities and language are highlighted as being conferred meaning within the specific context of the material artifacts and mundane everyday practices of local sites.

Overall, what these different cases showcase is that while discourses – and the language use and performances that in part constitute them - matter, they must be situated within the broader material contexts that too sustain and channel them in particular directions. To better understand the possibilities of language use and interaction, there needs, in other words, to be theorization and empirical examination of the ways in which language gains particular meanings in specific material contexts. In a world recognized as increasingly complex and in which issues are ever more intersecting with science, technology, and other material processes in significant ways, these processes also need to be accounted for in our explanations of politics. Failure to do so will come at the cost of understanding both the conditions and contexts under which certain frames and ideas emerge and the ways in which these frames either succeed or fail in attaining deeper resonance. This, in turn, means that rather than highlighting possibilities for human agency, we obscure the ways in which humans, in fact, enact agency through social action.

Conclusion

The contributions of social constructivism should be incorporated into empirical analysis of politics. Constructivism has transformed our understanding of the world, from one that was once

perceived as self-evident and transcendental into one that has been deemed as malleable and contingent. Rather than living in a permanent state of affairs, constructivism has demonstrated that humans are capable of overcoming relationships of enmity and replacing them with those of amity. Powerful objects like weapons of mass destruction can be managed through international conventions and rendered non-threats when held by particular countries constituted as friendly. And it is possible to establish security communities that reinforce certain expectations and habits of peace and negotiation. These normative processes are guided through our shared understanding of language and the interactions humans experience with one another. These interactions also shape who we are, which in turn shapes the range of actions that are possible for us in any situation. Constructivist research approaches have improved explanation in international relations, helping us understand, for example, how EU integration and expansion was possible at the end of the Cold War. With a focus on the how-possible question, constructivism has shown that an accounting of rules, norms, and identities, which are in turn formulated through our prior interactions and language use, can help analysts see how certain actions like the Western response to the conflict in Bosnia become possible.

This chapter has also suggested though that now that constructivism has shown us the power of language and performance, it is time to recognize that this emphasis can also be a major limitation. Even though constructivism was launched as a project focused on elevating human agency into our accounts of politics, there is no reason not to make sense of the ways that both humans imprint meaning on the material world and the material world intervenes to shape and constitute these very meanings. In taking note of the power of discourse, there is a need to broaden our understanding of the articulation of the concept to better analytically reflect that it is constituted not only by the storylines performed by human beings, but also material processes that mediate relationships and perform their own storylines in issue debates. Moreover, there is a need to recognize that language use gains particular meanings and comes to matter in the socio-material contexts in which it is embedded. Through a focus on matter then, analytically, we can better understand the limits and possibilities of human agency in reconstructing the world.

With this understanding of the materialist shortcomings of constructivism, the next chapter endeavors to examine some of the approaches, broadly incorporated into the “materialist turn” label, which have, in fact, begun to conceptually and analytically interrogate the articulation of

material agency in world politics. Similarly to this chapter, the aim is to highlight the ways they both provide and withhold intelligibility in explanations of politics, particularly in light of the contributions of constructivism in putting a spotlight on discourse on constituting phenomena. Such an academic move, in turn, engenders possibilities for constructive synthesis between the two research traditions, an opening that I pursue in developing a syncretic socio-material approach to understanding the construction of politics in chapter three.

CHAPTER 2. THE MATERIALIST TURN: THE UNCOVERING OF NOVEL SITES OF POWER BUT CAN WE EVER LET CONSTRUCTIVISM LOOSE?

In recent years, scholars have increasingly spoken of a “materialist” turn in research centered on scholarship that elevates the “often-ignored ways” that “seemingly passive and inert objects act upon us and shape our subjectivities and actions” (Baiocchi, Graizbord, and Rodríguez-Muñiz 2013, 328). This rearticulation of materiality has come at a time when scholars have noted an under-recognition of matter in the analysis of political and social life, including even in cases when matter is the subject of study. Jane Bennett (2010, 43), for example, examining the lively materiality of food, notes that most research in the social sciences and humanities explores food through its social construction (e.g. the “aesthetic-commercial techniques through which desire for a new food product is induced”). It is only in the natural sciences that there is recognition of the active power of food in its congregation with other materialities in the human body (Bennett 2010). Claudia Aradau (2010), similarly, in interrogating critical infrastructure such as that found in the computer, transport, and energy sectors, has pointed out that most scholars approach the topic of infrastructure from a managerial perspective in which humans protect pre-existing infrastructure or from the vantage point of discourses that construct and shape the type of infrastructures that are possible and the practices which they enact. What is missing is an examination of how the very materiality of infrastructure constitutes processes of securitization. Feminist criticism, meanwhile, is particularly targeted toward pervasive treatment of the body as abiological, as simply matter that is represented as “a mere blank state upon which discourse writes its stories, and biology itself has no agential force or dynamism” (Tillman 2015, 31).

Despite the urge to put the spotlight back on materiality though, albeit in notably different ways than the conventional historical materialism focus on the economic force of materiality, scholars must not forget the contributions of constructivism, including especially the recognition of social performance as being important for the putting together of societies and the role of discourse in shaping action. If the new materialist turn is going to provide added value in understanding the emergence of particular practices, rather than simply showing that material things matter and conceptualizing the ways in which they constitute particular processes, these approaches should also add intelligibility in terms of understanding how material entities are agentialized within a context in which discourse also matters. As is true that not everything is constituted by purely

social discourses, the same is the case with processes of materialization. There is a need to better understand how discourses come to constitute the meaning of matter, but also the situations under which material things come to shape the types of practices that are possible.

In this light, this chapter consequently seeks to critically examine the various contributions made toward conceptualizing materiality in the analysis of politics. Borrowing Can Mutlu's (2013) typology on the materialist turn, the chapter divides the approaches into two separate research traditions. The first – Actor-Network Theory – comes from the field of Science, Technology, and Society studies and emphasizes the relational nature of practices (i.e. practices as network effects), viewing objects as nodes within bigger assemblies that come together to make certain actions (im)possible. The chapter highlights the ways in which ANT has drawn attention to human/non-human assemblages involved in constituting particular issue outcomes, but also its limitations in terms of incorporating history, identity, and discourse within narratives and in adequately recognizing the differential capacities of human and non-human agency. The second tradition – more specifically referred to as “new materialism” - rests on more of a philosophical approach. Drawing on physics and biology, scholars working in this tradition have articulated some of the ways in which non-humans have enacted agency, illuminating the self-transformative and chaotic nature of objects and material processes. While providing additional tools to analyze the agency of non-humans, these approaches too fall short in terms of incorporating practices and discourses into their accounts of politics.

In consort with the previous chapter taking stock of constructivism, this literature review serves a function in contextualizing the conceptualization of my own syncretic framework – socio-material constructivism – laid out in the chapter to follow. The critiques articulated in this chapter, drawing especially on scholarship from Karen Barad (2007) and Erika Cudworth and Steve Hobden (2013), are channeled into this work.

2.1 Actor-network theory: illuminating distributed agency and power through networks

One of the central approaches to the conceptualization of material agency emerged in the 1980s in the work of the science, technology, and society studies (STS) community from Bruno Latour (2005), Michel Callon (1986), and John Law (1999). Those employing the Actor Network Theory

perspective have held that the generation of knowledge is much more complicated than usually presented, constituted not only by the technical elements of the natural world, but also by the interplay of these technical elements with the social world. For ANT scholars, the trajectory of science is always taking place in fits and starts, through the relations between the natural and social worlds. Science and technology are thus seen as “loci of strategic action in which existing scientific cum social relations are worked upon in order to produce, in one and the same movement, both new knowledge and novel social relations” (Callon, Law, and Rip 1986, 8).

While ANT has increasingly diverged into different strands, the core early ANT approach can be expressed through three central interconnected tenets. The first is that entities such as devices, machines, organizations, and agents are produced through the heterogeneous relations between their component materials. Drawing on semiotics, ANT presumes that “entities take their form and acquire their attributes as a result of their relations with other entities” (Law 1999, 3). One example to demonstrate this point is the case of a car, which only becomes a “car” when all its parts are assembled and linked with one another. If the engine or steering system is removed though, if the car is even slightly disassembled, the car becomes something different. In this regard, ANT puts a spotlight on the distributed nature of agency and power, including how various projects and ideas are the hybrid product of multiple entities involving people, machines, texts, organizations, and other nonhuman entities.

Second, ANT advances the position of “general symmetry,” the stipulation that we should not shift registers “when we move from the technical to the social aspects of the problem studied” and that there should be no *a priori* ontological distinctions made between humans and nonhumans (Callon 1986, 200). Following from these principles, ANT has asserted that material objects can practice forms of non-human agency and consequently are as central as humans to the generation of social facts. The term for these agents are *actants*, which originated in the work of Algirdas Greimas and has been employed to emphasize the notion that both human and non-human actors are integral to life. An actant has been described as a more abstract form of an actor and is not necessarily constituted by intentional action. Like actors though, they are elements that can modify a situation and make a difference, even without the ability to willfully act (Kärholm 2012). As Latour (2002, 252) argues, “Technologies bombard human beings with a ceaseless offer of previously unheard

of positions—engagements, suggestions, allowances, interdictions, habits, positions, alienations, prescriptions, calculations, memories.”

Finally, addressing the means by which “a diffuse and complex system, comprised of humans and nonhumans” develops into an actor-network, the third central premise of actor-network theory posits that networks never exist *a priori* or develop spontaneously, but rather always emerge through processes of assembly and reassembly in which component parts are put together (Alcadipani and Hassard 2010, 425). ANT describes political/social processes in which “heterogeneous elements are woven together and assembled into reality” (Young, Borland, and Coghill 2010, 1209). Thus rather than existing in the order of things, entities are viewed as effects that are generated in multiple interactions (Latour 1988, 2005; Law and Hassard 1999). As stated by Latour (2005, 208), “The whole is not an undisputed starting point but the provisional achievement of a composite assemblage.” A corollary of this point is that entities in a network never remain the same, but instead always emerge and reemerge over space and time (Latour 1999; Law 1999; Brown and Capdevila 1999). Thus while scientists in a biological laboratory generate academic articles through the assembly of their theories, lab machines, money, research subjects, and lab notes and data, their conclusions are always subject to later reevaluation and replacement (Latour and Woolgar 1979).

Empirically and theoretically, the conceptual apparatus of ANT has contributed to generating a rich variety of research in a diversity of fields, highlighting the ways in which humans and non-humans come together in the assembly of practices. In Latour’s (1988) account of pasteurization in France, for example, he argues that it is too simplistic to restate the typical story that Pasteur was a hero who discovered the anthrax vaccine. As he demonstrates, the anthrax vaccine was rather a heterogeneous product of both human and non-human forces, including microbes, cattle, laboratories, and journalists. He shows that microbes, in particular, were powerful actants who not only acted upon Louis Pasteur, but also shaped farming, medical, economic, and social practices.

Michel Callon (1986), meanwhile, seeking to understand how particular networks are (not) assembled, highlights how scientists, fishermen, and scallops engaged in similar forms of resistance and production in a conservation project in St. Brieuc Bay in France. In Callon’s story, in the context of a rapidly declining scallop population that had borne the brunt of over-trawling

by fishermen, scientists were compelled to act to replenish the scallop stocks through an experimental technological solution that had worked previously in Japan. The scientists were the representatives or spokesmen who enacted the network into circulation, the translating agents who defined the declining scallop stock as a problem, proposed a technical solution that involved anchoring larvae to the ocean floor, generated interest among fishermen for the project, enrolled the scallops and fishermen into their research project, and attempted to mobilize them in support of their research project. While initially this enrollment initiative proved successful, as demonstrated by the successful anchorage of larvae-stage scallops to the ocean floor, this was later followed by dissidence when the fishermen could not resist the allure of collecting the newly hatched scallops. The network was thus a feasible construction, but also precarious in its foundation. The researchers were able to problematize the scallop stocks and enact interventions with technological innovations, but without cooperation of the fishermen and scallops, these interventions proved unsuccessful. Callon thus highlights the distributed power within the network; with one act of resistance, the web of carefully ordered relations suddenly unraveled.

It has been noted that ANT scholars are particularly effective at denaturalizing binaries and the categorical separations that define the flaws of modernity (Jasanoff 2015). ANT research highlights alternative causal pathways and uncovers power and agency where previous assumptions dictated that investigations were unnecessary. An exemplary case of this is Timothy Mitchell's (2002) examination of Egypt's political modernization and period of nation-building in which rather than solely focusing on humans, he attributes the process to a distributed actor-network comprised of both a British military invasion from the north and a malarial mosquito infestation arising from the south.

While one of ANT's strength is its emphasis on problematizing traditional accounts of power and agency by illuminating the agency in things and the hybrid formations that are crucial to sustaining realities, this has also been a point of criticism. Sheila Jasanoff (2015, 16–17) argues that ANT is “too promiscuous in attributing cause and agency” and “risks a kind of moral nihilism, making all actions and agents seem equally empowered, or disempowered, and therefore equally responsible, or irresponsible, for the networks within which they function”. In other words, analytically, in highlighting how all things matter and the ways in which all entities are composites of other things, ANT provides interesting stories that nonetheless don't help us analytically decipher what

mattered most of all. As an illustration of this, Jasanoff (2015, 18) points to Latour's narrative on La Pérouse's cartographic mission for France, which she sees as failing to provide space for understanding the ways in which France obtained "the resources to draw things together or the force and violence often required to make representations circulate". Jasanoff (2015) also advances a normative critique of ANT, emphasizing that there is a risk in equating nonhumans and human agents, an argument that can closely be seen as entangled with the question of responsibility. For Jasanoff (2015, 17), "it is still humans and their collectives who can imagine a world...only humans can devise the strategies of disciplining and targeted eradication that may accomplish such wonders" as a world emptied of mosquitoes.

ANT scholars though have emphasized that the approach fills the void left by the nearly exclusive preoccupation with human agency in other sociological approaches. They also contend that while ANT is centered on the principle of *a priori* flatness, it doesn't assume that the world actually operates that way. John Law (1999) suggests that there is always asymmetry in control in networks, which emerges from the locations of different entities in a heterogeneous network. And as conceptualized by Latour (2005), ANT provides an approach in which researchers should pursue stories wherever the actors might lead them. As such, this doesn't necessarily require that the findings indicate flat power structures, and ANT, in fact, has produced rich empirical stories that at least implicitly highlight particular power structures. Law's (1986) research has been especially enlightening in illuminating particular "centers" and "peripheries" of networks, with an emphasis on the role of semiotic relations in generating these differences. Examining Portuguese imperialism, for example, Law notes that its generation of a network through the webbing together of ships, stores, guns, gifts, mariners, and many other elements allowed Portugal to control half the world. Lisbon consequently became an obligatory passage point for a whole set of tributaries. Furthermore, ANT scholars point to the fact that humans are not left underempowered in the ANT approach, but rather are illuminated through a relational lens. Law (2008), for example, argues that Latour's study of Pasteurization was a bottom-up analysis that understood Pasteur as a network effect rather than a shaping genius, as a product of multiple and decentered relations. Elsewhere it has been argued that rather than obscuring the human, ANT has rather shown a tendency to emphasize the role of Machiavellian-type strategies of control during translation, while at the same time obscuring the role of the less powerful (Eyal 2013). Eyal, for example, notes that Latour's conceptualization of network translation assumes a Machiavellian "fact-builder" who recruits

allies, persuades these actors to realign their interests with his, and then channels them toward particular goals. The fact-builder is “the rational strategic actor par excellence” (Eyal 2013, 166). This can be observed in Callon’s narrative on scallops in which the scientists perform this central role in aligning different entities toward the common goal of protecting scallops. It is also a common feature of Latour’s stories on translation, which usually involve a scientist or engineer as a fact-builder (Eyal 2013). For these reasons, ANT has been criticized as too managerialist, masculine, and even military-like, concealing marginalized existences (Star 1990).

Such different interpretations perhaps emerge from the fact that rather than being a single entity, ANT is better conceived as a multiplicity, an army knife that can be fitted with many different tools. Nevertheless, there is a point to be made that even while such distinctions between human and non-human agency have been made in particular case studies (or not), a key tenet – a common identity as it were – of the ANT approach is the notion of *a priori* symmetry between human and non-humans, limiting the ability of the approach to draw broader conclusions about how agency is performed by humans and various non-humans and how it comes to matter more generally across different cases.

Contesting ANT, Cudworth and Hobden (2015b) have rather argued that symmetry is never a feature of political and social practices, that instead phenomena are constituted in contexts of inequality. Complex systems comprised of the overlapping agencies of humans and non-humans, they argue, are necessarily hierarchical on account of the fact that species vary on some distinct features (Erika Cudworth and Hobden 2015b). While humans, for example, are capable of struggling over resources and making decisions regarding social organization, these capacities are rarely found in non-human entities. Cudworth and Hobden point, for example, to the precarious lives of non-human animals that are dependent on human beings for their survival and direction. More concretely, they examine the posthuman military, showing it not to be a hybrid assemblage of humans and non-humans, but rather one that reflects species hierarchy and social domination of humans over animals, “in which animals are lucky and most are exploited, often to further human ends that make light of all forms of life” (Erika Cudworth and Hobden 2015b, 517). They show that animals are capable of making a difference in these settings, enabling and constraining particular types of warfare, and further constituting the meaning of “success” through conveying

impressions of love upon their handlers, but that they are by no means capable of being equal in terms of performing transformative agency in such interactions.

Recognizing these differences *a priori* and in generalized terms matters because it makes a difference in terms of how we approach other cases and what we can say about the conclusions that we draw. If, for example, we recognize the *a priori* capacity for human use of language and their consequent ability to dominate socially over other animal species, then we can devise strategies for overcoming these systems of vulnerability. Moreover, through understanding of the ways that humans and animals make a difference, for example, in war in different cases and contexts, especially as beings-in-encounter, we can better explain and consequently prepare for these circumstances. In this regard, rather than outright rejecting the notion that phenomena are co-constituted by humans and non-humans and giving hierarchical preference to imagination and language, as Jasanoff might suggest, there is a need to better conceptualize the different mechanisms through which material entities perform agency and how these modes of action come together to constitute phenomena. While humans and non-humans may encompass different capacities of action, thereby making them unequal, the powerful non-linguistic ways in which non-humans do impart their effects should also be acknowledged. The differences that emerge nevertheless in situated relations must be accounted for if we wish to better explain phenomena and understand the contexts in which these modes of action can be agentialized.

A related critique of ANT focuses on the extent to which different ANT stories highlight the social dynamics, mechanisms, and contexts through which actor-networks come together. Notably, there is the tendency of ANT work to underspecify the politics of gaining consent within networks, particularly with regards to bracketing off history, situation, and social context (A. Barry 2013b). Problematically from a feminist perspective, while ANT engages with nonhuman forces, it fails to take into account “the productive working of geopolitics, economics and history”, particularly as it relates to performativity, referring to the mutually constituted meanings and agencies that emerge between entangled discursive-material practices in the field of practice rather than *a priori* (Aradau 2010, 497; Barad 2007). Agency, in other words, in ANT is mistakenly viewed as a property of things rather than the phenomena of systems or material-discursive practices in relations (Erika Cudworth and Hobden 2015a; Barad 2007). In his example of scallop farms, Callon, for example, says little about the political economy and social structures of St. Briec or

France that may have represented significant barriers on persuading the fishermen to chart a different course. In the narrative, they are simply fishermen largely bare of any identity or constraints beyond the need to earn a living. If we wish to understand how it happened that this enticement for a sudden scallop haul could not be overcome, how it was that translation failed, then we must provide additional theoretical specification on the social dynamics of the process, including how particular political economy practices and material entities such as scallops or fishermen mutually confer meaning on one another.

In this sense, distributive agency in ANT accounts tends to be attributed to the present moment, not to inherent social structures and identities developed historically. Even when there are certain semblances of discursive power within narratives, as in John Law's (1992) examination of the failed development of the Olympus 320 engine for the TSR.2 aircraft or David Young et al's (2010) cross-country case study of policy innovation for smoke-free places in California and Germany, it is usually attributed to audience (e.g. the political party in power), but there is little effort to trace the elasticities of identity and rules over time and the ways in which they intersect with other discursive practices. Not surprisingly then, Gil Eyal (2013), in exploring the commensurability of Bourdieu's field framework and Latour's concept of network, argues that ANT is particularly useful in understanding emerging phenomenon when social structure is lacking.

Eyal specifically focuses on spaces between different fields (e.g. economic, academic, artistic, military fields, etc...) as sites where habitus breaks down and instead new alliances are struck and actor-networks emerge that organize and relate information between various actants. An example of this is Lisa Stampnitzki's (2008) examination of terrorism expertise in the context of the 1970s terrorist attack at the Olympic Games in Munich. Within the emerging space for terrorism studies, various actors from the academic, journalist, and state fields joined in and began to carve out a space for an emerging industry. It was a space with few rules and where previously marginalized actors struggled over establishing particular norms, knowledge, and expertise and attaining the high stakes prizes available, including money, connections, and media coverage. A further case is Callon's (1998) investigation of "boundary work" in the context of economics. Rather than taking place within any particular one field such as the academic field where economists are found, the story of economics is presented as taking place in the boundary area between the economic,

bureaucratic, and academic fields. It is here that government and corporate economists relate particular objects and activities and identify them as calculable or incalculable parts of the economy. Importantly, this boundary zone is constituted not only by rhetoric, but also various sociotechnical mechanisms, economic instruments, and practices that open up spaces for inter-field politics.

While Eyal's research shows some promise for ANT to be employed in certain contexts in understanding politics, Andrew Barry (2013b) argues that this structure-agency problem must be addressed if ANT is to be employed effectively and more broadly in international relations research. Drawing on the scholarship of Emily Apter who coined the concept of "translation zone," Barry notes that all translations take place within complex and politicized spaces. For Barry, if we think through the literary dimension of translation, which entails some terms that are deemed untranslatable or resist translation, then we must come to terms with the fact that the "translation zone is a space where 'transmission failure is marked', not a space within which all translations are either easy or possible" (A. Barry 2013b, 416). While a scientific research project on a peptide might squeeze into the parameters of the translatable, the brokering of a peace treaty among warring parties may be too far a stretch under certain circumstances. There is always a difference in the conditions of success on any particular translation dependent on the respective issue, audiences involved, and time in which it is attempted.

Overall, ANT has demonstrated promise in opening up space for novel narratives on power and agency. On the other hand, its weakness rests in its tendency not to situate power and agency within historically constituted identities, histories, and norms and explore the relations between material entities and the discursive practices upon which they emerge alongside. There is also a further need to be more attentive toward conceptualizing the ways in which humans and non-humans distinctively enact agency, if we wish to understand how things can make a difference on their surroundings. These moves would add to the explanatory power of ANT narratives, particularly in terms of understanding how certain alliances are struck and phenomena emerge, and consequently provide better understanding regarding how human beings can intervene constructively in their environments. In the next section, I turn some of the parallel concerns that emerge with respect to new materialist traditions.

2.2 New materialism: the philosophical tradition of the materialist turn

Representing an alternative materialist tradition to ANT, a range of research has also emerged centered around the idea of a “new materialism” – also sometimes referred to as posthumanism or speculative realism (Coole and Frost 2010). Rather than a unified body of work, the emerging research tradition, in fact, itself encompasses an eclectic range of different perspectives. What they have in common though is that they have advocated for the elevation of materiality in social and political analysis to correspond to the primacy of matter in our lives and argued for a move away from the human-centered focus of research in the humanities and social sciences (Mutlu 2013; Erika Cudworth and Hobden 2015a). Taking stock of contemporary physics, new materialists explore the efficacy of material agency, including the material propensity for self-organization and self-transformation, in all different types of local and global systems (Connolly 2013; Coole and Frost 2010). Moreover, they examine the repercussions of this lively, dynamic, and vitalist matter on the organization of the world.

New materialist approaches have been particularly inspired by the scientific tenets of quantum theory, chaos theory, and complexity theory, which made it possible to make a break away from classical physics to think of materialities in a more dynamic and creative manner in our social theorizing (Connolly 2013; Coole and Frost 2010). Chaos theory, for example, suggests that the natural world encompasses many nonlinear and unpredictable dynamic systems, where we find that motion is characterized by fractals, bifurcations, intermittencies, and periodicities. For chaos theorists, things are in a process of becoming, rather than a state of being. Complexity theorists, meanwhile, emphasize the possibility that novel entangled systems may emerge from unpredictable events and the capacity for both organic and inorganic life to self-organize. For new materialists, these advances take us beyond mechanistic and stable understandings of the natural world and therefore our social understandings of the material world, which previously drew on these outdated Euclidian and Newtonian models, should be updated too. Seen through a post-Newtonian, post-humanist lens, the world is characterized by emergent, entangled, random, and complex patterns of organization. Matter is not dead, but active, lively, dynamic, agentic, transformative, and self-organizing. Thus, drawing on the process philosophy of Alfred North Whitehead, speculative new materialists conceive of a cosmology of creative becoming in which material objects not only participate in heterogeneous relations, but actually guide and control

them (Connolly 2013). Traditional conceptions of human primacy and unique agentic capacity are relaxed in favor of the materialist-dominant view that the world is composed of “emergent systems that move with a superficially chaotic randomness that is underlain by patterns of complex organization, which in turn function as foci for further organization and development” (Coole and Frost 2010, 14).

Drawing on this “new science,” new materialists lay out a number of speculations or key tenets. First, rather than being assumed passive and “dead,” non-humans and objects are conceptualized as much more creative, dynamic, and lifelike than typically conceived by constructivists and realists alike. Objects are seen as displaying self-organizing and self-transformative capacities, what William Connolly (2013, 399) refers to as a protean monism that replaces mind/body and self/world dualisms. Identifying a “materiality that materializes,” new materialists argue that matter has the capacity to form and reform itself in all types of novel ways (Coole and Frost 2010, 9). Notably, these capacities are not only attributed to organic material, but also to inorganic objects. Consequently, while orthodox materialists tend to isolate the material world as a field of determined and constant objects that react to forces in mechanistic and predictable ways, new materialists challenge these simplistic notions of cause and effect. They draw on the contemporary understanding of forces, charges, waves, virtual particles, and empty space to suggest that it is no longer tenable to think of matter in a simplistic mechanistic manner, but rather that matter must be recognized for its dynamic and interactive character. Instead, they locate causality in chaotic and complex terms, within interlocking and fluctuating systems and forces. Even as compared with actor-network theorists, there is a greater emphasis on the agentic capacity of objects, not just as mediating nodes, but as creative entities.

Second, new materialists prefer problematizations and investigations into the meaning of agency and its entailments. There is especially a conceived limitation of human agentic efficacy in some speculative new materialist work (Coole and Frost 2010). The tendency in some quarters of the literature rather has been to emphasize the agency of non-human things beyond their relationships with humans (Mutlu 2013). Rather than being viewed as instrumentalities, techniques of power, recalcitrant objects, or social constructions, nonhuman things (e.g. electricity, oceans, stem cells) are viewed as agents through and through (Bennett 2010). For new materialists, social scientists have distanced themselves too much from matter in the name of focusing on such immaterial things

as language, consciousness, subjectivity, agency, mind, soul, imagination, emotions, values, meaning, and so on. They argue that “radical constructivists rest on the over-estimation of human construction and authorship” and consequently too often presume that the material world is composed of passive matter awaiting to be imprinted in a socially meaningful manner (John Smith and Jenks 2005, 147; Coole and Frost 2010). Rejecting the notion that objects are reducible to such concepts as culture or discourse, the philosophical tradition of the new material turn is instead underpinned by an emphasis on the role of matter in the construction of social life. Rather than being passive stimuli, objects hold the capacity to generate ideas and encourage particular patterns of behavior. Consequently, new materialists tend to view social action as being constituted within fields of material forces and power relations. This is to say that rather than the material world being subsumed by discourse, discourse is often subsumed by the material world.

Third, while ANT follows a fixed methodological protocol, the philosophical turn tends to be highly methodologically speculative as indicated in the label of speculative realism sometimes applied to the emerging tradition. Scholars present a “contestable metaphysic and cosmology that emphasizes the dynamic, temporal and process character of systems and things,” while recognizing the difficulty of establishing such processes with certainty (Connolly 2013, 300). New materialists stretch out scientific discoveries to their limits, teasing out abstract formulations on material agency and applying these formulations in the field. With an understanding that the world is probably much more complex than we currently understand it, they approach the field in an experimental manner and tend to reach tentative conclusions.

This vital materiality especially comes through in many of the cases that Jane Bennett (2010) explores in her work on political ecology through the notion of “thing power” that conceives of non-humans as configuring phenomena and affecting both humans and non-humans. One case of actant mobility within an assemblage that she interrogates is the case of food and diet. Bennett (2010) takes note of food as not only something that is socially constructed by particular societies, but also something that itself interacts with and affects complex systems inside the human body in its digestion. In recognizing the neglect in the social sciences in presenting a materialist perspective of food, Bennett interrogates this aspect of food more closely, including especially fat, pointing out the broad range of research from the natural sciences highlighting the capacity of fat to alter moods and dispositions, either toward violence and aggression or attentiveness and reduced

depression. As such, a particular actant such as fat in a particular situation of digestion may re-orientate and subsume the actions of a whole.

An aim of these endeavors is to generate a more aware understanding of politics. This endeavor is exemplified in, for example, Bennett's (2010) illumination of the powerful nonhumans (e.g. electrons, trees, wind, fire, electromagnetic fields) involved in the electrical blackout in Canada and the northeast US in 2003. Pointing to the distributed agency in which this phenomenon was constituted, including generator failures, brush fires, and the overloading of transmission lines within a broader assemblage comprised of power plants, energy companies, electricity demands, and energy deregulation, Bennett notes that responsibility cannot be attributed to any single cause. Rather attentiveness to distributed agency suggests a broadening of the locating of sources of particular effects, including those that pose harm. In this regard, for a solution, we could look to "long-term strings of events: to selfish intentions, to energy policy offering lucrative opportunities for energy trading while generating a tragedy of the commons, and to a psychic resistance to acknowledging a link between American energy use, American imperialism, and anti-Americanism" but also to "the stubborn directionality of a high-consumption social infrastructure, to unstable electron flows, to conative wildfires, to exurban housing pressures, and to the assemblages they form" (Bennett 2010, 37).

Such stances of the philosophical approaches indeed represent a challenge and invitation to problematize existing accounts of issues and phenomenon and get beyond approaches that subsume everything to discourse, but still encounter many of the same limitations of ANT. While new materialist approaches are productive in revealing the entanglements that bind non-humans and humans together within relations in complex systems, what is less constructive is the lack of conceptualization of the quality of agency practiced by different entities. Within Bennett's approach, for example, it has been noted that there is a tendency to conflate the properties of different types of matter and the agency that is performed by this matter when it is, in fact, possible to recognize that all entities can affect humans and non-humans while at the same time maintaining unique capacities in this agency (Erika Cudworth and Hobden 2015a). The fact that fat or transmission wires can affect other things says nothing about the quality of this agency and all the implications this has for responsibility and ethics. There is, in other words, an obscuring of the

nature of agency, including the privileged and/or constrained positions that may emerge in different human and non-human entities, which can significantly affect the trajectory of events.

As Cudworth and Hobden (2015b) point out, more than showing assemblages and the differences that non-humans make, post-humanist work rather would be enhanced by accounting for the differential capacities of the human and non-human (and surely differentiation between many types of non-human matter too). Thinking only through things as agents, on the other hand, limits a theorization of power and the ways in which it is “forged through and continue to carry, relations of inequality and domination” (Erika Cudworth and Hobden 2015a, 139). But by analyzing differences and the ways in which they constitute power relationships across different cases, it becomes possible to better understand both how phenomena are constituted through different capacities of humans and non-humans within different relations and further the plausible politics of intervention in these situations.

Another question that arises is the treatment of history and discourse within particular material entanglements. While new materialists have shown that materiality is not always defined by human beings and social constructions, the role of discourse remains unclear within the context of vibrant material actants. Bennett (2010) shows that actants such as food or electrons become immersed in complex assemblages comprised of other things, in some cases becoming assemblage converters that can alter the direction of a whole. This emphasis on matter as nondiscursive actants though displaces the many situations in which matter is conferred meanings by discourse or in which both discursive and nondiscursive constitutions of matter define situations. It conceals the ways in which agency is a matter of the relations between different entities and practices (Barad 2007; Erika Cudworth and Hobden 2015a). Food, itself, for example doesn't just emerge into a body comprised of other matters to which it interacts, but also is itself socio-materially constituted as an edible option through prior entanglements between human and non-human matter. In now understanding that non-human matters are instrumental to the constituting of phenomena, more can be done to understand how discourses and matter intersect in these processes of effect-making. By thinking through the different ways in which different types of matter, human and non-human, and discursive practices each perform agency and consequently constitute political outcomes in their situatedness, we can draw lessons on the analytical and ethical implications posed by different situations of relations.

Recognizing the value of both constructivism and the materialist turn, this dissertation consequently branches itself in with approaches that seek to make sense of the socio-material constituting of phenomena, taking the sole emphasis off of either discourse or matter in analysis. In particular, I draw on Karen Barad's (2007) emphasis of phenomena as emerging through the intra-actions between material-discursive practices and Cudworth and Hobden's (2013) interrogation of complex adaptive systems and the distinct human and non-human capacities and features that comprise them. Through constructive pairing of these different approaches, explored more in the next chapter, there is an opportunity to better theorize the intertwining of discourse and materiality and in the process also better refine how humans and non-humans constitute actions in the relations in which they're bound together. Such approaches are reflected in the syncretic development of my own socio-material constructivist framework.

Conclusion

Emerging from the failings of rationalist and social constructivist approaches to adequately account for matter in explaining political outcomes, the materialist turn has come to encompass a smorgasbord of different approaches highlighting the vibrant matter involved in shaping phenomena. While uncovering agency and power in overlooked sites and problematizing views of linear causality, instead purporting emergence causality and distributed agency between humans and non-humans, the materialist turn has suffered from its own shortcomings. In not deciphering differences in the quality of agency practiced between humans and non-humans and in neglecting an incorporation of history and discursive structures into conceptual frameworks, these approaches have been constrained in their explanations of phenomena and the prescriptions that they can offer, being unable to adequately theorize power.

While ANT scholars and new materialists have consequently provided added value in teasing out the non-human role in the construction of politics and putting a spotlight on the reciprocal relations between all things, processes that constructively open up new interpretations of politics, more attention should now be heeded toward understanding how these processes come to intersect with the domain of discourse, defined in the next chapter as apparatuses that are constituted through the entanglements between matter (human and non-human) and other material-discursive practices. What is needed is a socio-material approach that takes into account the notions that both human

shared understandings and the actions of material entities matter and further that how they confer meaning on and affect one another constitutes phenomena. This perspective should also conceptualize how different types of matter, human and non-human, perform agency and the implications of these modes of action on the conditions of possibility in different settings and situations. Through this enhanced analytical rigor, there are possibilities of elucidating constructive human potential within dense material entanglements.

CHAPTER 3. A SOCIO-MATERIAL CONSTRUCTIVIST FRAMEWORK FOR THE ANALYSIS OF POLITICS

In light of the review of the constructivist and materialist turns in chapters one and two, respectively, in this chapter, I endeavor to develop a syncretic socio-material approach that takes into account the entangled agencies between matter and discourse and further unpacks the power relations and capacities of matter that are put into this entanglement work, a perspective that I refer to as *socio-material constructivism*. While social constructivism contributed to illuminating the many ways in which societies can reconstruct and transform political orders through language and social interaction, social constructivist perspectives have been limited in their analytical capacity of understanding how material relations too are crucial in these constitutive processes and in channeling discourses in particular directions. ANT and new materialist approaches, meanwhile, although bringing in the broader material world into accounts of politics, have suffered from their own neglect of discourse and grappling with how the agential capacities of both humans and many different types of non-humans engender the emergence of particular phenomena. My socio-material approach consequently advances the idea that our reality is not simply transcendental or self-evident, but rather constructed, an area of convergence between social constructivism and new materialist approaches. Importantly though, it is discourse and matter that together through their interplay constitute the phenomena of the world, including public policy, political actions, and everyday practices.

The approach of this dissertation is importantly particularly targeted toward going beyond existing approaches in the new materialist literature through the conceptualization and unpacking of the capacities and modes of action through which matter comes to make a difference, through an understanding of the boundary-drawing enabling/constraining meanings conferred upon agency through both the (1) inherent materiality of matter itself and (2) in its entanglements with discourse and other material things. This move, significantly, opens up opportunities for better interrogating and understanding – through empirical analysis – the conditions of possibility for different types of matter to come to matter and further how both humans and non-humans influence one another in their reciprocal relations. This engagement, in turn, is necessary if we wish to understand the analytical space for human intervention within dense and complex socio-material settings.

Though not particularly pervasive in the social sciences, in addition to the body of work surrounding ANT (with its already noted shortcomings), there have been a number of recent endeavors closely associated with the materialist turn that have adopted socio-material angles to the study of politics (Barad 2007; Tuana 2009; Aradau 2010; Erika Cudworth and Hobden 2013; Kaup 2014; Sheller 2014). This chapter first especially draws on the work of Karen Barad and her agential realist approach to understanding phenomena, a perspective that hones in on the co-constitutive nature of material-discursive practices that I have outlined as necessary. The approach of this dissertation though is differentiated from Barad's perspective in its recognition that although agency is performed through these intra-actions, the entanglements themselves – and consequently their effects – emanate from positions of differentiation in terms of the specific types of enactment of agency that can be and are performed. In particular, the dissertation takes the stance that it is productive to recognize humans and non-humans as being constituted by different capacities that are then engendered into the types of agency that can be practiced, a conceptual move similarly made by Cudworth and Hobden (2013).

The socio-material constructivism presented here envisions that in entering into relations, matter is conferred meaning both by the boundary setting incisions articulated by its own materiality and the material-discursive practices that it emerges alongside. I argue that this move is, in fact, feasible and constructive when we acknowledge that the recurring relations between matter and discourse give rise to certain relatively stable phenomena that while the product of entanglement effects that are further reproduced in ever continuing entangled reconfigurations of the world are at the same time also separate entities with particular capacities and possibilities of action. With such an understanding on the existence of matter both within and outside of relations, it becomes possible to conceive of both human and non-human matter as making a difference through various modes of action, four of which are explored in the dissertation, including gatekeeping, resistance, displacement, and symbolic action. This chapter further conceptualizes how such agency is enacted in different cases and argues that by doing so we can better understand and explain the emergence of different phenomena and gain a better grasp on how such outcomes could have been different. Rather than eviscerating human agency, consequently, this dissertation argues that in binding the analysis of social and technical worlds together, there is an opportunity to better understand the limits and possibilities of maneuvers within dense technical settings, thereby inviting more constructive intervention in politics.

3.1 Making sense of the relationship between matter and discourse

One productive endeavor toward developing the type of socio-material approach that this dissertation is after comes in the scholarship of Karen Barad (2007) who draws on the work of Niels Bohr and the quantum model of the atom. According to Barad, phenomena, referring to differential patterns of mattering (i.e. diffraction patterns), are generated through processes of complex “intra-action” between multiple material-discursive practices and particular material entities². As opposed to the concept of “interaction”, which presumes pre-existing agencies, “intra-action”, in turn, refers to the “mutual constitution of entangled agencies” between material entities and material/discursive practices (Barad 2007, 33). As such, rather than coming in the form of pre-formed entities that possess agency, Barad understands matter and discourse as being conferred meaning and becoming determinate only in the field of practice in specific situations. Contingent on how multiple other entities and practices constitute them in particular contexts (i.e. boundary setting or cut-producing effects), specific material entities are enabled/constrained from enacting agency in particular ways. At the same time, they too shape the properties of other material-discursive practices and apparatuses, thereby together mutually constituting phenomena through their entangled agencies.

The notion of a material/discursive practice or apparatus is especially important in Barad’s agential realist approach for these are boundary-drawing practices or “specific material (re)figurings of the world” that enact cuts that include and exclude and steer the performances of particular entities (Barad 2007, 140). They are the conditions of possibility that delineate the range of possible actions for any other entity. For Barad though, discourses are not simply constituted through shared understandings between humans through language and interaction, but rather they “*are themselves material-discursive phenomena, materializing in intra-action with other material-discursive apparatuses*” (Barad 2007, 203). In agriculture, to provide my own example, it is through the interplay of such things as fertilizer, pesticides, crop varieties, and farming equipment with material-discursive practices of farm design, market demand, and farmer expertise that the particular entities (e.g. fertilizer) are able to gain specific functions and perform a role with tangible

² Barad uses the term diffraction – an analogy from classical physics - to refer to the process in which a particular entity (e.g. a slit or obstacle in the example of waves) engenders particular effects on the meaning of the performances of other entities (e.g. a wave). This process is elaborated in more detail in chapter four in this dissertation with respect to methodology.

effects (e.g. supporting plant growth). Material things though are not simply subsumed in these processes by practices such as market demands, but rather they too alter the performance of particular apparatuses, channeling how they take shape in concrete situations.

In this regard, Barad (2007, 152) notes that “Neither discursive practices nor material phenomena are ontologically or epistemologically prior. Neither can be explained in terms of the other. Neither is reducible to the other. Neither has privileged status in determining the other. Neither is articulated or articulable in the absence of the other; matter and meaning are mutually articulated”. While on the one hand particular boundary-setting practices (e.g. market demands) are productive toward matter (e.g. use of fertilizer), these practices too emerge out of material (re)configurings of the world. As such, matter is constituted discursively and materially, while discourses too are constituted materially and discursively, both through lively intra-actions. Another important aspect to this process is that agency – and the phenomena that are produced through it - is in constant flux. This means that the universe is in a constant process of becoming through agential intra-activity. While these processes provide determinacy through the phenomena that come to matter, they may at any time be reconfigured, leading to the re-articulation of phenomena.

An illustration of these processes, provided by Barad, may be gleaned from the phenomena of fetal ultrasound images, which are generated in the intra-actions between a piezoelectric transducer and fetus. While at a fundamental level, the transducer functions to both provide and receive ultrasound waves, Barad notes that the performance of the piezoelectric transducer, nevertheless, is constituted through its entanglements with numerous elements, including the acoustic impedances of tissues, interface geometry, and frequency. As an apparatus of measurement, moreover, the piezoelectric transducer is itself not natural or passive, but rather “constituted through particular practices that are perpetually open to rearrangements, rearticulations, and other reworkings” (Barad 2007, 170). It is itself a phenomenon (re)materialized in the intra-actions between a range of material/discursive practices that “involve medical needs; design constraints (including legal, economic, biomedical, physics, and engineering ones); market factors; political issues; other R&D projects using similar materials; the educational background of the engineers and scientists designing the crystals and the workplace environment of the engineering firm or lab; particular hospital or clinic environments where the technology is used; receptivity of the medical community and the patient community to the technology; legal, economic, cultural, religious,

political, and spatial constraints on its uses; positioning of patients during examination; and the nature of training of technicians and physicians who use the technology” (Barad 2007, 203). In this vein, the transducer, as an object of matter, is both produced within the boundary-setting actions of numerous material-discursive practices, while also functioning to further generate these practices in addition to the ultrasound images that it more visibly produces.

Barad’s framework has also been put to use in a range of different fields in making sense of, for example, the development of health epidemics, the securitization of infrastructure, digital self-imaging, and primary school bullying (Wilbert 2006; Aradau 2010; Højgaard and Søndergaard 2011; Warfield 2016). Claudia Aradau (2010), for example, in examining the securitization of critical infrastructure after 9/11, in contrast to other securitization perspectives, contents that the agential realist approach of Barad demonstrates how materialization works, that is not only how discourse comes to matter, but also how matter comes to matter. In particular, Aradau interrogates the broader socio-material entanglements behind the construction of securitization, including the dynamic way in which shared understandings and matter intra-act in these materialization process. She points out that infrastructures are powerful forces on their own: they “break down, fail, corrode, rust, or, as the case may be, stop flowing, leak, outflow, seep and so on” (Aradau 2010, 505). The ways in which these material things come to matter though takes place within the context of intra-actions with other material-discursive practices, including civil engineering, legal practices of responsibility, emergency planning, and building design.

As an example, Aradau focuses on one MP’s differentiation between types of infrastructure, with the failure of toilets not acting materially to threaten a community, but nuclear power stations representing a serious threat through its own agency. The materiality of the infrastructures can be seen as intra-acting with other material-discursive practices, including energy grids, neo-liberal economic structures, national environmental imaginaries, and forms of government to constitute itself as a critical infrastructure or not, with in turn implications on security practices. The infrastructures become materialized “through their capacity for being disrupted and their effects upon the smooth functioning of society” (Aradau 2010, 506). Urban infrastructure, meanwhile, often reliant on steel and concrete, becomes securitized on account of the tendency for these materials to corrode, in connection with the societal importance placed on bridges, water systems, and transport systems.

These types of material-discursive engagements have engendered analytical added value in terms of uncovering surprising and overlooked explanations of phenomena. In an examination of avian flu (H5N1), for example, Chris Wilbert (2006), employing the agential realist approach, challenges the prevailing narrative that the disease is caused by wild migratory birds that have visited lax small farm operations and the associated solution to this problem – enhanced surveillance of migratory birds, stiffer regulations over small farms, and increased support for larger scale farm operations. Wilbert (2006, 8) instead shows that the avian flu rather emerged through complex open-ended networks involving the mixing of natures, cultures, and technologies comprised of various practices, including “all kinds of rules, veterinary techniques, forms of production, transport networks, slaughtering practices, laws, and more”. These practices importantly came to be materialized in the form of large-scale intensive poultry farming that within the crowded environment intra-acted with mild virus strains in such a way as to allow rapid evolution toward more severe strains that could easily be transmitted to wild birds. In viewing the phenomena in this lens, the solution to the problem becomes less clear-cut, with potential intervention points including the provision of cheaper and safer food to impoverished families and the targeting of intensive practices of factory farming, remedies that were obscured by the simplistic attributing of causal agency to either wild bird populations or the management practices of small farms.

This dissertation consequently shares the view with Karen Barad and others that phenomena are constituted in the field of practice through the intra-active agencies of material-discursive practices, taking note of the added value in engaging with *what relations do together*, rather than treating such entities as separate causal processes, as providing insightful and novel explanations of practices. This dissertation though makes a departure from Barad’s agential realism in its conceptualization of agency or at least in how the cuts are enacted to which agency comes to be performed. It has been pointed out that while the agential realism approach provides intelligibility in terms of understanding entanglement effects, it doesn’t yet speak to the inequality in relations within entanglements, that is, to the ways in which particular configurations are differentially enacted (Aradau 2010, 510). Though no particular thing possesses agency, as something that is performed, with regard to this inequality, I argue that particular human and non-human entities can still be characterized as being enabled/constrained in their actions and the agency that they can perform through the cut-inducing effects of particular (indeterminate) capacities, abilities, and traits. Barad’s move is similar to ANT in seeing all material things such as human beings as

actually the product of heterogeneous relations and consequently as collective reifications rather than human beings *per se*. As already discussed with respect to ANT and new materialism, it is the view of this dissertation that Barad's position, in fact, neglects the fact that even though humans are embedded within particular intra-active settings that confer meaning and possibility to their actions, they still maintain certain unique capacities, including the ability to use language, imagine futures, and make complex decisions, which are generally lacking in most non-human animals and things (Erika Cudworth and Hobden 2015b, 2013). Non-human animals, meanwhile, lacking these capacities are still able to make a difference through their reciprocal interactions with humans and other things, but their agential possibilities within this relationship are limited to particular performative and enabling/constraining enactments. They can thus constitute the decision-making of human beings, displacing interests, resisting intentions, and conveying particular impressions, but are themselves generally constricted in their ability to influence intra-activity through language and other reflexive capacities. In other words, even as particular material entities are demarcated in processes of intra-activity through which phenomena are constituted through boundary drawing practices, this dissertation holds that the phenomena are at the same time also separate entities that are too capable of engendering certain types of enactments and not others.

In this regard, this dissertation presumes that matter – human and non-human - is both simultaneously discursive and non-discursive. While it becomes intertwined with material-discursive boundary-setting practices in its articulation of agency, it also comes pre-cut through its very materiality, incisions that alter the agential conditions of possibility. One such example that illustrates this view, explored in more detail empirically in chapter five, is the particle bombardment apparatus, a device for plant genetic engineering that enables technicians to insert genes of choice into particular plants that may then express the relevant trait. It is, yes, a material-discursive practice, a phenomena emerging through market demands, design features, engineering capacities, knowledge practices, and so on, and also one that enacts agency in intra-actions with particular genetic materials, plant cells, and technical expertise of personnel that constitute how specifically a gene is inserted into a plant. As a piece of matter though, it also comes pre-tailored in terms of its capabilities at any moment. It is pre-cut with certain capacities through which it is able to transfer certain types of genetic material, but not others, and further insert these genes in specific ways that engender certain degrees of stability and integration within plant cells. It enters into intra-actions not capable of socially dictating the decisions of an experiment, but it can

displace relations between particular genetic sequences, targeted plant cells, and scientists and resist the intentions of human beings, thereby altering the decision landscape for project leaders.

Cudworth and Hobden (2013) have similarly explored phenomena through the entanglements between the social and material, while at the same time recognizing the differences in the capacities for agency between humans and non-humans. They specifically outline three types of agency (transformative, reproductive, and affective) practiced by humans and non-humans in different ways. Transformative agency refers to the struggle over resources and the organization of society that determines the distribution of these resources. Transformative agency, in other words, is the sphere of action that constitutes the formulation of systems as oppressive or emancipatory. Cudworth and Hobden emphasize that this is generally the dominion of humans although some non-human species may also perform transformative agency. I would note that my reading of the conceptualization of the term is especially inclusive of how social action is understood under constructivism. Through the performance of frames, language use, and social action, particular shared understandings are constituted that delineate the rules and norms that guide further action. For most material things though, they are excluded from this agency through the boundary setting practices constituted by their own materiality within the ever evolving materialization of the world.

Though transformative agency is generally inaccessible to natural systems and things, non-living assemblages too have the capacity to affect their surroundings in dramatic ways that alter “the systemic conditions, the agential landscape, for other beings and things” (Erika Cudworth and Hobden 2013, 446). It is this type of difference-making agency – one exemplified in the material systems that produce global warming - that Cudworth and Hobden label as affective agency. It should be noted that Cudworth and Hobden put emphasis on the fact that affective agency is always situated, that is, it is performed in particular entanglements. As such, I would add, the theorization of affective agency becomes plausible based on the presumption that all things share a common space in which they intra-act. That polar bears, to provide an intuitive example, can become a central symbol of global warming is constituted through their vulnerability in systems of nature embedded within climate changes and further to their ability to convey impressions through their coupling with human beings. In this regard, not only is agency contingent on the capacities of material things and not only is it situated in its performance, but these capacities are themselves

built on the presumption that they operate within systems of many things, including human beings capable of reflexivity.

A third type of agency that Cudworth and Hobden (2013, 447) conceptualize is called reproductive agency, acknowledged as “the way in which agential beings, both human and non-human, emerge into a pre-existent web of social relations and unequally distributed power and resources, and their practices over time reproduce those situational constraints with relatively minor alterations.” This type of agency is importantly crucial to sustaining the particular constructions engendered through the pairing of transformative and affective agency. This could, for example, be exemplified in the factory farming poultry operations that Wilbert (2006) studied in which chickens are born into exploitative and oppressive systems that they reproduce through their obedience. The reproduction of structures is consequently contingent on the non-articulation of transformative and affective agencies that may reorient the material-discursive terrain.

Taking into account these differential capacities of human and non-human entities is importantly significant in terms of not only how we approach empirical analysis, but also the conclusions that we draw. In examining the case of non-human affective agency in wars, even while engaging with the phenomena through the intra-activity that makes it possible, it becomes clear that animals are acting from a standpoint of vulnerability and social domination, leaving the possibilities for transformation of the system ultimately with human beings (Erika Cudworth and Hobden 2015b). Yet in acknowledging the capacities of animals to resist their encapsulation as tools of transformation or in conveying feelings of companionship in animal-human communities, as Cudworth (2011) illustrates in a separate work, it becomes feasible to examine the conditions under which these particular enactments come to matter across a range of cases. To take the case of avian flu discussed above, similarly, an understanding of the problem rests on recognizing the power of migratory birds to mediate relations between large-scale and small-scale farms and human exposure to the virus, but also on the human, not bird, capacity to solve these problems through interventions that succeed or fail in making a difference (e.g. surveillance of birds or transformation of industrial agriculture and the political economy of food), maneuvers that themselves will come into contact with other matter and material-discursive practices (Wilbert 2006). As Nancy Tuana (2009) further emphasizes in her examination of Hurricane Katrina and New Orleans, researchers have political and ethical responsibility to engage with the

interconnections between matter and language. Understanding and preventing similar events in the future rests on making sense of the ways in which the social, political, and natural aspects of problems emerge and intersect with one another.

Understanding and recognizing the capacities of particular entities to affect one another in different ways within an intra-action setting then, I argue, is crucial to understanding the potential dynamics of these entanglements and further to uncovering the performance of power within these relations. This is not to diminish the power of material agency nor the discourses that shape them, in other words, but rather to take analytical note of how the differences between particular entities come to denote different possibilities of agency and modes of difference-making. It is to give materiality its due both as matter made agential in its intra-actions, but also as self-defining content within these generally reproductive structures. Failing *a priori* to recognize the capacities that are possible for materiality, meanwhile, forecloses analytical opportunities to study the conditions under which particular modes of action come to matter. In assuming the power of transformative agency through speech acts and framing, for example, social constructivists have been able to study these particular acts through empirical phenomena and consequently understand how they make a difference and the conditions under which they make a difference. Now, in adding material things to our frameworks for analysis, it would be worthwhile to conceptualize some of the ways in which material processes too can make a difference and subsequently through empirical study attain understanding on the conditions through which such modes of action succeed or fail in shaping political outcomes in specific situations.

A central focus of this dissertation is contributing toward understanding some of the specific ways in which both humans and non-humans enact agency and further how these performances intra-act with one another in the field of practice in the co-constituting of phenomena. Although Cudworth and Hobden (2013) tease out three general categories of agency, they are largely left under-specified in terms of the modes of action through which they operate. It remains unclear, in other words, precisely how material entities, for example, practice affective or reproductive agency. If we accept the premise that different material entities are constituted by different pre-cuts conferred by their own materiality, then there is, in fact, additional value to be gained by further specifying how material entities perform agency and how these modes of action fit within and intra-act with the broader agential spectrum of other material/discursive practices, some of

which are routinely involved in propagating imaginaries of the future. This is the focus of the next section.

3.2 Theorizing affective agency in practice: what are material things capable of?

If non-human material things are capable of enacting affective agency, then a critical question remains regarding what precisely they are capable of doing, that is, what makes it possible to state that material entities are able to alter agential landscapes or the views of human beings. This dissertation, at the broadest level, identifies the ability to *constitute* different processes - the capacity to confer meaning - as a common constituent of all things, human and non-human, that enable these affective enactments. When situated, many different entities are capable of mediating or changing the relations between other entities and practices, putting them into contact with one another in a specific way or of destabilizing these relations in a particular manner, which in turn can facilitate/hinder the achievement of goals, reconstitute interests, channel entities in particular ways, and alter attitudes. An intuitive example is the case of a hammer, which through its material pre-cuts may at once create both connections and disconnections between a human being and a nail. While a hammer enables certain types of action (hammering in a nail), it limits the realization of others (screwing in a nail), regardless of the discursive-material practices through which the hammer intra-acts. In providing access to the nail in particular ways, but not others, it may both facilitate and constrain the achievement of certain goals.

It is important to emphasize that the notion that material entities can constitute processes still doesn't specify the quality of this agency. Significantly, this dissertation engages with non-human matter as not only tools that mediate relations, but also as dynamic entities that are capable of intra-acting with humans in more complex ways by imparting particular viewpoints on them, obfuscating (or facilitating) action, or disrupting (or reifying) patterns. To refine this theorization, material entities can constitute processes in at least four crucial ways. These modes of action in which this agency may be expressed are identified as resistance (or compliance), displacement (or reification), symbolic action (i.e. the conveying of impressions), and gatekeeping (i.e. providing/limiting access to other material/discursive practices). The next parts endeavor to examine these specific modes of action through which these constitutive processes take place in the field of practice, interrogating how they work and why engaging with them matters to better

understanding the construction of politics. This conceptual development, it should be noted, was conducted in an abductive manner, moving between my own fieldwork and the theorization of the concepts, as outlined in the discussion of methodology in chapter four. A more comprehensive demonstration of how they work in practice is therefore elucidated in the empirical work in this dissertation found in chapters five and six.

3.2.1 The matter of gatekeeping

Material entities are often constituted by the capacity of gatekeeping, which I conceptualize as the ability to regulate access to any particular entity or practice. Without access to gatekeepers, it becomes difficult to accomplish particular goals, regardless of resistance to them or any other barriers that would prevent their achievement. There are many well-studied examples of human gatekeepers, including political party leaders or financial supporters who select candidates to run for office and chief of staffs who channel access to public figures (Norris 1997; Conway 2001; Cohen 1997). They have also been shown to be key linking mechanisms that mediate the flow of information into an organization (Tushman 1977).

With the rise of social media, there has been increasing attention toward social media platforms as new sites of gatekeeping in the provision of news and other content. As performance sites though, rather than humans, the gatekeepers or curators notably often take the form of powerful computer algorithms that “selectively bring artifacts out of storage for particular audiences” and continually devise “more sophisticated ways to curate artifacts” (B. Hogan 2010, 381). Given that the databases store more artifacts than can be displayed, the computer curators mediate the interactions between users through filtering, ordering, and searching, deciding what things it deems relevant and interesting for particular users. With regard to the algorithm’s tendency to narrow ideological content based on the users’ prior preferences, some studies have shown that there is at least some reduction on cross-content material that is viewed by users owing to these algorithmic processes (Bakshy, Messing, and Adamic 2015). The social media platforms thus function to provide digitalized performance spaces that change the nature of interactions and impression management within that space.

In the analysis of politics, material access points then should be seen as constitutive of action, as both enabling and constraining of particulate articulations. They can hinder the fulfilling of

interests in certain contexts, while facilitating the same in other situations. Through these processes, they, in turn, shape the construction of phenomena. Access to them significantly doesn't guarantee success in any particular action, but it does make it possible. Lack of access to them, meanwhile, can be expected to alter the strategies of excluded entities to less desired alternatives. In situations when certain actors attain access, but not others, it can be expected to give these entities advantages in the completion of the tasks. In this respect, particular gatekeepers, human or non-human, can become *privileged access points* that are vital for the propagation of any intended action, but at the same time limiting in terms of who or what attains this access.

These implications are concretely interrogated in this dissertation with respect to the development of the research and development field in plant biotechnology and the debate over genetically modified foods in Bavaria, Germany. While not examining social media specifically, this dissertation, in chapter six, takes note of the materiality of lobbying and campaigning in debates over public policy in terms of the communication of a message, highlighting the ways in which information flow can be impeded without access to objects of materiality that open up communication channels to particular groups of actors. This access can be deemed crucial if it means a key segment of society or key public figure can or cannot be targeted by a pressure lobby. Importantly, it is not only people that maintain these communication linkages, but also non-human things like phone books and address catalogs. The existence (or non-existence) of a thing such as a catalog of addresses and phone numbers thus comes pre-cut, as it were, preordained in its capacity to enter into entanglements with other things that then further channel its use, while it at the same time channels their possibilities. In terms of the ramifications in the debate for genetically modified organisms specifically, anti-GMO activist access to material entities, human and non-human, that provide communication channels to key constituencies is shown in chapter six to have been crucial in allowing these groups to communicate (or not) to farmers and consequently constituted the strategies of activist groups and the (non-) mobilization of farmers in different contexts that are otherwise similar.

Engaging with material entities as gatekeepers though highlights the fact that their capacities in this regard aren't only confined to the flow of information, but that they can also become instrumental entities in the facilitation of processes. Access to these particular nodal entities also constitutes the ability to complete a particular task. This dissertation, in chapter five, especially

explores the role of key technologies as gatekeepers to research in the field of plant biotechnology. Access to enabling and trait technologies, key to the development of transgenic crop applications, is found to be pivotal toward how the broader research field emerged. This is both with respect to the types of innovations that became possible, but also with regard to who developed them. This is on account of the fact that access to these instruments enables/constrains what is possible for any particular researcher or organization in the field. And this power is especially prone to being magnified in certain scientific research fields where the available technological options are limited owing to both pre-material cuts and further material-discursive practices centered around intellectual property rights. In the case of plant biotechnology, the intra-actions of the transgenic crop technologies with patents, in particular, are shown to have favored large corporations that had attained most of the IP rights in the field over public research scientists.

While not able to use language, non-human matter is thus too able to perform gatekeeping functions, capacities constituted simultaneously both through the boundary setting incisions enacted by their own materiality and in their specific entanglements with other material-discursive practices. In this regard, power is revealed not only in the transformative actions of human beings, but also in the banal everyday material sites of gatekeeping.

3.2.2 Resistance is (not) futile?

A second characteristic constituting the capacity for material agency is the ways in which the very nature of matter can enact resistance. In political analysis, resistance has often been conceptualized in human-centric terms. Paul Routledge (1997, 69), for example, conceptualizes resistance as referring to “any action, imbued with intent, that attempts to challenge, change, or retain particular circumstances related to societal relations, processes, and/or institutions”. He further specifies that such circumstances may involve “domination, exploitation, subjection at the material, symbolic or psychological level” (Routledge 1997, 69). Tied into discourses and practices of domination, resistance can be associated with various elements of dominating power such as patriarchy, racism, sexism, and homophobia. Numerous cases have been studied, including youth subcultural resistance, everyday forms of covert resistance from groups like peasants, and resistance to neoliberal capitalism (Juris and Sitrin 2016). Resistance can be covert or overt, conscious or unconscious, visible or invisible, and large-scale or micro-scale (Juris and Sitrin 2016). To the

extent that non-human materiality comes into play, it is with respect to how such materials are assembled into particular processes of contestation, but not how they themselves become agents and sites of resistance.

It has, nevertheless, been increasingly recognized though that non-human material things too can act in a recalcitrant manner, obfuscating the aims and actions of other entities (Bennett 2010). In embracing this agency as in part tied in with the very materiality of matter, I employ the term of resistance with an understanding that many non-human material entities too maintain the capacities to perform resistance, conceptualizing it in more inclusive terms, as the non-conformity with the directions or intentions of other material-discursive practices. In this vein, it is also possible to conceptualize the converse enactment on a continuum as *compliance* to a particular action. Importantly, for my understanding, resistance (or compliance) is not constituted by the intentions of material entities, but rather simply through the act of obstinate (or submissive) behavior. Such acts of resistance can be constituted through the imposing of obstacles or barriers that hinder the achievement of specific intended actions. While these particular boundary setting incisions become meaningful and affect processes within specific socio-material contexts in which they intra-act with technical know-how, market structures, societal imaginaries, and technological instruments and other material-discursive practices, they already also come pre-tailored with the potential to perform this agency, something that should be accounted for in engaging with this matter. Although resistance can only be performed in the field of practice, through certain traits that enable them to facilitate the completion of particular tasks with varying degrees of success/failure, material things enter into intra-actions with certain possibilities of being resistant or compliant.

As an example of this, in a different field but very similar to some of the processes explored in this dissertation in agriculture and plant biotechnology, Brent Kaup (2014) sheds light on the socio-material constituting of political economy structures in Bolivia between nature and labor in the country's natural resource sectors, with a particular focus on the resistance put up by different material resources in their extraction. In the mineral mining sectors, the geographic and geological configuration of the country's mineral deposits, including the need to use underground lode mining techniques, are shown to constitute extraction as a labor-intensive process in contrast to the typical above-ground alluvial mining techniques found elsewhere. The problem, importantly, is not one

of technology, but rather the need for workers with rudimentary tools to overcome the obstacles of the high altitude and below ground terrain. In the hydrocarbons sector, meanwhile, the obstacles put up by natural gas in its extraction, including its flammable nature and resistance to containment, significantly steered developments not toward a build-up of labor, but rather toward investments in infrastructure, technology, and exploration activities. Rather than being labor-dependent, the flow of natural gas is noted to have been material-dependent with a minimal workforce to ensure continued operation of the infrastructure and technology.

In this vein, it was the very materiality of nature that first of all enabled its resistance in different ways in each case, in turn, shifting how the two sectors developed, perhaps away from the intentions of public or private companies. Rather than simply enacting visions of resource extraction, project leaders were thus hindered by matter and steered toward implementing alternative strategies. In addition to being pre-cut though, it must also be emphasized that these capacities of matter to resist intentions became further meaningful when they intra-acted with other boundary setting practices, including particular technological and labor practices that were employed to overcome these obstacles. As such, matter and discourse both simultaneously conferred meaning on the constellation of material entities encompassing the resource extraction process, constituting the precise phenomena of resistant agency that was articulated. These processes importantly also engendered political implications. In the case of the mining sector, in the context of the neoliberal political shift in the 1980s, this situation is revealed to have been channeled into worker-led cooperative movements, owing to the lack of technological and infrastructural investment needed to maintain the operations. As such, practices of material resistance were routed into low-investment and large-scale worker projects, which in turn, were channeled into forms of worker-led political power. In the natural gas sector, meanwhile, the entanglements between resistance methods and the technology of extraction, have pushed workers to support infrastructure investments by oil and natural gas firms and subsequently state companies following the pillaging by the transnational firms. The socio-material intertwining of nature and labor, then, have rendered the emergence of different paths and types of counter-neoliberalization structures in the political economy of the country.

These processes highlight the need to, in fact, incorporate theorization of material resistance into our accounts of politics. Kaup (2014, 1839), for example, notes that “Recognizing how natures

influence the labor process and the ways through which workers exercise power provides a means to understand why some workers in extractive industries may more actively embrace—and more actively resist—processes of neoliberalization and the potential alternatives”. This dissertation, meanwhile, similarly examines the processes through which genetic sequences, plant cells, and technological apparatuses either resisted or complied with meaning intentions in the laboratory in the development of the field of plant biotechnology, with this mode of action in part constituted by their own complex materialities. In consort with knowledge practices and market demands, these acts of resistance are shown to have shaped the development of the field (and in turn the political debate over the issue), allowing for the corporate capture of the industry and the development of GM crop varieties that were perceived as less consumer friendly, thereby shaping public policy debates. Given the possibility that similar processes can be expected to shape emerging fields in the natural sciences and associated public contestation, these processes of resistance should be adequately examined in different contexts, particularly in terms of how they gain meaning in their entanglements with different socio-material settings.

3.2.3 The displacement of other matters

A third way in which material entities may practice agency involves the displacement – referring to the movement of something from its initial location - of other material-discursive practices. Displacement is a commonly recognized phenomenon affecting humans, emerging at the grand scale from conflict and natural disasters. The displacement of the impoverished in New Orleans following Hurricane Katrina, for example, has been well recognized (Tuana 2009). Nancy Tuana though shows that such acts of (non)displacement are not only connected with the tidal waters that overpowered the dams, but also contingent on the interactions of this materiality with practices of racism and disability discrimination. Furthermore, it was not only people that were displaced, but there were also concerns about the contamination of groundwater supplies from the spillover of toxic waste harmful to human health. Tracing this phenomena through broader material-semiotic interactions, Tuana similarly shows that such toxic waste is a product of complex interactions, including acceptance of rampant corruption by the Louisiana government, geographical factors that rendered the area rewarding for industry, and lax environmental regulations imposed by the state government. It is the intrusion of floodwaters though through contaminated soil that allows

for this toxic waste to be displaced and in doing so change the relations between this toxic waste and humans.

Jane Bennett (2010) interrogates numerous examples of material displacements that impinge on humans and non-humans. In the electrical blackout that struck Canada and the northeast US in 2003, electricity is shown to have been displaced by a series of cascading events, including generator failures, brush fires, and the overloading of transmission lines. These processes were further embedded within assemblages comprised of power plants, transmission wires, the practices of energy companies, electricity demands, and energy deregulation. Bennett also explores the case of food, noting the capacity of nonhuman fat, for example, to displace human moods or affective states in a nonlinear manner. Fat, she notes, steers the direction of human wills, ideas, and habits. Through these processes, not only human intentionality defines diets, but also food, as self-altering and dissipative materiality, becomes a critical aspect that constitutes the metabolisms, cognition, and sensibilities of humans.

Displacements matter because not only do they constitute the existence of the materiality that they directly affect, but these materialities further displace other material-discursive practices. Through acts of displacement, in other words, multiple connections and/or disconnections may be created. This dissertation specifically examines various displacements that occur in the plant biotechnology laboratory and in the public debate over the issue of GMOs in Bavaria. The displacement of pollen by winds and insects is especially emphasized as a phenomenon that changes the relations between farmers in the region, once transgenic crops emerged as a farming option, by putting their fields (then potentially genetically modified) into contact with one another in a different way than before. While material things are in part pre-cut with these capacities for displacement action, the narrative though also highlights how these actions came to gain contextual meaning within their intra-actions with the political economy of food, regulatory developments in the EU, and the socio-material spatial constituting of farmland.

The capacity for displacement is constitutive of the potential for matter not only to resist particular actions, but alter the relations between things in significant ways. Recognizing this capacity is consequently crucial to better understanding how this agency is enacted in different situations. Through understanding how the displacement of pollen, for example, comes to matter in different

socio-material settings, it becomes possible to better understand how the import of new agricultural technologies may affect farmers in different regions and further how these processes may impinge on political mobilization. Through understanding how floodwaters matter, both through their own boundary setting role and in their intra-actions with discourses on race and poverty, it opens up space for intervening constructively to prevent similar situations in the future. And by engaging with food and its displacement of human moods and cognition through both its own incisions and the societal complexes through which it intra-acts, we can better suggest paths to alternative visions of diet and health in society that can improve general well-being. Chris Wilbert (2006) highlighted the phenomena in which avian flu was displaced not only by migratory birds, but also in powerful ways through evolutionary processes constituted by densely placed poultry birds in large-scale factory farms. Taking into account these types of displacements can be employed to prevent further harm in the future if constructive interventions are pursued.

3.2.4 The performance of matter: rearticulating symbolic interaction in materialist terms

A fourth manner in which matter is enacted is through *symbolic action* or *performance*, involving the conveying of impressions upon audiences that shape how they think about a particular issue. Symbolic interactionism, as a human-centric element of constructivism, was already expounded on in chapter one. Symbolic actions involve the performance of specific impressions upon audiences that shape how they think about something, drawing attention to the notion that phenomena are constantly performed and that impressions matter for gaining broader resonance. Conventional symbolic interactionism is based on the idea that humans convey these impressions. Goffman (1959), for example, highlighted how the hygiene standards in a hotel restaurant on the Shetland Islands were performed by the impressions conveyed by the interaction between staff and customers, including particularly the (non) concealment of the backstage food preparation processes. In these conventional accounts, non-human material objects are only conceived of as props, facilitating the human-organized performance of a particular frame.

The notion that the world is comprised of recurring processes through which humans and non-humans routinely intra-act though suggests the capacity for non-humans to also convey impressions upon humans. While non-humans generally are not capable themselves of enacting transformative agency through language and thought, they may still engage in particular actions

that can be internalized or not by other actors, thereby constituting the views and opinions of these other entities. What they can perform is constituted both by their very materiality and the practices and contexts in which they intra-act that confer meaning. Some recent scholarly work has begun to advance this notion of symbolic action of materiality, examining the ways in which matter and discursive practices intra-act through symbolic action to enable particular phenomena.

Research from Alex Thompson (2013) on people with Inflammatory Bowel Disease (IBD), for example, has demonstrated the ways in which the performance of self is closely intertwined with both the dramaturgical performance of the body and the management of the disease through communication in specialized physical spaces. When the body is chronically ill, Thompson points out that there is a great challenge in presenting the image of a morally embodied self to everyday audiences. Consequently, there is also the challenge of warding away stigma from one's self. Thompson demonstrates that feelings of stigma are subverted through interactive processes within support group settings though. In an IBD support group through communication in the language of euphemisms, systems speak, and humor, participants reconfigure their selves into unsoiled organisms. They cast away the befouled nature of their bodies and transcend the self who confronts the problems of fecal matters on a daily basis. The mental health for people with IBD, in other words, is constituted through socio-material performances of self, on the one hand the soiled material body laden with social meaning, but on the other, the management is these experiences through language in the confined physical spaces of support group settings.

Scholars have also examined the role of cross-species relations between humans and other animals, taking note of the reciprocal relations between the species. Erika Cudworth (2011), for example, interrogating dog walking communities, revealed the intimacy that can develop between humans and their dog companions. Dog walkers emphasized the relationships that they developed with particular dogs and noted that the dogs' actions often improved their moods. Public spaces of dog walking became places of beings-in-encounter between dogs and humans, with both particular dogs and their walkers influencing relationships with other humans and dogs in the walking communities. Moreover, dogs adopted from rescue centers showed signs of being affected by prior encounters, including abuse. Cudworth and Hobden (2015b), exploring the relations between camels and soldiers during World War I, similarly highlight the communities that emerged through

the interactions between the species. Soldiers were noted to have become attached to the camels and viewed them as comrade in arms.

Objects though too have been shown to have sparked the imaginations of human populations. Mimi Sheller (2014), for example, highlights the case of aluminum, showcasing the ways in which its lightness, purity, and speed have captivated aluminum dreams. Despite the longer than portrayed incorporation of aluminum into car bodies and other elements of larger pieces of infrastructure, its aerodynamic streamlined shapes has enabled it to be enlisted to thrall audiences and serve as “harbingers of a technologically enhanced future, when travel will be frictionless, smooth, and fast” (Sheller 2014, 103). The very appearance of aluminum as epitomized in the Airstream vehicle, implying mobility, lightness, aerodynamic speed, and durability, is argued to have conveyed meaning to consumers, in consort with American identity of the 1950s. Such narratives shed light on how matter can come to or not come to perform particular ideas that may alter views in specific settings and consequently should be accounted for in examination of phenomena.

This dissertation further highlights illustrations in which performances by non-humans were perceived as conveying particular impressions and imparting ideas within the space of debate over genetically modified organisms. These performances, notably, were often setting dependent. In the laboratory, while particular discoveries in plant biotechnology awed scientists or corporate firms, the transgenic crops that resulted often engendered negative reactions from European consumers. As such, some of the same conditions of possibility engendered from an examination of human speech acts and the respective audience settings in which they are articulated also seemingly apply to non-humans (Salter 2008; Hajer and Uitermark 2008). Honey bees, meanwhile, are shown to have played a pivotal role in the debate over GMOs in Bavaria, through their role as sentinel species in constituting beekeepers as experts in the debate. The symbolic performance of non-humans, including both animals and objects, remains a generally underexplored area in new materialist research, but invites further analysis of cases exploring the relations between objects and humans or animals and humans in particular settings like laboratories, conflict zones, or protest sites.

3.3 Putting it all together: matter as mattering and emergent causality

This section endeavored to examine several of the specific modes of action through which material entities constitute processes in the field of practice, laying out how they work and why engaging with them matters if we wish to better understand the construction of politics. In conceptualizing different capacities of matter as, in part, constituting its ability to perform various agential acts, including gatekeeping, resistance, displacement, and symbolic action, and specifically the potential quality of these enactments, this dissertation has contrasted a socio-material constructivist position with ANT, new materialist approaches, and agential realism. ANT, with its flat ontology, draws no conclusions about the agential hierarchies between humans and non-humans before engaging with the empirical field. Agential realism, meanwhile, premised on the tenet that nothing possesses agency, but rather that agency is something that is enacted and constituted in processes of intra-activity with other material-discursive practices, too neglects *a priori* conceptualizing differences between different types of matter.

Socio-material constructivism recognizes that agency is performed in intra-activity and that practices are conferred meaning in these entanglements, but it also provides space for fleshing out how these intra-actions are pre-figured by the very materiality of matter. This conceptualization is possible on account of the recurring relations between material-discursive practices that provides for a certain degree of stable expectations regarding how particular capacities may displace, resist, convey impressions, and conduct gatekeeping. With the general presumption that human beings are capable of constituting particular rules and norms, of enacting transformative agency through language use and performance, constructivists have already been able to examine some of these processes in action, drawing conclusions on how particular speech moves come to constitute specific contexts and how they matter. If we similarly approach case studies with the presumption that all kinds of matter are capable of performing affective agency, we can tease out how these processes work with different types of material entities (e.g. gatekeeping access points, resistant technological apparatuses, different animal species that convey impressions) within different socio-material contextual settings.

As this dissertation shows, these moves are necessary to better take into account how different processes happen and further how to prepare for and transform them. If we are familiar with the

reciprocal ways in which different animals and humans affect one another in wartime, then we can prepare for these eventualities. Understanding how the enactment of transformative agency by anti-GMO activists comes to gain meaning or not through their channeling through points of privileged access, meanwhile, enables a better understanding of the conditions of possibility that constitute these world making endeavors. And through familiarity with the types of resistance that might arise with any particular type of innovation, we can better understand the feasible trajectories of research and market organization that may emerge in these fields when intra-acting with specific intellectual property rights and political economy practices. Such material-discursive practices, in turn, may be crucial to the acceptance of the new technology, as shown in this dissertation, or may give rise to new political movements that contest dominant structures in society, as Kaup (2014) demonstrated in the case of resource extraction in Bolivia.

This is not to say that the points of intervention should necessarily lie with the material entities that resist or displace. Unlike ANT, socio-material constructivism places an emphasis on both matter and discourse, conceiving of discursive practices as also conferring meaning on other practices, and doesn't equate agential equality between different parts of networks. By investigating entangled and mutually constitutive agencies, it becomes possible to uncover novel sites of power that may emerge only through the intersections of these discourses and particular entities. Socio-material constructivism, then, emphasizes causality as an emergent phenomenon, as something that comes through in the entanglements that appear in particular settings. Wilbert's (2006) findings on the overlooked explanation of avian flu as emerging out of factory farming and food discourses, rather than the seemingly more direct causal factors that intra-acted with these practices, is illustrative of this potential. Mimi Sheller's (2014) exposition of aluminum and its shaping of modernity also underlines some of the quandaries – between development and environmental degradation – that can be unearthed through exploring some of these processes.

In illuminating the socio-materiality of the debate over genetically modified organisms in the EU, this dissertation similarly shows that rather than the surface-level causal variables (e.g. European food identity, aggressive Monsanto behavior, strength of Greenpeace and the European environmental movement) that are generally attributed as the reasons behind the failed translation of the technology, these agential landscapes themselves were conferred meaning and enabled by the socio-material processes in which the technology was developed in the first place. These

processes, in turn, are shown to have been tied in not only with technological apparatuses and genetic materials in the laboratory, but also importantly neo-liberal practices of political economy and industrial agriculture that underpin the very fabric of how scientific research is conducted. Viewing the case in this light, as with the case of avian flu, more than minor tweaking, the non-translation of transgenic crops in the EU suggests that a possible more radical revisit of global practices of producing and consuming food and how these are channeled into crop research may have been needed.

Conclusion

A socio-material constructivist approach shows conceptual promise in providing added value to explaining and better understanding phenomena in politics. More than simply contributing the idea that both humans and non-humans or social and material matter, socio-material constructivist narratives can especially foreground how phenomena emerge from the interplay between different material-discursive practices and entanglements between transformative, reproductive, and affective agency. Such stories can also highlight how within this intra-activity, non-human materiality matters not simply as tools but also as dynamic entities that resist, displace, perform, and conduct gatekeeping and in doing so both confer meaning on other practices and become the recipient of meaning constitution.

These moves are necessary to better understand the constituting of phenomena, including the construction of discursive and material practices, and further how particular discourses come to matter or not in certain situations. In this regard, a socio-material constructivist approach overcomes the shortcomings of the social constructivist and materialist turns laid out in the prior two chapters and also further provides added value in enabling the uncovering of overlooked yet crucial sites of power that are embedded within the very entanglements of politics themselves and further within the incisions that constitute matter as it enters into relatively stable fields of practice. The next three chapters aim to illustrate this added value of the framework, putting it to empirical use. After outlining the case selection and methods employed in chapter four, chapters five and six examine different sites of the debate over genetically modified organisms in the EU.

CHAPTER 4. RESEARCH METHODOLOGY: AN ABDUCTIVE-INTERPRETIVE APPROACH FOR CONDUCTING A SOCIO-MATERIAL CONSTRUCTIVIST ANALYSIS OF THE CASE OF GENETICALLY MODIFIED ORGANISMS IN THE EUROPEAN UNION

Now that I have conceptualized the socio-material constructivist approach of this dissertation, this chapter seeks to set out the case sites in which to assess the added value of this perspective in providing novel intelligibility to our understandings of politics and further to lay out a methodological approach for examining material-discursive intra-activity. In interrogating the EU debate over genetically modified organisms through socio-material constructivism, this chapter argues that an interpretive and abductive approach is needed that ensures exposure to a broad range of different source materials that are then examined in an intermaterial light in the context of alternative and counter explanations to overcome some of the methodological quandaries of this type of analysis.

4.1 Constituting of case parameters

In examining the intelligibility of a socio-materialist constructivist framework, this dissertation takes up the case of the issue of genetically modified organisms in the European Union. This is a case that has been widely explored in existing social science literatures in terms of explaining the development of the stringent regulatory and societal frameworks, operating supranationally and nationally, that have constituted the non-use and non-application of the technology within the EU. Before providing a brief overview of the case, to clarify terminology, it should be pointed out that first of all the EU understands genetically modified organisms to be cells or organisms whose genetic material has been modified through the tools of modern plant biotechnology including recombinant DNA technology (European Commission 2015; Sprink et al. 2016).³ This genetic engineering is conducted with the aim of introducing novel traits in plants, with the two most prominent examples of transgenic crops – a term often used to refer to specific plant applications in farming - including soybean plants that can resist toxic herbicide sprays and maize plants that can resist insects through the release of an insecticidal toxin (Gewin 2003).

³ The biotechnology field, meanwhile, is also commonly referred to as plant biotechnology or plant genetic engineering, terms that I employ interchangeable throughout this dissertation.

The issue first began to come to public light when two major conferences were organized in 1973 and 1975 to review scientific progress and potential pitfalls in the area of biotechnology (Jasanoff 2007). In the EU context, as the first wave of transgenic crops were engineered in the laboratory throughout the 1980s and early 1990s, the issue was generally discussed in the competent agencies of national governments, but came under increasing EU regulatory oversight as the first applications to hold commercial field trials were submitted and significant differences emerged in the regulatory frameworks of the member states (Howlett and Laycock 2012; Jasanoff 2007). From 1990 onward, the overall process in which transgenic crops are approved for cultivation in the EU has come to be characterized as stringent (compared to other contexts), with EU regulatory oversight requiring a process-oriented review of the crops for safety and assessment for risks to humans and the environment rather than the more lax product-equivalence based perspective of the United States that doesn't require additional safety assessment if a particular final product is deemed equivalent to an already approved safe food item (Toke 2004; Sprink et al. 2016). EU legislation, furthermore, dictates mandatory labelling for all products containing or derived from GMOs in any step of the process of producing the food (European Parliament and Council of the European Union 2003a, 2003b).

As of today, only one transgenic crop – a Monsanto maize variety that releases an insecticidal toxin - has been approved for cultivation in the EU, grown in five countries on around 150,000 hectares of land, despite numerous applications over the past couple decades, many of which received “positive” opinions from the European Food Safety Authority, the EU body established in 2002 responsible for risk assessment of transgenic crops in terms of human and animal safety and the environment (European Commission 2015). This contrasts with the over 100 transgenic crop varieties that have been deregulated in the United States and the prevalent cultivation of transgenic soy in many countries of South America, including Argentina, Brazil, and Paraguay (O'Connor and Johnson 2015; European Commission 2015). And there has only been a small reported presence of genetically modified foods sold by food retail chains (European Commission 2015). A notable exception though, explored in this dissertation in chapter six, has been made in the case of the import of GM animal feed. According to 2013 figures, the EU imported around 60 percent of plant protein used for food and feed, mostly genetically modified soymeal and soybean from countries where transgenic soy is prevalent (European Commission 2015).

This case provides a number of advantages for assessing the utility of the socio-material constructivist framework. Especially important is the fact that the issue outcomes have already been widely analyzed from different rationalist and constructivist perspectives. From a rationalist point of view, it has been argued that the EU acted in the protectionist interest of European farmers in rejecting GMOs, thereby leading to WTO complaints from the United States, Argentina, and Canada (Lynch and Vogel 2001; Fortin 2017). This position has been rejected though in favor of identity arguments on the basis that European farmers arguably didn't benefit from the regulatory restrictions on account of the non-competitive nature of the maize and soybeans markets between the EU and the US and the fact that EU had earlier taken more favorable attitudes towards GMOs in light of the fact that it could increase the competitiveness of European agriculture (Lynch and Vogel 2001). Rather, a more pronounced focus has been on explaining issue outcomes through the contestation process involved in the debate and the broader discourses in which such moves have been situated. The anti-GM activism from small-scale farmers, celebrities, consumer groups, and green NGOs combined with misfires from the pro-GM coalition, for example, have been attributed as being fundamental to the EU regulatory disavowal of GMOs (Schurman and Munro 2010; Heller 2013; Stolle and Micheletti 2013). Ansell, Maxwell, and Sicurelli (2006) argue that the anti-GM movement was successful in Europe because they outmaneuvered the pro-GM movement by mobilizing a diverse coalition of actors and effectively using both institutional and direct protest tactics to achieve their aims. This size and initiative was argued to have been lacking in the case of the pro-GM movement as compared with the pro-GM coalition in other countries, with devastating consequences on the acceptance of GM in Europe. In particular, while national lobby associations representing food retailers and conventional farmers were fundamental to the acceptance of transgenic crops in the United States, the equivalent actors in the EU took noticeably indifferent stances that are argued to have affected issue outcomes differently (Ansell, Maxwell, and Sicurelli 2006).

The biotechnology industry, in the 1990s represented largely by the American company Monsanto on the commercial side, meanwhile, is argued to have committed major blunders when Monsanto entered the European market with unannounced and unlabeled products, leading to a broader European revolt against GM (Ansell, Maxwell, and Sicurelli 2006; Bauer 2015; Levidow and Carr 2009; Toke 2004; Schurman and Munro 2010). An anti-Monsanto and anti-GM movement arose from these actions, defined by crop trashing events in which activists destroyed open field trials

and port blockades of GM crop shipments, which was argued to have both successfully leveraged pressure on food retailers to exclude foods derived from GMOs in their supermarkets and further exerted pressure on EU institutions to enact stringent provisions mandating the labelling of all EU products. Various anti-globalization groups were brought into the fold, as may be expected, but so too were farmers increasingly concerned about the labelling requirements that might be imposed on their products (Doherty and Hayes 2012; Seifert 2009).

More broadly, these contestation processes have been argued to have been situated within certain discourses on European food/farming culture, democratic deficits, and the precautionary principle. As an example, the anti-GM coalition was argued to have moved “quickly and effectively to seize the initiative to frame GMOs as a threat to biodiversity and farmer autonomy and an insufficiently regulated food safety issue” in the “context of preexisting issue salience of the mad cow crisis and the emerging antiglobalization movement” (Ansell, Maxwell, and Sicurelli 2006, 119). In this regard, the pre-existing precautionary principle was conceived of as guiding the foundations of risk on the issue. It has also been argued that European identity frames of appreciation for the “natural” non-industrialized environment and “natural” historically-based food have made GMOs an “other” that risks contaminating nature and leading to the artificialization of European life (Hayes 2006). Sassatelli and Scott (2001, 215) have pointed out that “in many European societies food is crucially linked to a sense of belonging to a national community and to the ways each nation has customarily portrayed itself, and often, derogatorily, the ‘others’”. By strategically framing GM as an attack on identity, on legitimating symbols and political values, the anti-GM movement has consequently, as the argument goes, persuaded Europeans to largely reject the technology and its associated negative consequences (Heller 2013). The frames of national identity, food culture, and agriculture are argued to have been synthesized particularly effectively by European small-scale and peasant farmers, including José Bové, the small French cheese farmer turned European Green Party leader, who used the term *malbouffe*, referring to a general disdain for many aspects of globalization-oriented food and agriculture, including GMOs, the fast food industry, and industrialized agriculture (Toke 2004).

Sheila Jasanoff (2007) further situates the stringent GMO regulations and societal developments more generally into a process of Europe-making, which took place within a 1995 context in which the EU was reevaluating its mission and purpose as a political entity. In the context of the debate

on biotechnology, the question was to what extent the EU would coordinate divergent national policies on GM within a period of “ambiguous, contested superstate formation” (Jasanoff 2007, 69). As she argues, “seemingly technical questions about how the EU should promote biotechnology in the member states turned out, in other words, to be unanswerable without also taking on board the deeper question of what kind of European Union there should be” (Jasanoff 2007, 69). At a time period when the EU was seeking to address questions of its legitimacy, this meant improving public opinion on expert advice and specifically on the GM debate it meant a more stringent regulatory framework that took into account public concerns. The 2001 Directive on deliberate release consequently included many of the aims of anti-GM activists, including step-wise evaluation of GMOs, emphasis on the precautionary principle, and space for independence and divergence within member states (Jasanoff 2007).

This sampling of the literature shows that there is space to highlight the added value of a socio-material constructivist approach against these alternatives and counter explanations. Like many other phenomena, the debate over genetically modified foods has rather become a social construction devoid of the materiality of the transgenic crops themselves and the processes in which they’ve been cultivated, the genetic sequences that enable novel traits in plants, and the technologies involved in making such debates possible in the first place. Rather than being understood as producing relations and pre-figuring the terms of the debate, for example, farmland and crops are seen simply as the reflective constitutive product of language and discourse and the object whose management is contested. Specific genetic modifications are brought in only as merited in discussions about environmental activists contesting their impact on the environment, but are left detached from the genetic and technical processes that constituted the (im)possibility for certain transgenic crops in the first place.

The existence of prevalent alternative approaches importantly provides an opportunity to make sense of the value added of examining the debate through material-discursive entanglements by allowing the perspective to be put in the context of these other narratives. Particularly, the socio-material constructivist perspective can be evaluated for its incisiveness in providing novel intelligibility about processes for which theoretical explanations already exist or in filling gaps in knowledge. In this vein, the case of genetically modified organisms in the EU is particularly appealing as there are a number of gaps and inadequacies in the existing literature.

This dissertation specifically explores two prominent areas for further inquiry. While constructivist approaches have generally been able to make sense of the agential landscape that contested the debate and the ways in which these different actors shaped governance on the issue, what remains unanswered is how the agential landscape was constituted in the first place. The populating of the field between biotechnology companies, public research scientists, farmers/producers, and environmental activists is something that is taken for granted – or only explored in its further development in the field of contestation.⁴ Given the importance of these mobilization patterns and power relations in constituting the debate, this is a gap in knowledge that is crucial to fill. By explaining, for example, how multinational biotechnology corporations came into a predominant position in the debate, but not public research scientists, we can illuminate overlooked processes that mattered in constituting the trajectory of the issue and clarify how identity and interest positions came to be articulated. Similarly, if we can understand how it came to be that conventional farmer groups in the EU as a whole articulated positions that were more skeptical of transgenic crops than their counterparts, for example, in the United States, then we can make contributions that go beyond simply pointing out the size and configuration of the advocacy coalitions as strategically shaping the views of EU and national politicians and instead understand how such constellations could have emerged in different ways. As such, two central research questions guiding my case analysis are (1) *how, by what socio-material relations, was the biotechnology sector landscape configured in its power relations* and (2) *how was the generation of interest constituted in the case of different farmer groups (e.g. conventional, organic and small-scale)?*

Another opportunity for socio-material constructivism is to overcome the limitation of existing approaches in making sense of the role of identities and interests in specific situations. Across the EU, while there has been differentiation, for example, in the generation of support/opposition to GMOs among farmer groups situated within different contexts, as might be expected, farmers with arguably similar identities and interests though have also responded in different ways to the issue in terms of their political mobilization and activism patterns, as indicated in different levels of political activity among farmers in the Rosenheim and Augsburg counties of Bavaria that are

⁴ See above and chapter five for a discussion of the relevant literature.

situated within similar contextual environments⁵. While particular traditional farming identities might constitute the generation of farmer opposition on the issue and the possibility of farmer mobilization into anti-GM coalitions, this perspective has limited reach in understanding mobilization in specific cases. If engaging with the intra-activity between different matters and discourses, with the socio-materiality of contestation and lobbying, can help elucidate and provide clarity to the translation of identities and interests into activism, then the approach would demonstrate added value in complementing and seeing further than existing perspectives. This dissertation consequently also explores this research question: *how do interests and identities come to constitute political action in particular contexts?*

Overall, the case of genetically modified organisms in the EU provides promise in offering many different processes and sites to examine, especially with respect to the aim of understanding the different types of ways in which matter may perform agency. As a technology connected both to laboratory science and the field of agriculture, there are numerous material aspects (e.g. crop cultivation, modification of genes) that can be interrogated. As a case of contestation and one seemingly characterized by prevalent discourses, there is also an opportunity though to explore the interplay between discourse and matter and also between particular human and non-human things in these processes. As a debate that largely took place in the 1990s and 2000s – although discussions continue in the present - there is also a wide variety of archived data and few moving elements that would hinder analysis. This dissertation, in chapters five and six, specifically takes up the above questions in elucidating the power of a socio-material constructivist approach. It does so in chapter five by providing an examination of the populating of the biotechnology and agricultural field landscapes in the EU context in the 1990s through a socio-material lens focused on understanding how technical processes in the laboratory and on farmland became intertwined with broader material-discursive knowledge practices, regimes on intellectual property, political protests, political economy trends, and historically constituted farming structures in enabling the production of the research field and farmer interest that came to politically define the debate.

Chapter six, meanwhile, turns to examining a regional case in order to better understand how these processes of the laboratory and agriculture both emerged alongside and were further translated in

⁵ See chapter six for a description of the farming structure of these two counties.

specific sites. Being able to provide added value in understanding regional processes in the debate is especially pivotal to understanding the broader whole in the EU as individual regions have been shown as crucial in constituting national positions and further particular entities (e.g. regional farming associations) are involved in shaping the positions of the equivalent EU-level associations (Spiegel 2009b, 2009a). Interrogation of local sites also allows for the possibility of seeing how specific configurations of matter and discourse come to make a difference. For this dissertation, I chose to examine the case of Bavaria, Germany, which provides advantages in that it was a case of intense contestation, a region that wasn't dominated by a one-sided view in favor of transgenic crops or against. While many prominent regions of the EU such as Tuscany, Wales, and Salzburg collaborated together and immediately joined the newly created GMO-free Regions Network of the EU in 2005, Bavaria rather became the 61st member only in 2014 (Bayerische Staatskanzlei Pressemitteilung 2014). Bavaria also provides a case of political stability in which the same political party (the Christian-Social Union or CSU) has been in power - once in coalition - since the issue erupted on the scene in the 1980s. While CSU political leaders were initially prominent supporters of transgenic crops, they later changed their stances and framing though, setting up local GMO-free initiatives and committing the region to membership in the GMO-free Regions Network⁶. In this regard, the case of Bavaria, from the 1990s to the 2014 GMO-free declaration, provides ample opportunities to explore the different processes at play, as cases of contestation also are sites in which different actors come to struggle to develop political movements and coalitions and articulate their viewpoints on an issue. There is thus an environment in which different theoretical perspectives can be juxtaposed against one another with respect to how their differences make a difference in understanding the case. While these observations provided my initial motivation for examining the case, through my further investigation of different sites of the process, I came to further seek to make sense of how the generation of Bavarian farmer interest on the issue came to be constituted, how it became possible for farmers to demonstrate different levels of political activity in different counties of the region, how farmer attitudes on the use of GMO animal feed was constituted in different ways than their rejection of GM crop cultivation, and how beekeepers became involved on the issue in politically distinct ways from farmers. Overall, the

⁶ See chapter six for further discussion on the relevant literature.

case further puts emphasis on how these different processes came to matter politically in a broader sense in constituting the shift in the position of the CSU party leadership.

With this overview of the case parameters in mind, the next section turns towards highlighting the interpretive methodological approach with which I engaged these different case sites.

4.2 General engagement with the field: abductive strategies for research

As Karen Barad (2007, 91) emphasizes, engaging with the entangled agencies of the world requires a methodological approach that recognizes that “practices of *knowing are specific material engagements that participate in (re)configuring the world*”. The process of knowledge production, in other words, is also the process of world-making or in giving material form to the world, which in turn entails great responsibility on the part of the researcher. Drawing on Barad, what is especially needed in my view is attentiveness to the fine details that make a difference through the setting of boundaries *both* simultaneously in their relations with other things (e.g. the specific material configurations of farmland including topography, climate, spatial distribution of crops, prevalence of bees, and so on in their intra-activity with particular discursive practices), but also through their own very materiality, departing in part from Barad on this second point as discussed in chapter three. Rather than a focus on the perfect translation of undistorted representations, such an approach is contingent on an interpretive research method that allows the researcher to engage with different material sites in all their grainy details and interrogate the different material-discursive practices in their relations with other things, thereby necessitating an iterative and recursive process between different sites.

In accordance with these tenets, this dissertation consequently was overall guided by an interpretivist abductive approach, which entailed beginning from the particular phenomena that I was seeking to explain and then moving back and forth between the empirical field and theoretical explanations of these phenomena (Friedrichs and Kratochwil 2009; Yanow and Schwartz-Shea 2011). As Yanow and Schwartz-Shea (2011, 27) point out, the abductive process involves simultaneously “puzzling over empirical materials and theoretical literatures”. It suggests the examination of particular source materials, the deriving of categories of sense-making, and then the reconceptualization of these categories upon reiterative interrogation of additional fieldwork. At the same time, it means the bringing forth of theoretical insights – sometimes carried over from

similar research or other empirical fieldwork – and constantly reexamining empirical data in light of additional theoretical material. In this way, my research was neither deductive – the testing of specific hypotheses and theories in particular cases – or inductive – the movement from particular observations to broader generalizations, but rather directed in an inferential manner through examination of phenomena and continued movement to and fro between my narratives and empirical observations.

In approaching the field, I came with my prior theoretical knowledge from my reading, for example, of constructivist, new materialist, and other socio-material perspectives and their examination of specific phenomena as discussed in the conceptual reviews in the previous chapters. I also came with the presumption that agency is performed in the context of entangled intra-activity, but also that there was a difference between human and non-human matter in the types of agency that could be practiced by each, that different material entities could be constituted by different capacities that could come to matter. My prior reading of the new materialist literature and my own prior experiences told me that non-human matter could also displace relations, resist actions, and mediate processes and consequently I came attentive to listening for such capacities and their enactments with these initial “hunches” and expectations, but I was also prepared to uncover novel patterns of the performance of agency and the intra-activity conferring meaning toward them.

I further came to the field with an initial reading of the case of the debate over genetically modified organisms in the European Union, which led me to ask particular types of research questions that remained inadequately answered. These observations certainly informed my examination of the field case sites, but importantly didn't will or determine my findings and nor were they simply operationalized and tested as variables in these environments. The specific modes of action of different materialities and the ways in which particular intra-actions between matter and discourse came to matter in my different case examinations were also constantly revised and adjusted in a circular fashion in the process of empirical research. In light of an issue debate that has been examined largely in terms of the identities and contestation processes and interests at stake, I, in fact, didn't expect to find, as discussed in chapter six, difference-making power in terms of coalition mobilization in the banality of a particular well-networked leader or a farmer database that enacted gatekeeping functions. These findings were rather driven by my engagement with

multiple sources including interviews with participants and observers of the process, newspaper accounts, other documentary materials from activist websites and press releases, and material things themselves. Once these enactments initially came to light, in other words, they were incorporated into my tentative theoretical explanations and further examined in the context of the intermaterial relations between different sources.

My examination of the development of the research field of biotechnology was conducted through a similar process of abduction. It should be pointed out that the research question focused on understanding field constitution itself, as pointed out above in the case selection, initially came about as a puzzling and inadequately researched topic through my interrogation of the current literature on the debate over GMOs. Within the inquiry itself, a perusal of review articles and interviews with several scientists involved in plant biotechnology and plant breeding research further directed me toward theorizing about the role of enabling and trait technologies in these processes. Upon interrogation of specific research projects and scientists' reporting of their research processes, it was possible to further refine these categories and theorization of how the complexity of molecular mechanisms – in intra-action with our prior knowledge practices – or access to specific enabling technologies guided both the paths of particular projects and the development of the field as a whole.

In this regard, socio-material constructivist analysis can take lessons from Vincent Pouliot's (2007) subjectivist methodology, which calls for taking into account local subjective understandings and then seeking to make sense and draw meaning out of them within broader intersubjective webs. This process for me began with my prior knowledge as a researcher, but then was adjusted as I came into contact with particular human and non-human entities within specific contexts and sites. The subjective knowledge of scientists, for example, was examined and put into the light of other knowledges to allow for the development of more distant theorization of the entirety of the process. As Karen Barad (2007) notes, engagement with intra-activity entails diffraction, analogous to the process in physics in which waves (e.g. light or ocean waves) bend or spread when they encounter obstacles or slits. The patterns of waveforms and effects that emerge from these diffractions are known as diffraction patterns. In the social sciences, diffraction involves the highlighting of particular patterns of difference and the differential entangled nature of the contingent and changing ontology of the world that produce such patterns. In engaging diffractively with the

entanglement effects of particular entities then, it is important to note that I too consequently was involved in this process of developing theoretical knowledge through my own interventions in which I conferred meaning upon the capacities and actions of particular human and non-human matter and in doing so created new diffraction patterns. As such, this interpretive research was in part removed from the local contexts in which it was embedded, coming with the possibility of distorting specific understandings in devising theoretical explanations, but also providing the added value of “connecting meanings with context” in making sense of particular events and phenomena (Pouliot 2007, 374).

In the context of this approach, the next section now seeks to engage with some of the methodological quandaries that have been raised regarding interpretive research and how the methodological rigor of my dissertation research was enhanced. After laying out some of the limitations of interpretive approaches, the section specifically examines these methodological issues in light of the data collection and analysis procedures that were pursued in my research.

4.3 Engaging with trustworthiness in socio-material constructivist analysis

As an approach reliant on the researcher conferring meaning to particular processes and drawing this information from human interpretations, either that of my own or both that of others and my own, socio-material constructivist analyses can be expected to encounter some of the many limitations of interpretive research that have been outlined elsewhere (Yanow and Schwartz-Shea 2011; Pouliot 2007). In contrast to the positivist emphasis on validity, reliability, replicability, objectivity, and falsifiability of interpretive research, interpretive research is concerned with what Yanow and Schwartz-Shea (2011, 91–92) call the “trustworthiness” of researcher claims, necessitating the addressing of quandaries connected with the process in which knowledge is negotiated.

The epistemic distance between the researcher and the object of study, for example, makes it impossible to fully discern processes. As Herbert Rubin and Irene Rubin (1995) have noted, there are many challenges in recovering pertinent information from first-hand sources. When conducting interviews, care must be taken to ensure that the most accurate accounts are provided by interviewees. In particular, there is a problem in prying out useful information from specific actors who are either too native or too alien to specific processes (Pouliot 2010). Interviewees may lack

conscious knowledge about the world around them - the common problem of interpretive research in asking the fish to describe the water in which it swims (Pouliot 2008). And as Yanow and Schwartz-Shea (2011) note, there is a need to check against the possibility that research participants may intentionally skew their accounts and the nature of events.

These potential pitfalls were recognized both in the interview fieldwork that I conducted and also with respect to other primary and secondary source material such as my examination of peer-reviewed plant biotechnology research as part of an endeavor to understand the emergence of the transgenic crop agential landscape. In approaching peer-reviewed scientific research in my inquiry on the emergence of the plant biotechnology field and agential landscape, for example, I approached the scientific texts with an understanding that scientists in the natural sciences notably themselves become interpretivists in their own research in reporting the history of the field, the steps and complications of their research, and the pertinent findings that they observe. In each of these moves, there is no perfect translation, but rather the experiments are also defined and conferred meaning by the research teams, as attentive and sensible as this engagement may be, or more appropriately by the intra-activity between scientists and science. In following Kuhn (1962) and the significance of paradigms and putting this into conversation with Barad's (2007) notion of intra-activity, these processes, moreover, can be said to be embedded within entanglements with particular paradigms of science and knowledge production that may influence sense-making procedures, including how experiments come to be evaluated. Relatedly, publishing standards could be expected to constitute the type of information that is included or excluded in the reporting of the research process. Beyond this role of sense-making and epistemic practices, it should be further noted that research teams may be selective in the type of information that is included in published research articles on account of word limits or other idiosyncratic factors. As such, pre-recorded textual data too comes with the same problems of ensuring reasonable and sensible analysis of processes and the meanings implied therein.

In the case of socio-material constructivism and new materialist approaches, there is a further quandary that arises in making sense of the agency enacted by non-human matter. As Jane Bennett (2010, xiv) notes, there is no simple process for writing the stories of non-human vibrant matter. Instead what is needed is "a cultivated, patient, sensory attentiveness to nonhuman forces operating outside and inside the human body". As Barad (2007, 91) further adds, there is a need for

attentiveness to the fine details of matter, including in her example the size, volume, and spacing of slits in diffraction gratings, and the ways in which these minute differences come to make a difference in processes of intra-activity. Given the inability to speak to these entities, such understandings must come from human observations and interpretations, either that of the researcher directly or as reported by other human beings. For this reason, Can Mutlu's (2013) review of the materialist turn takes note of the fact that researchers in their data collection and analysis rely on human interpretations of non-human things and similarly to constructivists draw on policy documents, participant observation/ethnographic techniques, interviews, newspapers, other field research, and secondary literature. In the laboratory, as an example from this dissertation, it is the research teams, not the material objects - as imposing as they may be in their reciprocal relations with humans and other things - that make decisions about how the research is framed (e.g. a scientist reporting on the characteristics of a particular gene and the molecular mechanisms in which a particular protein is embedded). Aradau (2013) though importantly points out that analyzing documents to discuss materiality is not necessarily a problem if we presume that matter and discourse are entangled with one another. At the same time, understandings of matter in the natural sciences must be viewed cautiously, as they have notably been subject to review over time, with findings often noted to be inaccurate or false, a point acknowledged by Bennett (Ioannidis 2005; Bennett 2010). This further highlights the fact that even though non-humans may have a powerful existence beyond their relations with humans, what we conceive of as non-human agency is, in fact, entangled with our human understandings of objects and things, which may at times be faulty.

In light of these limitations, I sought to make best use of interpretive research methods through enhancing what Yanow and Schwartz-Shea (2011) call the trustworthiness of a research project. As Kratochwil (2000) points out, this process is similar to finding truth and facts in a courtroom. Rather than a positivist conception of falsifiability per se, such projects should especially be guided by the question of "*How would you know if there were something else afoot in this situation that might be a better explanation of the puzzle you are seeking to explain?*" (Yanow and Schwartz-Shea 2011, 108). Following from Yanow and Schwartz-Shea (2011), this dissertation indeed takes the position that the trustworthiness of conducting socio-material constructivist research is contingent on pursuing strategies of exposure to multiple sources and perspectives for all truth claims, reasonable engagement with alternative accounts, and the use of logical argument, the

weighing of evidence, and counterfactual reasoning in the sense-making process. It is through use of these methodological tools that it becomes possible to identify plausible shortcomings of a theoretical explanation of a particular phenomenon and consequently constitute the credibility of the research. The next two sub-sections explain how these insights were incorporated into my case studies through data collection and analysis methods.

4.3.1 Ensuring exposure: procedures for field preparation and analysis

Yanow and Schwartz-Shea (2011) refer to the concept of exposure as the process in which the researcher exposes themselves to the perspectives of a wide range of different relevant participants connected to their specific research purpose, including through interviews, participant observation, field research, and/or written/visual records. This incorporation of multiple data points is often referred to as triangulation in positivist-qualitative research and is aimed at finding particular convergences in which our understandings of reality become true. Interpretivists though have pointed out that this process of exploring different sources also involves finding inconsistencies and contradictions and therefore refer to it as intertextuality (Yanow and Schwartz-Shea 2011). Within any topic, importantly, variance can be expected among participants in terms of their backgrounds, locations, roles, and vantage points, consequently entailing a need to account for this diversity of sense-making experiences. This dissertation, furthermore, recognizes that meaning construction not only involves humans but also non-human matter and the patterns of diffraction constituted through the entanglements between these entities. For this reason, I employ the term of *intermateriality* to denote the notion that there is a need to map out relevant human (e.g. activists, farmers, politicians, scientists, etc...) and non-human entities (e.g. pollen, bees, laboratory technologies, genes, proteins, plant tissues, etc...) that could be expected to contribute to the process of developing broader understandings about any particular phenomenon. Notably, it should be pointed out though that while selected human participants may be able to share their experiences first-hand, with non-human matter it is necessary for the researcher either to draw on the second-hand sense-making of individuals who are engaged with these materialities or themselves through sensory attentiveness and observation tease out how such material things experienced particular processes. In this regard, Aradau (2013) emphasizes, in particular, that drawing on a varied selection of documents and source materials is crucial to being able to trace materialization processes in different contexts.

With regard to exposure, the dissertation employed the use of multiple primary (scientific texts by plant biologists and biotechnology scientists, interviews with a range of relevant individuals, media discourses from print, radio, and television, and webpages/news bulletins/reports/press releases from a range of different organizations) and secondary source literature that were incorporated into data analysis. In this vein, different entities and material-discursive practices were mapped out and allowed to intra-act with one another through the lens of myself as the researcher, thereby together constituting both particular shared and inconsistent meanings. As various barriers – language skills of both researcher and prospective participants (including the inability of material objects to speak at all), time availability/willingness of prospective participants, time and financial constraints on the part of the researcher - hindered complete randomization and sampling of the entire field, the overall strategy pursued was instead one of exposure to numerous perspectives in the field. This process was “complete” to the satisfaction of the researcher when the principle of saturation was – when feasible in terms of access to data - met – when the same findings repeated over and over across different sources and case sites (Miles and Huberman 1994). For example, many of the key elements of the story of a major protest in Rosenheim and its perceived effects on the CSU, as highlighted in chapter six, were verified repeatedly across multiple sources, including both interviews with key actors involved in the events and newspaper reports. Similarly, key findings related to the complexity of particular types of genetic traits and associated costs in conducting transgenic crop research recurred across numerous sources, including multiple scientists that I interviewed and scientific texts that I examined.

In some cases, incongruences in accounts appeared though, for example, with respect to interpretations regarding Bavarian farmer attitudes towards the utility of transgenic crops in the region. In that case, disagreement emerged among different agricultural experts that I interviewed. These differences were annotated in my field protocols and then pursued in further probing with additional interviewees or other data sources. The findings were then emphasized in my narratives only to the extent to which they were generally corroborated across several sources. In the aforementioned case regarding Bavarian farmers, the review of additional sources and interviews with experts in farming and plant breeding and with individuals who maintained political connections with farmers, in fact, revealed a complicated view of the relations between transgenic crops and Bavarian farmers, one largely marked by an understanding that some farmers perceived

transgenic crops as having some potential for the area, with others disagreeing, but overall signified by a context in which farmers were rather indifferent to their utility and in which plant breeding scientists and farmer representatives perceived topographical and geographical barriers in Bavaria to the local use of the most common crop varieties. As such, my findings heeded this ambiguity, emphasizing the generally apathetic attitude of farmers in the region for or against GMOs, while recognizing the fact that some Bavarian farmers wanted to cultivate transgenic crops and further the opinion that Bavarian farmers were generally oriented toward the economics of modern farming. This allowed me to establish a narrative, with the aforementioned caveats, that it wasn't inevitable that farmers would campaign against GMOs, a general point of agreement among experts regardless of whether or not they perceived a potential utility for or farmer interest in transgenic crops in the region.

The interviews (thirty nine in total) largely took place during fieldwork trips to Brussels, Belgium in July 2014 and Bavaria, Germany in July 2015 although some additional interviews were conducted over phone. The interview participants were selected through purposive sampling – the inclusion of interviewees based on their knowledge of or experience with respect to a particular topic (see: Palinkas et al. 2015) - premised on an initial review of the primary and secondary source document literature, taking note in Bavaria, for example, of organizations and figures regularly cited in the media or of particular types of actors (e.g. politicians, plant breeding scientists, farmers) that could be expected to be able to provide a plausibly relevant perspective on the debate trajectory from their first-hand perspective (e.g. scientists on sense-making in the process of plant biotechnology research; farmers with respect to the processes in which their mobilization was constituted, etc...). The selection was further aimed at including a symbolically representative range of individuals from environmental organizations, corporate watchdog groups, agricultural organizations (small-scale and conventional), the food sector, the biotechnology industry, the scientific community (both university and government-affiliated scientists), civil society activists, Bavarian political parties, and EU political institutions, including the EU Parliament, the EU Commission, and the Scientific Advisory Office to the EU Commission President.

The interviews were approached in a semi-structured manner by which I mean that the interviews were neither rigidly structured in a survey manner nor without any guidance as in an unstructured interview. Instead, topic guides were prepared in advance with open-ended questions based on

research regarding the concerned interviewee(s) and a perusal of primary and secondary source material on the respective case site/topic. On account of the different sites of the debate that I was exploring (e.g. laboratory research, agriculture, civil society protests), these interview guides differed substantially in substance. In general though, the interviews began by capturing the role of the participants in their particular realms of the transgenic crop issue trajectory and then opening up the discussions to allow the interviewees to speak more freely about their point of views on the concerned processes (e.g. laboratory research, mobilization of farmers in a county, etc...) for their particular sphere of the issue. Despite the use of the guides, I allowed the interviews to proceed in unexpected directions and actively pursued additional probing questions when I deemed them relevant (e.g. probing into specific details about the organization of a protest event). The advantage of this approach was that the participants were able to share knowledge that was relevant for them while at the same time not straying too far away from the overall research objectives. Following the interviews, transcripts and protocols were developed highlighting pertinent findings and particular themes that I identified as necessitating further research. The data was employed generally as part of a strategy of *intermaterial mapping* in consort with narratives developed through the examination of other source materials, thereby allowing for the identification of patterns and contradictions between different sources and my engagement with them.

The purposive sampling of scholarly research articles in consort with interviews was especially pivotal in the preparation of the chapter five section focused on examining access to the field and the trajectory of transgenic crop research. This area of inquiry was refined following an initial perusal of these topics through interrogation of multiple review articles in the field of plant biotechnology and interviews with scientists and other experts in the area of plant biotechnology and plant breeding⁷. The review articles were selected based on an examination of numerous digital research databases, collections, and libraries, employing relevant key search terms such as “plant

⁷ Numerous review articles (Sussex 2008; Christou 2013; Vasil 2008; Mahfouz, Cardi, and Stewart 2016; Kamthan et al. 2016; G. Hansen and Wright 1999; Ahmad and Mukhtar 2017; Lindsey 1992; Barton and Brill 1983) were examined.

biotechnology trends”, “transgenic crops review”, “plant genetic engineering history” and related combinations.⁸

These entry-level sources provided initial findings through which I was able to establish that the development of enabling technologies such as *Agrobacterium*-mediated transformation and particle bombardment-mediated transformation and the complexity of trait technologies performed a crucial role in the trajectory of the field. In this regard, I further narrowed my search terms in the different databases and pursued relevant cited work, examining both review articles and original scholarly articles related to these forms of genetic engineering technologies. An interrogation of multiple sources and research projects enabled an identification of particular recurring themes with respect to the research process and the functioning and complications that arose with different research projects. I, for example, further examined specific research projects tailored toward developing novel traits in plants, focusing on the barriers and knowledge understandings imposed by different targeted genetic sequences and molecular mechanisms. When particular entities (e.g. the restrictive nature of the use of *Agrobacterium*-mediated transformation systems) were identified as constituting particular effects, I sought to verify these interpretations through other scholarly articles and/or the supplementary interviews with scientists in the field, allowing the material entities to lead me on in this type of sensory way in which it became possible to map out and make logical connections regarding their feasible effects in specific situations.

The case analysis of the agricultural agential landscape - and its connections with supranational legislative processes in Brussels and European political economy trends – similarly draws on interview fieldwork that I conducted with various actors connected to these processes as referred to above and the secondary source literature that has broadly examined the generation of farmer interest in the debate and anti-GMO farmer movements in particular countries.⁹ This data is complemented with my analysis of primary source material and review articles in the natural sciences related to pollen drift and gene transfer, thereby adding to constructivist accounts of the

⁸ The databases included: Science Direct, Web of Science, SpringerLink Journals, JSTOR, EBSCO, and Google Scholar.

⁹ These scholarly books, book chapters, and journal articles were identified through the use of digital research databases and libraries for the humanities and social sciences, including Project Muse, Taylor and Francis SSH Library, Web of Science, SpringerLink Journals, JSTOR, EBSCO, and Google Scholar.

phenomenon.¹⁰ Building on the contextual foundation of the biotechnology and agricultural empirical work, the case analysis of Bavaria explores the emergence and translation of these processes at a local level. The chapter especially draws on interview fieldwork with a variety of different actors involved in the process, including representatives of Bund-Naturschutz, Zivil Courage, county-level anti-GM initiatives, the Bavarian Farmers Association, local plant biotechnology and plant breeding scientists, and political party representatives. These sources are supplemented with data collected from the websites of the relevant civil society groups, Bavarian government websites, and key word searches in Bavarian and national newspapers related to “gentechnik” and “gentechnikfrei”. Newspaper articles were especially interrogated in connection with particular protest events that were mentioned in interviews or appeared in activist websites and used to verify specific details and analyze reactions to these protests. With respect to non-human matter (e.g. pollen, bees, topography), I sought to verify details about the capacities of such material entities and the ways in which they became entangled in intra-activity in my case studies to the best extent possible through the above sources. It then became possible to logically reason about their potential effects in different contexts.

Overall, this strategy of exposure ensured breadth in terms of the number of different human and non-human entities in which I engaged. It is especially important to emphasize that while this research design mapping was prepared in advance, it was also constantly readjusted as the project advanced and new interpretations came to light, thereby leading me in novel directions that necessitated both broader and more refined exposure. In this way, as expected for interpretive research, data collection and analysis were intertwined (Yanow and Schwartz-Shea 2011). This engagement with contextual understandings, in turn, allowed me to then broaden these experience-near knowledges out and put them into the intermaterial context of other understandings accessed through other sources, enabling the development of broader narratives on entanglements that came to matter (see: Pouliot 2007). The next sub-section seeks to engage more strictly with this process of analysis.

¹⁰ These scholarly articles were identified through the use of digital research databases and libraries for the sciences, including Science Direct, Web of Science, SpringerLink Journals, JSTOR, EBSCO, and Google Scholar. Particular key word search terms included “bee travel”, “pollen drift”, “pollen-mediated gene transfer”, “

4.3.2 Demonstrating novel intelligibility to alternative explanations through the use of argument

As Yanow and Schwartz-Shea (2011) point out, consideration of counter and contradictory accounts is crucial to enhancing the incisiveness of any particular theoretical explanation, insights that were incorporated into the data analysis stages of my research. My theoretical findings were especially compared against alternative rationalist and constructivist approaches, perspectives that were selected based on their predominance in the field, as noted above, and their prevailing status in international relations and political science research. The different explanations were each allowed an opportunity to make sense of particular events and phenomena, with the chapters taking note of their contributions and shortcomings. The dissertation overall argues that the socio-material constructivist approach provides added value in improving understanding of particular events. While interpretive studies cannot adjudicate a “final” answer in a transcendental way - an insight noted by Pouliot (2007) - I assessed the relative validity of arguments by examining their incisiveness – referring to the capacity of interpretations to see further than counter interpretations. Through the possibility of academic debate and reinterpretation, these interpretations, moreover, are always subject to further contestation.

As an example of this procedure, chapter six highlights the intra-actions between material gatekeepers (e.g. farmer databases, well-networked individuals) and anti-GM activists across different case sites (e.g. Rosenheim and Augsburg Counties) that were vital in constituting the mobilization of farmers against transgenic crops. The narrative first of all highlights the limitations of identity and interest-oriented arguments that are unable to account for how interest/identity constellations are translated into action or not in specific contexts. In this case, two counties revealed different political mobilization outcomes despite their similar agrarian backgrounds and material interest environments. In this regard, rational choice theory, as represented in, for example, resource mobilization theory, through an examination of costs and rewards is unable to alone account for individual involvement in one case but not the other (McCarthy and Zald 1977). Similarly, approaches focused on collective identity formation and framing struggle to alone make sense of the differential mobilization of farmers given the similar framing endeavors that were articulated and agrarian backgrounds of the areas (Hunt et al. 1994). Through comparative analysis across the two different sites and the intermaterial engagement with newspaper accounts and

interviews held with different activists and observers of the process, the socio-material constructivist narrative presented in this dissertation establishes that the intra-actions between matter and discourse and the agency conferred through them were significant to the political outcomes. In this regard, the socio-material constructivist approach is shown in this particular analysis as being able to complement rationalist and constructivist explanations through clarity on the processes in which interests and identities come to be channeled.

In terms of making sense of data, through the abductive research method, I categorized entanglement effects. Due to the complexity of the nature of the reporting of scientific findings, my interpretations in chapter five were based on my own judgement and engagement with scientific texts and interviews with scientists. In exploring the development of transgenic crop technology in the laboratory, specific genetic sequences were rendered/categorized as posing resistance, for example, when interviewees or research terms reported their struggles in manipulating these sequences. Conversely, conformity to specific actions was identified through the reporting of adherence of technologies to the intentions of research teams. These types of understandings were often either directly referred to or implied in sections of research articles focused on literature review, research procedures, and discussion that the research teams provided. Scientists often directly made note of what specific enabling technologies enabled or constrained them from doing with ease. Similarly, in chapter six, particular entanglement effects (e.g. role of matter as gatekeepers and as crucial constituents of action in intra-activity with anti-GM activism) were identified based on my interpretation of interviewee and other texts (e.g. the discussion by anti-GM activist of the lack of a farmer database in Augsburg County and its role in hindering the group's feasible activities). As discussed above, in accordance with the principles of intermateriality and abduction, these findings were verified across multiple sources in a reiterative process. Such indications more broadly made plausible conclusions that the socio-material approach provided added value in clarifying the constituting of interests and identities that are crucial to constructivist and rationalist accounts.

To enhance the methodological rigor of these comparative engagements, the case sites were especially pursued through logical argument, counterfactual reasoning, and the weighing of evidence generated through processes of intermaterial mapping. In examining the role of specific protest events and their socio-material coming together and mattering, my findings relied on the

sense-making of interviewees in highlighting the effects of bees or tractors, but also a pragmatic engagement with the repercussions of such processes in generating media coverage and counterfactual reasoning on what may have happened if not for the particular reciprocal relations, for example, between bees and Bavarian society and their articulation in the debate over genetically modified organisms. An engagement with the story of the import of GM soybeans for animal feed is similarly contingent on counterfactual reasoning in contemplating what may have been if not for particular practices, including European demands for protein-rich meat, the government acceptance of transgenic crops in Argentina, Brazil, and the United States, and the climate patterns of Bavaria and their repercussions on soybean cultivation in the region.

Conclusion

The objective of this chapter was to introduce the case sites of this dissertation and connect them with the methodological data collection and analysis process. The case that was broadly selected was the debate over genetically modified organisms in the EU, a strategic choice made in light of the proliferation of pre-existing explanations of the EU issue outcomes (to which I could juxtapose socio-material constructivist narratives), the neglect of materiality in this existing academic literature, and the presumption that as an issue that has been deeply contested and revolves around technology, there would be ample opportunity to examine the novel intelligibility that a socio-material approach would be able to provide. More specific case sites within this broader case were also presented, which, rather than being solely pre-selected, were constituted in the abductive process in which access to the field was negotiated. Data collection and analysis was oriented toward the interrogation of various documentary sources and interviews with the aim of ensuring exposure for the intermaterial engagement with these sources at a higher level of abstraction, while staying true to the abductive circular nature of interpretive research where theoretical explanations and empirical field are constantly adjusted with one another and contradictions are explored. This methodological approach offers promise in diffractively engaging with the materiality of the world in a responsible way that enshrines trustworthiness into the process. The next two chapters now seek to employ the conceptual apparatus and methodological approaches outlined in engaging diffractively in an intra-active manner with the empirical field.

CHAPTER 5. THE SOCIO-MATERIAL CONSTITUTING OF THE PLANT BIOTECHNOLOGY RESEARCH SECTOR AND THE MOBILIZATION PATTERNS OF FARMERS IN THE DEBATE OVER GENETICALLY MODIFIED ORGANISMS IN THE EUROPEAN UNION

As outlined in chapter four, a central focal-point of the existing scholar literature examining the politics of genetically modified organisms in the EU has been on explaining issue outcomes from the perspective of the pro and anti-GM coalitions that have contested the debate. This literature has especially put an emphasis on the role of multinational biotechnology firms, the environmental movement, farmers' organizations, and food retail groups in constituting the issue through particular frames about transgenic crops and food, performances that have in turn recalibrated societal norms and influenced the acceptance of the technology in the EU (Toke 2004; Ansell, Maxwell, and Sicurelli 2006; Schurman and Munro 2010; Heller 2013; Stolle and Micheletti 2013). While environmental groups and small-scale farmers are argued to have effectively raised alarm regarding the safety risks of the technology and appealed to identities premised on the "natural", for example, the multinational biotechnology company Monsanto is argued to have helped reinforce these motifs through its perceived hasty and aggressive introduction of transgenic crops in the EU market and its unwillingness to compromise (Charles 2001; Hayes 2006; Ansell, Maxwell, and Sicurelli 2006; Bauer 2015).

What is, nonetheless, neglected is an accounting of how this agential landscape was constituted in the first place. This is to say that there has been inadequate analytical attention directed toward understanding how the field came to be populated in the way that it was. While we know that Monsanto's record of public engagement on the issue mobilized opposition to transgenic crops, for example, the question is raised about how the company came to be put in this role in the first place. Similarly, although the activist roles of small-scale and organic farmers and generally indifferent attitude of food retailers and conventional farmers have been deemed pivotal in stabilizing the anti-GM regulatory framework in the EU, it remains a question how their positions in the field and their particular power representations became possible (Ansell, Maxwell, and Sicurelli 2006; Seifert 2009; Toke 2004; Doherty and Hayes 2012). These understandings are, nevertheless, crucial in light of the literature highlighting the importance of coalition composition

in shaping issue outcomes (Hajer 1993; Sabatier 1988). By pursuing these areas of inquiry, there is an opportunity to uncover overlooked sites of power in the process, beyond the language use and framing that are typically deemed as fundamental in shaping the issue trajectory. By putting a spotlight instead on how such entities and frames were pre-figured in the first place, we gain purchase on how the coalitions that constituted the issue could have emerged in different ways and thus how the debate could have been shaped differently.

Consequently, rather than further examining the processes involved in negotiating the public policy of the issue, this chapter endeavors to interrogate how this agential landscape and the power relations between different actors fell into place, explaining, for example, the dominance of major private firms in the biotechnology sector eco-system and how the constituting of the nature of the research process set this research on a particular trajectory that made a difference. The chapter argues that rationalist approaches, although they provide plausible explanations, fall short in their failure to account for the (contingent) background processes in which interests are constituted. And in doing so, they provide a deficient understanding in terms of how the processes could have proceeded differently. And though constructivist accounts can partly help understand the construction of interests through a focus on the norms and identities shaping the decision-making context, they are not able to coherently explain key questions, including, for example, why the plant biotechnology agential landscape diverged from historical patterns in the plant breeding industry, and they under-emphasize the amount of contingent work put into political mobilization patterns. At the root of my alternative explanation instead is that these field compositions were constructed socio-materially through the intra-actions between particular material-discursive practices.

This chapter specifically hones in on two sites of the agential landscape and their emergence and the power relations between actors that developed therein. These sites were selected based on the importance assigned to them in the academic literature in terms of their role in shaping the issue trajectory on the issue. Section 5.1 concerns the innovation/knowledge sector, encompassing the biotechnology companies and public research scientists that conducted research and development on plant genetic engineering. This section first establishes their particular roles and positions in the public aspects of the debate, noting that the biotechnology companies, including especially Monsanto, have been perceived as instrumental actors in the process. The section then transitions

into explaining how this particular micro-field was populated, first outlining how rationalist and constructivist perspectives might approach this question. After noting the limitations of these approaches, the section then provides a socio-material constructivist account that draws out how the biotechnology sector and the research process emerged from the entanglements between particular material entities (e.g. genetic sequences, laboratory equipment) and discursive-material practices (e.g. intellectual property rights regime, agricultural demands). The section concludes by once again highlighting how these processes of emergence of the issue area came to impart particular effects on the contestation over the issue, processes that could have plausibly been different if certain contingent processes (e.g. a US court decision on the constitutionality of patents in the life sciences) had been different.

The second site (section 5.2) is focused on the mobilization of farmer organizations into the anti-GM coalition or into indifferent roles in the public debate over the issue. This was noted as a significant departure point from other contexts, most notably the United States, where most farmer organizations and food retailer groups were largely unified in their support of genetically modified organisms and the rejection of stringent regulatory and social rules. After establishing the positioning of these entities within the broader agential landscape, the section proceeds to examine how their roles were made plausible in the field of practice, complicating conventional approaches by underlining how material things such as pollen were constituted as powerful entities that shaped these processes, but only in consort with particular material-discursive practices, including EU regulatory regimes on labelling, the political economy of supermarket branding, and European agriculture structures.

The findings indicate that a socio-material constructivist approach uncovers important sites of power in the process, enabling a more penetrating understanding than mainstream approaches of the construction of the agential landscape and the public policies that were engendered through these configurations. In particular, the approach complicates and fills gaps left unexplained by other approaches, including how particular interests of biotechnology companies or farmers came to be constituted and how certain identity-interest constellations came to matter or not in the enrollment of particular entities. Rather than being determined in any direct cause-effect manner, the biotechnology sector landscape, for example, is shown to have become meaningful through particular discursive-material practices (e.g. global intellectual property rights regime on the life

sciences) and their entanglements with other material-discursive practices that reinforced these principles through their performance of resistance or compliance (e.g. genetic material/plant cell complexes that complicate the achievement of particular research or societal aims) and gatekeeping (e.g. limited options in terms of technologies enabling gene transfer). Similarly, the mobilization of EU farmers against transgenic crops is demonstrated to have been constituted by both the ability of insects to carry pollen over great distances and the entanglements of these processes with other material-discursive practices related to the topography and spatial distribution of farmland and the contingent socio-material work put into the development of an EU labelling regime. These are not at all trivial matters, but rather showcase contingencies that shaped the trajectory of the field in perhaps unexpected ways and in turn rendered implications on the public policy debate. In this regard, this empirical engagement in de-reifying and unpacking the presuppositions of other perspectives shows that the socio-material constructivist approach not only improves understanding of politics, but also elucidates space where particular (strategic) interventions could have made a difference in issue outcomes. It is in understanding these conditions of possibility in the socio-material construction of the world that we can begin to constructively engage with and improve our politics.

5.1 Contextualizing the biotechnology research field landscape and its incongruences with historical patterns

There have been multiple groups of actors, including large biotechnology corporations, small and medium sized enterprises (SMEs), university scientists, and public research institutes, involved in conducting research and development (R&D) on GM crop varieties. Commercially though, in practice, the different groups of actors have occupied different positions in terms of their role in developing transgenic crop applied research and then in subsequently marketing and/or providing such GM applications to producers and consumers. Importantly, these different field positions, explored in this sub-section, have been understood as mattering in shaping the contours and ultimate trajectory of the issue debate.

Large multinational corporations have been at the center of the development of transgenic crops and food, a deviation from their lower level of involvement with conventional plant breeding in the past (Graff et al. 2003). In the European Union, there have been numerous companies that have

at different times marketed particular GMOs for cultivation, animal feed, or food, including the American Monsanto, the German BASF, the Swiss Novartis (now Syngenta), the German Bayer, the American Dow AgroSciences, and the American Pioneer (now DuPont Pioneer).¹¹ Monsanto's MON 810 maize – corn modified to resist insects – was approved for farming in the EU in 1998 and is the only GMO currently cultivated in the EU, with 2013 data showing that it was grown in five member states on around 150,000 hectares of land or less than 1.5 percent of total maize production in the EU (European Commission 2015). In 2010, a potato crop used for industrial purposes was also approved by the EU, but the GMO crop developed by BASF has now been discontinued and is no longer authorized in the EU (European Commission 2015).

While only one crop is currently approved for cultivation, numerous GMOs have been approved in the EU for food and feed, including cotton, maize, soybean, oilseed rape, and sugar beet, all originating from the aforementioned multinational companies¹². And there have been multiple commercial applications for GM crop cultivation submitted by the major corporations, particularly relating to the production of GM maize modified for insect resistance, but also sugar beet and oilseed rape for herbicide-tolerance (European Environment Agency 2002)¹³. These applications, nevertheless, amidst public outcry, have not been sanctioned with EU approval. Moreover, one study found that 65 percent of GMO field trials in the European Union between 1991 and 2001 were conducted by large companies (Lheureux and Menrad 2004). And internationally, 74 percent of the intellectual property in agricultural biotechnology is held by the private sector, with the predominant majority of this total constituted by large companies (Graff et al. 2003).

The market position of SMEs, meanwhile, presents a contrasting situation. Their scope in terms of the development and provision of specific GMO applications has been limited in scale, with only 6 percent of field trial notifications between 1991 and 2001 in the EU arising from such firms (Lheureux and Menrad 2004). One study noted that there has been a particular tendency for SMEs that are focused on developing transgenic crop applications to either merge with larger companies or fold (Blank 2008). Meanwhile, a German government plant breeding scientist pointed out to me that although SMEs are often driving forces of technology, in the case of agricultural

¹¹ Information taken from the EU Register for authorized GMOs; see: http://ec.europa.eu/food/dyna/gm_register/index_en.cfm

¹² Ibid

¹³ Ibid

biotechnology, the commercial market was dominated by large multinational companies, with smaller companies unable to gain a market niche (Interview, Peter Doleschel, 2015).

The commercial involvement of university and government scientists tracked similarly to that of the SMEs. Despite the fact that early research on genes and the mechanisms through which they affect plants was conducted at universities and in spite of the fact that public research institutes (e.g. specialized government plant breeding facilities) have historically played a major role in developing applied research in conventional plant breeding, it has been noted that such university and government scientists were rarely directly involved in the development and marketing of GMO products or applications (Rotman 2013; Graff et al. 2003). University and public research institute scientists were noted to have accounted for only 17 percent of field trials between 1991 and 2001 in the EU (Lheureux and Menrad 2004). A rare case in which a university directly made transgenic seeds available to producers was the development of virus-resistant papaya by scientists at Cornell University in the United States that was provided to growers in Hawaii at cost (Gonsalves, Lee, and Gonsalves 2007). There have, nevertheless, been no similar cases in the European Union. Internationally, the public sector accounts for only 24 percent of intellectual property (Graff et al. 2003).

In addition to the “who” of the production of GMOs, another important aspect that has been established as constituting the agential landscape is the “what” of transgenic crops, referring the trajectory of plant biotechnology research. At a time period when European societies were formulating their first impressions of the technology in the 1990s, the nature of the specific GM products and applications, including perceived costs and benefits, weighed on the debate. As it were, the biotechnology industry’s focus on transgenic crops in the 1990s was preoccupied with the pre-existing industrial agricultural system with a particular focus on alleviating problems related to pests and weeds. There was minimal development of crops, meanwhile, targeted toward adaptation to extreme environmental conditions (e.g. drought-resistance), nutrition enhancement, nutrient uptake efficiency (e.g. plants that require less fertilizer), disease resistance, and food quality (e.g. “improved” flavor). From 1991-2001, a total of 53 percent of field trial notifications in the EU were related to insect or herbicide-resistant crops compared to 13 percent for pathogen resistance, 12 percent for nutrition-related GMOs, and 4 percent for abiotic stress and yield-oriented transgenic crops (Lheureux and Menrad 2004). The EU’s first (and currently only)

transgenic crop approved for cultivation was Monsanto's MON 810 Bt maize – corn modified to resist the European corn borer pest. Later applications – not approved for commercial cultivation in the EU - focused on adding herbicide tolerance to crops, thereby enabling farmers to use herbicide spray without any harming their own crops.¹⁴

In noting the configuration of the agential landscape, it should be emphasized that the academic literature has also established that these particular entities and the power relations between them mattered in constituting the field of practice. In addition to their outsized roles in research and development, large biotechnology companies, for example, have been noted as crucially significant actors in constituting (negative) public attitudes of GMOs in the EU (Ansell, Maxwell, and Sicurelli 2006). And this is especially the case with the American company Monsanto, which has received the bulk of scholarly attention. This is in no small part due to the fact that as plant genetic engineering was first debated in the 1990s in the EU, the crop and food markets were largely dominated by the corporation's products. The company consequently became a central focus for the news media and groups skeptical of GMOs.

Analysts have pointed in particular to the interactions that Monsanto had with European societies as fundamentally shaping the contours of the debate, including the specific frames employed to contest the issue and the configurations of actor-networks arising to challenge GMOs on such grounds (Ansell, Maxwell, and Sicurelli 2006). It has been argued that the decision of Monsanto to begin exporting non-labelled and non-segregated GM soy into Europe in 1996, the first commercial GMOs to reach continental Europe, in particular destabilized what had been an already only cautious tolerance of GMOs in at least certain parts of the EU (Levidow and Carr 2009). Port blockades in Hamburg and other direct action campaigns across the EU led by environmentalist and consumer groups were said to have arisen directly in response to Monsanto's move to impose the non-labelled products on European consumers (Schurman and Munro 2010). Monsanto's overall approach was labelled as arrogant and aggressive and lackluster in terms of persuading societies to accept GMOs (Bauer 2015; Interview, Gerhard Wenzel, 2015). Its refusal to label its products in particular was understood to have put pressure on European food retailers to support labelling of transgenic crops and exclude such products from their grocery shelves, consequently

¹⁴ Ibid

sidelining an actor whose parallel sector in the United States had been pivotal as part of the pro-GM alliance in that country (Toke 2004; Pringle 2003; Kilman and Cooper 1999; Mitchener 1998). Altogether, as public support for genetically modified foods waned and transgenic crops and foods became untenable in the EU, other biotechnology companies piled blame on Monsanto's shoulders (Coghlan 1998; Harvey 1999).

One particularly notable effect that Monsanto engendered on the debate was in broadening the issues at stake, in turn inviting in more groups to protest against GMOs. Highlighting Monsanto's role in steering the nature of the discourse on the issue, the Assistant to the Chief Scientific Advisor of the European Union pointed out to me that once Monsanto became the key biotechnology player, the field was less about science and more about company ethics (Interview, Jan Marco Müller, 2014). A Bavarian government plant breeding scientist noted that Monsanto's involvement raised concerns that it would subsume the plant breeding field and treat farmers unfairly (Interview, Peter Doleschel, 2015). Other European scientists had early on, in fact, worried "that important taxpayer-funded biotech work could be frozen out of Europe on the back of a redundant anti-Monsanto trope" (Lynas 2014). These interpretations are borne out by empirical evidence from the scholarly literature. Hayes and Doherty (2012) and Seifert (2009), for example, specifically highlight how the corporate emphasis in industrial agriculture emboldened anti-globalization actors in France whose ire was provoked. In that country, the *Confédération Paysanne* (CP) – a radical left farming association formed in the 1970s rejecting predatory capitalist practices in agriculture and the homogenization of culture accompanying liberal globalization – became a centerpiece of the French campaign against GMOs beginning around 1997. They broadened the issue of GMOs from environmental and health concerns to issues connected to neoliberal globalization, laying out the stakes as a struggle over the capture of agriculture to industrial lobbies and the accompanying biodiversity loss associated with this takeover (Doherty and Hayes 2012). Ultimately, the tactics of the CP were noted to have been met with success in France, with the government inviting the group to government consultations and reversing its pro-GM stance.

Another example lending credence to the notion that biotechnology companies helped mobilize broader dissent came up in my own fieldwork examining anti-corporate actors. Specifically, the Brussels-based Corporate European Observatory (CEO), which frames itself as a watchdog over

corporate lobbying in the EU, since its founding in 2006, has been involved in a variety of anti-GM campaigns. Most notably, in coordination with anti-GM farmer groups and scientists, the organization spearheaded a 2012 conference on food safety in Parma on the 10th anniversary of the creation of the European Food Safety Authority (EFSA) – the Parma-based EU agency tasked with overseeing and communicating risks in food safety. The event sought to raise public awareness of what the organizations deemed conflicts of interest and the misuse of industry science in risk assessment processes of genetically modified foods, with the chief GMO researcher and campaigner for CEO pointing out that the event succeeded in ensuring that EFSA knew they were being followed (Interview, Nina Holland, 2014). CEO has also cooperated in the development of a public awareness raising campaign and accompanying website titled “Stop the Crop”, with framing that has particularly focused on GM-crops that “are unnecessary, risky and profit large multinational companies at the expense of small scale and sustainable farming” and benefit “big business” over “people and the planet” (“About the Stop the Crop Campaign” 2017).

In comparison to the biotechnology giants, scholars have not emphasized SMEs and public research scientists as constituting pivotal roles in terms of directly influencing public attitudes in European societies. Little space was left for SMEs and public research scientists, without a single EU-wide crop product from the 1990s to today, to leave an imprint on the process. One of the only exceptions came in 1996 when the medium to large sized British Zeneca marketed a tomato paste – derived from GM tomatoes grown in the US – on British supermarket shelves (Kilman and Cooper 1999; Mitchener 1998). The product range was, nonetheless, never extended to other European countries and had little long lasting impact once European institutions stepped in to regulate the issue across the entire EU. Even though public research scientists were more involved in terms of fundamental research on the mechanisms of gene transfer, including enabling and trait technologies associated with mediating such processes, and served as general supporters of the applied use of genetic engineering, particularly in government consultations, they also largely shied away from public advocacy roles (Graff et al. 2003; Bonny 2003). One scholar noted that the overall participation of scientists in pro-GM advocacy in the 1990s and early 2000s was sporadic, with scientists generally participating in academic conferences and publishing their research in scientific journals rather than participating in public debate (Bonny 2003).

The trajectory of applied research, particularly in terms of the crop varieties that were developed, has also been noted as shaping the debate. While on the one hand the emergence of the technology altogether enabled pro-GM politicians, scientists, and industry representatives to frame the possibilities of the technology to improve agriculture, on the other, the early development of herbicide- and insect-resistant crops has been especially associated with the mobilization of dissent among European environmental and wildlife conservation groups on account of the means of operation of these specific GM plants (Levidow and Carr 2009; Bauer 2015; Blair 2000; Toke 2004; Duke 2005; Sinha 2009). Environmental groups protested the possible effects of herbicide and insect-tolerant crops on biodiversity, with concerns that pollen-mediated gene transfer could lead to the incorporation of genes in wild relatives conferring ecological advantages to particular wild species over others (Duke 2005).

Environmentalists also protested the fact that herbicide-tolerant crops could lead to the increased use of herbicides by producers, which in turn could lead to the development of “superweeds” through evolution and associated increased use of herbicides (Toke 2004; Duke 2005). In one case, a soybean variety was shown to have developed herbicide-resistance (Duke 2005). The increased use of glyphosates and other herbicides, meanwhile, has itself been increasingly challenged in the 2010s by environmental groups seeking the EU ban of such synthetic substances on account of potential health risks sparked by a World Health Organization report (Michalopoulos 2017; Cressey 2015). In the UK, English Nature – the government agency charged with oversight on wildlife conservation issues - and the Royal Society for the Protection of Birds (RSPB), a charitable organization focused on bird conservation through various activities, in consort with a policy network comprising organic farmers and environmental organizations were noted to have successfully pressured the government to enact a moratorium on GM crop approvals and further to conduct studies specifically examining the impact of herbicide tolerant plants on wildlife, research that found some limited negative effects on wildlife (Toke 2004).

Insect-resistant crops also raise particular environmental concerns through their modes of action related to the fact that in targeting specific insects, they may also harm non-target species. One study often invoked by environmental groups revolves around research purporting harmful effects on the larvae of the monarch butterfly fed Bt maize (Sinha 2009). These concerns have in turn been featured prominently in justifications that different EU actors have employed in their use of

the precautionary principle on the issue. Even though EU-wide approval was given to one type of Bt maize in 1998, Monsanto's 810 Bt, multiple member states have invoked the EU's "safeguard clause" to prohibit the cultivation of the crop variety within national territory for reasons of risks to human health and the environment (Barling 1997). In announcing Germany's ban on MON 810, for example, the Agriculture Minister Ilse Aigner noted that the crop posed "a danger to the environment" (Sinha 2009, 594).

This review of the biotechnology agential landscape raises a number of questions - so far inadequately answered - regarding how this constellation of entities emerged in the first place. It is especially important to take note of the multiple situations that diverged from historical patterns in the broader socio-economic sphere (e.g. activity of plant breeding institutes in conventional plant breeding vs genetic engineering). Explaining such agential deviations is particularly pertinent given the prospects that the debate could have developed differently. Although the biotechnology industry's role in shaping the debate in the EU has been established in existing research, this takes the biotechnology industry and its position of power as a pre-given entity within the field of actors engaging with genetically modified organisms. What is missing is an accounting of how the biotechnology industry, including especially Monsanto, came to populate the political space in the EU to begin with while the role of public research scientists and SMEs was constrained. Similarly, there is a need for further inquiry regarding the nature of the research trajectory, including how it came to be that certain crop varieties were developed, in turn shaping the policy debate, but not others. Answering such questions can, in turn, help provide understanding regarding the interventions that enabled such outcomes to occur and consequently highlight lessons for understanding future negotiations over similar issues. The next sub-section aims to engage with this endeavor, first examining conventional rationalist and constructivist explanations before turning to a socio-material constructivist perspective.

5.1.1 Gaps in conventional explanations of agricultural biotechnology landscape

In explaining how the agential landscape emerged in the way that it did, rationalist and constructivist oriented approaches can provide some initial insights that put mobilization decisions in the context of rational calculus and the discourses and identities that constitute interests. With regard to a material interest-based perspective, as profit-seeking enterprises, it could be presumed

that multinational corporations like Monsanto acted rationally to maximize business opportunities in a novel sector. As two of the most valuable crops in the world – maize at \$23.1 billion and soybeans at \$14.6 billion compared to the next highest valued crop wheat at \$9.7 billion in the United States in 1995 as the first transgenic crops began to be developed - the notion of conferring agricultural benefits on maize and soybean crops presented lucrative opportunities for firms (Agricultural Statistics Board 1996).¹⁵ Both maize and soybean crops faced expensive billion dollar annual threats, including the Western corn rootworm and the European corn borer and various weed populations, and herbicide and insecticide products had already been widely used in agriculture (WSSA 2016; Secchi et al. 2006). From a rationalist point of view, development of glyphosate-resistant crops especially would have been appealing for Monsanto given that it would reinforce its dominance in the glyphosate market where it held a patent until 2000 (Duke 2005). Estimates, meanwhile, have shown that a 20-30 percent increase in yield is necessary to make a transgenic crop viable for commercialization, thereby steering biotechnology corporations toward particular crops over others (Goodman 2002). According to a representative of the large biotechnology seed company Syngenta, it was indeed the need for a business case for each product that they developed that guided the corporation in its decisions and that certain products were too elusive (Interview, Alain Dominique Quintart, 2014). As it were, herbicide-tolerant soybeans and insect-resistant maize went on to be used on 94 percent and 81 percent of crop acreage, respectively, by 2015 in the US (Economic Research Service 2017). In Argentina, near 100 percent levels of glyphosate-resistant soybean usage has been reported by farmers (Duke 2005).

There is still a question though about why university and public research institutions and SMEs didn't intervene in any significant way to carry out research on the type of crop traits neglected by the large corporations, a role historically pursued by these actors in agriculture but also other sectors (Graff et al. 2003). Rather than being about strategic interests per se, in fact, at a surface level, some actors have indicated that their decisions have been about costs and affordability, thereby cutting off decisions before they can even be made (Rotman 2013). This though leaves much to be unpacked regarding how these cost-structures came to be constituted and if they could have been different. One study tangentially highlighted the unwieldy structure of the

¹⁵ The equivalent 2016 data shows maize valued at \$51.7 billion, soybeans at \$40.9 billion, and wheat at \$9.1 billion in the United States (National Agricultural Statistics Service 2017).

biotechnology market (i.e. division into research and seed distribution components) as a strategic motivation for SMEs to avoid the industry (Blank 2008). And one of my own interviewees – a plant breeding scientist - referred to the costs of complying with regulatory frameworks as a barrier to research (Interview, Peter Doleschel, 2015).

While such accounts indeed provide plausible reasons as to why particular actors came to dominate the marketing of GMOs and why certain applications were developed over others, what they still do not help us understand is how certain research decisions, whether constituted by interests or not, came to be feasible actions. Even if an herbicide resistant soybean would have proven economically advantageous for Monsanto, a solely interest based approach takes for granted as unconscious presuppositions that interests aligned in such a way as to enable this outcome. What is left unsaid and unproblematized is the agential performances that constitute these cost-structures and interests as meaningful. In other words, there is still a political story to be unpacked and told that is less about interests *per se* and more about the enabling and constraining of particular interests through a multitude of background processes. It is these processes that, in fact, can help us understand the sites of power in the constituting of the agential landscape.

Social constructivist approaches offer a remedy to close part of this theoretical and empirical gap by presenting alternative tools focused on identity and language. Constructivist perspectives could be employed to argue that first of all interests are not transcendental but rather situated within and made possible by particular rules and identities that are contestable and fluid in nature. In this regard, the value of particular crops and the meaning of intellectual property rights that rationalist approaches reify can be seen as made plausible and appropriate by a politically and economically capitalist system that could have been otherwise. A constructivist perspective might, for example, interrogate the contestation and contingent processes involved in constituting an intellectual property rights regime in the area of the life sciences that has been understood as limiting access to the biotechnology research field for particular actors, including especially public research scientists. With respect to the precise transgenic crops that have been the focus of the biotechnology companies, meanwhile, rather than taking them as self-evidently valuable, constructivist explanations would add narratives about how these particular crops gained societal value on the first place, particularly in relation to the social construction of the associated agriculture, food retail, and energy sectors that depend on these crops. The very plausibility of GM

insect-resistant maize and herbicide-tolerant soybeans could thus be said to be embedded within discourses on factory farming and practices of corn/soybean use in animal feed and energy/climate change and practices of corn-related ethanol use.

From another point of view, a social constructivist perspective would invite attention toward the identities of corporations and scientists in constituting their interests rather than simply economic interests. It could be argued that different normative and rule-oriented cultures guided university scientists – peer review research and the need to publish - and companies – the need to satisfy profit-seeking shareholders in order to attract more investment - and this consequently shaped their decisions on what to research and how to share the fruits of such work. This constructivist explanation indeed finds some support in my fieldwork on the case. My empirical findings indicate that university scientists were embedded within particular epistemic research traditions that channeled researchers toward basic and fundamental research related to understanding unfamiliar mechanisms of molecular biology within plants rather than developing applied research and market products. One plant breeding scientist emphasized that publishing standards mean that scientists can't publish articles on ordinary transgenic plants, but rather are steered toward conducting research examining the function of genes at a deeper molecular level (Interview, Peter Doleschel, 2015). Similarly, the director of a major university plant breeding department remarked to me, the central question for scientists is: "Is it scientifically interesting?"

Scientists are not interested in producing a GM crop, but rather interested in understanding a gene; that's where I stop. It comes through collaboration, but the company focuses more on [the] production [side]....Once you understand the mechanisms, where is the scientific interest in taking it to the market? That's enough – move on to the next scientific research question. (Interview, Chris Schoen, 2015)

Overall, constructivist narratives then contribute by putting the spotlight on the significant politics and work at play, processes that could have been different, thereby explaining how interest-formation and specific actions became possible. In shedding light on the epistemic research identities, for example, the contingent nature of the entire issue trajectory is highlighted. If university research identities and rules had evolved differently, with a greater emphasis on societal impact as some scholars have suggested, then this may have steered the decisions of university scientists toward developing applied research instead of basic research in the field (Nelissen, Moloney, and Inzé 2014).

Yet although social constructivist approaches make a productive move in problematizing conventional rationalist approaches and elucidating the human agency involved in enabling/constraining particular interests and actions, they too face their limitations in adequately accounting for the characteristics of this agency, including particularly its material entanglements. This material/discursive intertwinement can be conceptualized in two ways. The first is that while constructivist perspectives help enable an understanding of how particular actions became (im)possible in broad terms, we still lack an understanding of how identities or rules were channeled in specific situations, important knowledge if we wish to understand political action. For this reason, certain phenomena are left unexplained by constructivist perspectives in the case. As an example, even if some university scientists were shaped by different research purposes and identities, the historical record shows that the public sector, especially government-sponsored research institutions, had been a major source of crop varieties developed for producers in the past, a position not yet re-articulated in the area of transgenic crops (Graff et al. 2003). Moreover, even while some university scientists have expressed skepticism toward applied research and it may be generally viewed as a hobby distinct from university research, there are others who have emphasized that they would pursue this area of research if not for the financial constraints imposed on their work (Rotman 2013). With respect to the development of specific crop traits, similarly, even if herbicide and insect-resistant crops were socially constituted as valuable for genetic engineering, they were not by default suitable to be developed as the first genetically modified organisms on the market. This specific action was made plausible by particular discourses, but not at all made inevitable given that these discursive constructions would need to reckon with technological and material processes that could obstruct the channeling of particular ideas.

The second analytical shortcoming for constructivism in this case is in inadequately accounting for the construction of particular identities, rules, norms, and interests. It should be emphasized, for example, that “discourses” on energy and agriculture broadly or soybeans and maize specifically were themselves not simply socially constructed, but rather socio-materially constituted by the material mediating performances of soybeans and maize as boundary objects that connect different fields together (e.g. agriculture, food, and energy sectors). Consequently, while understanding rules and identities enables a partial understanding of how certain courses of action became possible or impossible, what is missing is an examination of the material processes that shaped specific actions in this particular case and that further consorted and intra-acted with

social processes in constituting specific outcomes. An examination of all of these socio-material processes is outside the scope of this dissertation and indeed each would require their own in-depth analytical engagement. This chapter does, however, concern itself with establishing background information on these processes, acknowledging their role in particular intra-actions, and moreover concentrating on the socio-material construction of interests in this specific case.

5.1.2 A socio-material constructivist accounting of the biotechnology agential landscape

Rather than necessarily countering a constructivist or rationalist understanding of the field constitution process, I aim to highlight how the socio-material constructivist framework of this dissertation makes a difference in terms of understanding how the interests and identities of particular entities came to be constituted and channeled in specific ways, understandings that are pivotal for unpacking how the agricultural biotechnology landscape emerged. I specifically focus on presenting a narrative that highlights the socio-material constituting of research interests through the coming together of different material-discursive practices in the scientific laboratory and agricultural field trial sites connected to this research. The central argument is that particular power relations and storylines in the public policy debate came to be made possible and constituted through the socio-material relations within these sites, including enabling and trait technologies that – in their entanglements with scientific knowledge practices and norms on political economy - both enabled and hindered certain research trajectories for some actors and not others. Seen this way, the section problematizes pre-configured identity and interest-based accounts of the emergence of the field of actors, instead highlighting the process as driven by the articulations of a fragile and contingent constellation of material-discursive practices in intra-action with one another, configurations that could have engendered different policy outcomes if they had emerged differently.

This sub-section is divided into several parts. The first part focuses on the role of gene transfer enabling technologies, in their intra-actions with various apparatuses centered around intellectual property rights and the socio-material historical constitution of agriculture, in enrolling large biotechnology companies over public research scientists into plant engineering research. The second part, meanwhile, turns to an examination of genetic sequences themselves (i.e. trait technologies) and the ways in which their complexities, again in their entanglements with other

material-discursive practices related to societal needs, rendered the trajectory in which particular crop varieties were developed. The third part is oriented toward considering the interplay between laboratory research and the field plots – and all the socio-material relations constituted therein - in which crop varieties have been evaluated in terms of their added value and safety risks and consequently given rise to ballooning costs that have shaped the plausibility of plant biotechnology research for different groups of actors in different ways. A final section draws conclusions on the implications that all these processes together engendered on the agential landscape that emerged and policy outcomes in the debate over genetically modified organisms in the EU, taking note of both the stable and less stable parts that constituted the necessary and contingent conditions of possibility for these outcomes.

5.1.2.1 A laboratory paradox that made Monsanto: when enabling technologies became constraining technologies

As a means for research, enabling technologies are one of the central entities that constitute the possibility of conducting transgenic crop research. They are the technologies that facilitate and allow for genetic manipulations to be enacted to particular DNA sequences in plant cells of target organisms, enabling the transfer of genes that code for the production of particular proteins and enzymes (Graff et al. 2003). As such, enabling technologies perform an important role in mediating relationships between various entities (e.g. laboratory scientists, biotechnology firms, specific crop varieties, plant cells) centered around transgenic crop research. Rather than simply being instrumentalized as tools though, they have functioned as powerful entities that have shaped the terrain of research and development in plant genetic engineering and in turn EU policy on GMOs in two primary ways. The first is through their enactment of resistance to the intentions of human actors. Through their technical means of operation as part of their own materiality and in their intra-actions with other material-discursive practices, including particularly pre-existing scientific knowledge in the field and agricultural demands, enabling technologies render certain types of genetic manipulations feasible while hindering the accomplishment of other modifications. Secondly, in consort with international practices of intellectual property, they have become a privileged point of access to transgenic crop research. Entities that are able to gain access to enabling technologies are permitted to conduct research, but those that lack access encounter additional technical and financial hurdles. These two modes of action and the intra-actions through

which they came to matter in constituting the agricultural biotechnology research field are explored in this sub-subsection.

In light of their importance for transferring genetic sequences into new plant cells, the origins of the biotechnology field itself was constituted by discoveries associated with one of the two primary enabling technologies. This particular mode of transfer is referred to as *Agrobacterium*-mediated transformation and it is derived from the soil phytopathogen *Agrobacterium tumefaciens* that is also the causative microbial agent of crown gall disease – a tumor-inducing disease that affects many species of plants (Zupan et al. 2000). By the 1940s, scientists understood that the bacteria induces permanent changes in plant cells and by the 1970s that this transformation was generated by the transfer of genetic material from the bacterium to the plants (Zupan et al. 2000). The mode of transfer is what is now called a Ti plasmid in the *Agrobacterium*, which transferred part of its DNA to the plant cells (Zupan et al. 2000). Drawing on these observations, research through 1983 indeed led to the development of a binary plant vector system for the introduction of genes of choice into plant genomes (Hoekema et al. 1983). This system was successfully employed later in the year to transform cells in a tobacco plant, regenerate the cells in the plant, and then ensure that the genetic changes were passed onto future generations (De Block et al. 1984). Suddenly an array of novel opportunities in plant transformation were available to scientists, made possible by a bacteria that had only once been studied as the cause of a plant disease. Reflecting back on this power, one of the initial researchers on *Agrobacterium* noted that “It is unusual that the study of a single organism can reveal a unique biological system, contribute to an understanding of fundamental biological principles and lead to the development of an entirely new industry” (Nester 2015, 11).

In addition to *Agrobacterium*-mediated transformation, alternative enabling technologies for genetic modification were developed too, the most successful of which was biolistic-mediated transformation (particle bombardment by a gene gun), a technological innovation originally developed by John Sanford at Cornell University in 1984 but since adapted (Klein, Wolf, and Wu 1987). The gene gun functions to insert a gene into the plant cell chromosome by physically shooting a tiny particle covered with the DNA at high velocity. The biolistic-mediated transfer innovation helped overcome some of the logistical barriers initially laid down by *A. tumefaciens*. Specifically, *Agrobacterium*-mediated transformation had long been studied in connection with

dicotyledonous plants, their natural host, and thus early research favored dicots such as tomatoes and soybeans over monocotyledons such as rice and maize that resisted the bacteria (Sussex 2008). Monsanto, the US-based agricultural and chemical company, for example, had in 1985 reported the successful modification of tobacco, petunia, and tomato plants – all dicots - and the inheritance of these genes in later generations (Sussex 2008). The development of herbicide-resistant tobacco plants was reported a year later and in 1987, a private company called Plant Genetic Systems developed tobacco plants that could produce insecticides (M. D. Chilton 1988). Successful transfer of foreign genes into one of the most agriculturally significant monocots, maize, was reported only in 1988 with an electroporation method that left the plants infertile. It was only in 1990, with use of the particle bombardment technique, that fertile maize was successfully genetically engineered (Gordon-Kamm et al. 1990).

As scientists continued to negotiate with *A. tumefaciens* though, it was later discovered in the mid-1990s that if tissue culture techniques and plant material were optimized and choice strains of *A. tumefaciens* and vectors were selected, then Agrobacterium-mediated genetic transformation could be possible even in monocots (Ishida, Hiei, and Komari 2007). These later advancements in enabling technologies though were met with their own technical hurdles that continued to constrain what scientists could do with genetic engineering in plants. The process of microprojectile bombardment, for example, also introduced imprecision into the process, with the gene gun inserting the new introduced genes randomly into the chromosome of the plant. The genes have been noted to sometimes target a place where they can be expressed effectively, while other times failing in this task (Rotman 2013). Overall, a considerable degree of variation has been reported in terms of the stability, integration, and expression observed in the introduced transgene, especially over generations (Kohli et al. 1999; Shou et al. 2004). Although the Agrobacterium-mediated system, meanwhile, generally enables better integration and stability of inserted genes, even with the improved monocot-oriented tailoring of the system, there are still considerable limitations in the targeting of specific tissues, genotypes, and species (Shrawat and Lörz 2006).

Beyond shaping what research could be done in the field of plant biotechnology, in limiting the options available to researchers, enabling technologies like *A. tumefaciens* importantly would also acquire political roles as gatekeepers, enabling certain entities with access to the technologies to become actors in the field, while constraining others lacking this access. This power of the

technologies was especially constituted in their coming into intra-action with a system of increasingly strong intellectual property rights protections in the area of biological innovations. A key US Supreme Court decision in the 1980 case, *Diamond v. Chakrabarty*, on a 5-4 vote found that a “live, human-made micro-organism is a patentable subject matter” under US law (Graff et al. 2003; M. Day 1980, 712). The passage of later laws would further allow university scientists to patent specific technologies related to plant engineering that could then be transferred to commercial firms (Graff et al. 2003). There was a subsequent proliferation of IP claims in the field of agricultural biotechnology. Suddenly the market had been significantly altered, enabling IP holders to deny the use of particular enabling technologies for strategic reasons (Graff et al. 2003). That the intellectual property rights mattered was itself also constituted by the materiality of the enabling technologies and existing knowledge in limiting the development of alternative methods of gene transfer that were efficient in transforming plant cell DNA.

One of the constituting outcomes of the coupling of exclusive IP rights and the technical barriers of genetic transformation technology would be in constraining public sector scientists and SMEs from pursuing research related to the development of GM crop varieties. Even though the genetic transformation methods were largely developed in the public sector, private sector actors laid claim to vital patents and would come to appropriate this knowledge (Graff et al. 2003). Ciba-Geigy (now Syngenta), Monsanto, DuPont, and Japan Tobacco in particular swept up key patents for both *Agrobacterium* and biolistic-mediated transformation (Harvey and McMeekin 2009; Graff et al. 2003). What could have provided an important toolbox in public sector research, in other words, instead became the exclusive purview of the private sector, including especially large corporations. The case of the public sector developed B-carotene enriched rice (so-called Golden Rice) that would be targeted to countries with Vitamin A deficiencies provides an illustration of this constraining landscape. In order to research and develop the crop variety, public researchers needed to gain permission to use over 40 patents, highlighting the tedious and expensive process that other researchers could face (Graff et al. 2003; Kowalski et al. 2002). The collection of patents was noted to have restricted the possibility of small companies to conduct research owing to the costs of purchasing all the patents (Interview, Volker Mohler, 2015).

These examples highlight the ways in which enabling technologies came to serve a fundamental role in including and excluding, serving as privileged access points that mediated points of entry

into specific intra-action complexes and sites of resistance that directed the types of research that were possible through their technical means of operation. These agential abilities were shown to have been realized and articulated in a specific manner in the intra-actions between the American IP regime based in the country where plant biotechnology had largely been developed – and the contingent and unpredictable claims to these patents – and the knowledge practices of firms and public scientists. In coming to matter in constituting the field of research, rather than being about interests *per se*, these findings indicate that trajectory of the research field was also crucially shaped by the conditions of possibility and impossibility that were constituted in the socio-material relations of laboratory and society. And these entanglements, moreover, engendered the empowering of major private firms in the research process over public research scientists, thereby guiding the contours of the public policy debate over the issue.

5.1.2.2 Traits of stimulation and resistance, traits of possibility and impossibility: the constituting of the trajectory of plant biotechnology research

While enabling technologies provide the means for genetic transformation in plants, other entities, known as trait technologies, provide the genetic basis for enabling the expression of particular novel traits in plants. Trait technologies include area specificity promoters, targeting sequences, and crucially the genetic sequences and materials that code for proteins that are necessary for specific plant features (Graff et al. 2003). In this regard, trait technologies come into interplay in the constituting of the field of plant genetic engineering research. Similarly to enabling technologies, trait technologies have first of all performed *resistance* to particular ideas imposed on them through imaginaries while yet facilitating the coming together of specific imaginaries and genetic sequences in other cases. Secondly, they have become tied up with historically constituted discursive-material practices (e.g. herbicide-dependent industrial agriculture, soybean and maize demand) that have *displaced* relations between various entities (e.g. farmers and weeds; farmers and crops) and have, in turn, within these intra-action contexts further contributed to *displacing* and *reifying* relations (e.g. between industrial scientists and corporate visions; public research scientists and societal needs). It is especially important to emphasize that decisions about what to do with genes have been steered not simply by the imaginations of scientists and entrepreneurs nor solely by the genes themselves, but crucially by the entanglements between imaginaries of science, genetic sequences, enabling technologies, market research demands, and agricultural practices.

In terms of vision, there had indeed been some initial hope that genetically modified foods would usher in a new revolution in agriculture, enabling the creation of crop varieties that could withstand extreme weather events or offer added value to the consumer in terms of nutritional benefits and health outcomes. In a 2000 editorial, then Prime Minister Tony Blair, for example, while pointing to potential food safety and environmental risks, drew attention to their “potential for good” in terms of “helping feed the hungry by increasing yields, enabling new strains of crops to be grown in hostile conditions, or which are resistant to pests and disease” (Blair 2000). He also stressed the parallels with medical biotechnology and its production of life-saving medicines. The biotechnology industry itself participated in this imaginary-construction, with Monsanto, for example, emphasizing on its website the capacity for transgenic crops to protect the environment, reduce hunger, enhance nutrition, protect plants from pests, and improve the quality/taste of foods (Cook 2004). Their motto became “food, health, and hope” (Bauer 2015, 199).

Biotechnology corporations though also set their sights on herbicide and insect-resistant crops. From a business perspective, the companies were perceived as envisioning these products as vehicles to help them become global leaders in agricultural biotechnology and profit financially (Bauer 2015; Ansell, Maxwell, and Sicurelli 2006). They also portrayed the applications as integral to their visions for sustainable development.¹⁶ Monsanto noted that “Our products create value for our customers by helping them to combine profitability with environmental stewardship. For product impact, this means: more productive agriculture, more soil conservation, less insecticide use, less energy, better habitat protection” (Levidow and Carr 2009, 78). Novartis, meanwhile, emphasized that insect-resistant maize “contributes to sustainable agriculture through savings on mineral fertilisers, fossil fuels, and pesticides” (Levidow and Carr 2009, 78).

These different aims importantly weren’t simply a human construction, but rather embedded within prior socio-material practices that pre-constituted their plausibility. The idea of rice enhanced with Vitamin A, for example, reified the situation in which rice was a primary staple food for hundreds of millions of people around the world, many of whom who suffered from Vitamin A deficiency (Beyer et al. 2002). The possibility for this trait to be attained through genetic engineering rather than conventional plant breeding, meanwhile, was constituted in the lack of any

¹⁶ The track record of these crop varieties in according with this vision have notably been contested (Hakim 2016).

rice cultivars containing Vitamin A in the endosperm section normally consumed by humans (Beyer et al. 2002). Projects focused on improving the yields of particular crops through more efficient nutrition uptake or conferring disease resistance to crops have similarly emerged alongside and been pre-framed by socio-economic conditions lending sense to such proclamations (Gilbert 2016).

The channeling of these visions in concrete projects though has too been a matter of the agency conferred in the context of specific intra-actions between human-articulated ideas, material entities, and a range of material/discursive practices. The imaginaries presuming the dominion of politicians, scientists, and industry over life itself, in other words, came into contact with genetic materials and technologies that in some cases functioned as elusive and refractory entities, but in others as relatively submissive objects. They put up hurdles that rendered certain novel innovations more difficult than others to achieve within the context of the specific knowledge practices that were in place when the agricultural applications from technology were first being commercially introduced in the 1990s. In this early period of transgenic crops, trait technologies facilitated the rapid development of single-gene changes, as necessitated in herbicide-tolerant crops, but impeded the immediate enactment of some of the perceived more lofty ideas such as drought-resistant features in plants.

It is important to emphasize that the language construction-genetic material complexes were further tied up in relations with knowledge practices of scientists in the area of plant genetics. While genetic modification enabled plant breeders to select from a wider variety of genes, plant scientists have been “careful to note that no magical gene can be inserted into a crop to make it drought tolerant or to increase its yield” (Rotman 2013). A plant breeding scientist, drawing an analogy with the early development of cars that lacked the more advanced safety features found today, pointed out that “in the first run [1994], we just checked how the plants looked like...it was very early...we couldn’t do too much at that time” and so complicated “disease resistance” projects were less the focus of university research groups (Interview, Gerhard Wenzel, 2015). Marc van Montagu, one of the researchers who developed transgenic plant technology at the University of Gent, similarly noted that in terms of health-oriented GM products, “there we needed already much more science before we were able to do it” (Interview, Marc van Montagu, 2014). Such agronomic modifications require detailed knowledge about the genes of a particular plant and their complex

functioning, and they further often necessitate multiple genetic changes, the sources of which can be difficult to locate, if they can be found at all (Rotman 2013). Developing crops that can resist disease requires an advanced understanding about how pathogens attack the plant, while creating drought-resistant plants can necessitate changes to a plant's physiology. Genetically engineering these metabolic pathways of plants, moreover, has proven complex (Kowalski et al. 2002).

An interrogation of scholarly articles publishing the findings of specific experiments and research projects is indicative of these processes. The endeavor to genetically engineer oilseed crops to produce omega-3 long-chain polyunsaturated fatty acids, widely considered to be beneficial to human cardiovascular health and also crucial for sustaining the aquaculture industry, in particular exemplifies the ways in which the intertwining of technical and material relations and social-material developments can hinder the achievement of research objectives (Ruiz-Lopez et al. 2014; Usher et al. 2015). To prove practical, an ideal omega-3 genetically engineered crop variety would need to demonstrate an ability to accumulate two instrumental fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) at levels similar to those in fish (Ruiz-Lopez et al. 2014). In order to achieve this though, rather than a single genetic modification, the omega-3 LC-PUFA biosynthetic pathway necessitates that multiple genes, expressing traits for primary synthesis and the direction of the flux of substrate and biosynthetic intermediates, be introduced into a suitable host plant (Ruiz-Lopez et al. 2014). Furthermore, the process must be characterized by coordinated tissue-specific expression of the genes in the developing seeds of plants (Ruiz-Lopez et al. 2014). Multiple initial attempts to produce adequate fatty acid levels in plants indeed failed due to various technical complications related to the genetic template, particularly with respect to the expression of enzymes that lead to the build-up of biosynthetic intermediates that are unwanted in fish oil (Ruiz-Lopez et al. 2014). The discovery and later introduction of an alternative desaturase enzyme originating in marine green algae that could be transferred as part of a genetic complex to *Camelina sativa* seed oil plants not only reduced such accumulation of bad fatty acids, but also promoted the production of additional EPA (Ruiz-Lopez et al. 2014). Drawing on similar advancements with respect to genes coding for the build-up of DHA in seed oil plants enabled researchers to eventually also direct enough accumulation of DHA in camelina crops through a transgene combination (Ruiz-Lopez et al. 2014).

The development of nutrient efficient crops has been another particular area that has flummoxed plant biotechnology researchers. The vision and investment has been there to develop plant varieties that require less fertilizer to grow and take up nutrients like nitrogen and phosphorous more aptly, crop varieties that could potentially be useful in both the developing and developed world (Gilbert 2016). These imaginaries notably themselves have been pre-framed by the material/discursive practices of agriculture, especially the problem of nutrient deficient soil in sub-Saharan Africa that emerged from the coupling of intensive farming and the non-use of fertilizers – itself constituted through the inability of farmers to afford fertilizer - to replenish these nutrients (Gilbert 2016, 2012). Yet these ideas haven't yet been realized. This came as a surprise to some in the industry, with one plant biologist noting that “Nutrient efficiency was supposed to be one of those traits with broad applicability that could make companies lots of money. But they haven't developed the way we thought” (Gilbert 2016). The particular nature of nutrient efficiency traits in particular has put up barriers, with plant breeders noting that it's difficult to target a plant with a single gene (Gilbert 2016). Instead, similarly to the case of the omega-3 plants, the success/failure of the translation has been constituted by interactions between a complex assortment of genes that further come to enact agency in different ways contingent on the socio-natural environment in which they're intra-acting (Gilbert 2016). Paradoxically, there has, in fact, been more success reported by scientists using conventional plant breeding techniques to enhance nutrient efficiency in plants, especially through breeding for particular physiological root characteristics associated with nutrient efficiency (Gilbert 2016). A similar story of conventional breeding success has been witnessed in the case of drought-resistant crops in light of the fact that drought-resistance is constituted by multiple genes in interaction with one another (Gilbert 2014).

The field has continued to develop in recent years, with genomics enabling the sequencing of important crops and in consort with high-throughput transcriptome, proteome analysis, metabolomics, systems biology, and bioinformatics also allowing for a better understanding of plant biology and genes (Christou 2013). These material/discursive knowledge practices have opened up previously excluded possibilities in research, especially connected to modification processes related to photosynthesis and nitrogen fixation in plants. Promoted as “cutting edge” research in 2014, the omega-3 transformation of camelina plants as such wouldn't have been possible in the 1990s owing to the knowledge of multiple enabling and novel trait technologies that was drawn on in the studies and further advancements made in the course of research (Ruiz-

Lopez et al. 2014). Rather than immediately socially constituting reality, some of the imaginaries associated with quality oriented traits that framed the possibilities of plant genetic engineering struggled in the 1990s and early 2000s to be channeled into specific applications that could be easily paired with these visions.

As already implied, there were, however, other trait technologies that availed themselves to research scientists with more ease in the context of the knowledge practices of the 1990s. Modifications for herbicide and insect resistance in plant crops especially proved among the simpler changes to engineer, not only on account of the lack of the complexity in the genetic material that needed to be sequenced and transferred, but also owing to the pre-existing body of knowledge regarding these traits. This knowledge was itself tied in with the history of the political economy of agriculture, which witnessed a shift from hand weeding and tillage systems to the adoption of herbicides in the 1950s and 1960s in the developed world (Gianessi and Reigner 2007). In the case of herbicide-tolerant plants, including especially those engineered to resist glyphosate (N-phosphonomethyl-glycine), the scientific name for Monsanto's mass-produced Roundup herbicide spray commercialized in 1974, there had consequently been a bulk of knowledge that had been developed on the molecular mechanisms in which the glyphosate targeted particular plants (Pollegioni, Schonbrunn, and Siehl 2011). Specifically, there was a generally acknowledged understanding that glyphosate targeted an enzyme, 5-enolpyruvylshikimate-3-phosphate (EPSPS), that is crucial in catalysis processes and in the biosynthesis of aromatic amino acids necessary for organisms to survive (Pollegioni, Schonbrunn, and Siehl 2011). While initial endeavors to locate a gene effectively coding for herbicide resistance through screening plants exposed to herbicides largely faltered, a 1985 study identified some bacterial species that could resist the toxicity of the spray (Schulz, Krüper, and Amrhein 1985). One such bacterium, *Agrobacterium* sp., coincidentally thriving on a waste-fed column near a Monsanto glyphosate facility, was taken for additional study (Pollegioni, Schonbrunn, and Siehl 2011). The relevant single gene expressing EPSPS resistance was identified as CP4 and employing the *A. tumefaciens*-mediated transformation method, the Monsanto company succeeded in transferring the CP4 genetic material into soybean plants, which demonstrated no changes in yield when sprayed with herbicides (Padgett et al. 1996). The product was placed on the commercial market in 1996. Overall, as pointed out by one plant breeding scientist, "It [herbicide resistance] was the only thing that was possible. They had the genes from the bacteria and the research wasn't that far in those days that

you could really say I would go in that direction or that direction, so it was one of the rare situations that you had a gene and you could transfer a gene” (Interview, Gerhard Wenzel, 2015).

The story of the development of Bt plant varieties – crops that can resist pests through the release of toxins - is similar. These plants derive their name from the *Bacillus thuringiensis*, an endospore forming bacterium that expresses a Cry protein that produces an insecticidal toxin that is fatal to many pests through its interactions within their guts (Sanchis 2011). Although the permanent introduction of Bt toxicity genes into plants was novel, the use of the bacterial form as an insecticide was not new, dating back to the 1930s (Sanchis 2011). In fact, even organic farmers had long employed Bt as a “natural” insecticide to protect crops from potential pests, including the European corn borer and the Western corn rootworm that inflicted significant annual costs to the maize crop (Toke 2004). Although use declined with the development of more lethal synthetic/chemical variants of insecticides in the 1940s and 1950s, they became more popular from the 1960s onward as environmental damage and insect resistance were raised as concerns (Sanchis 2011). Consequently, a vast amount of knowledge had already been developed on Cry genes/proteins, including the mechanisms in which the proteins enact toxic effects in particular insects, especially moths and butterflies (Sanchis 2011). A gene expressing the Bt toxicity trait had been cloned by 1981. And genetic sequences of different Cry genes were later classified into specific sub-groups, with their insecticidal features and target species identified (Sanchis 2011). Already having unmasked its identity, the Bt gene expressing the toxicity trait consequently availed itself to industry and university scientists, enabling its insertion into plant cells. While initial research focused on dicots such as tomatoes and cotton plants, owing to the limitations of the *Agrobacterium*-mediated transformation method, the particle bombardment method of gene transfer later allowed the genes to be inserted into monocots like maize (Sanchis 2011). Although there were still some further barriers to the successful development of transgenic plants that expressed the cry genes effectively, including the need to resynthesize cry genes, these obstacles were overcome with developments in technology allowing for the creation of synthetic cry genes that could better target pests (Sanchis 2011). A particular advantage conferred to these plants over conventional Bt was that they could target pests in the stalk of the plant, a region that was off-target to the sprays (Sanchis 2011).

That herbicide and insect-resistant soybean and maize specifically became a central commercial focus for biotechnology corporations can further be tied in with the socio-material mediated construction of the political economy of agriculture and energy. In particular, soybean-based biodiesels and corn-based ethanol have become increasingly tied in with the production of usable energy (Barrionuevo 2006). Moreover, as demand for meat-intensive diets have picked up, so too have the demand for protein-rich animal feed derived from soybeans and maize (Barrionuevo 2007). As such, maize and soybeans have become among the most valuable crops and a target for yield increases, especially given their intra-actions with pests that threaten their survival. The nutrient and physiological constituents of these crops have consequently, in consort with societal practices in food and energy, made plausible their targeting through transgenic crops. Unlike fungal resistance, herbicide-resistant crops have also notably conferred the additional advantage of ensuring a two-fold demand for both herbicide products and the herbicide-resistant seeds. In this regard “it was done what was possible on the one hand and on the other hand of economic use for the industry” (Interview, Gerhard Wenzel, 2015).

In this vein, both genetic sequences and the imaginaries that had already embedded particular manipulations came to confer specific agentic meanings on one another through their intra-actions with one another, but also other material/discursive practices. Certain imaginaries were selected over others by the trait technologies, in consort with scientific knowledge at the time, but so too were trait technologies guided in particular directions over others through market demands and societal agricultural needs. In this regard, it is crucial to emphasize that despite the mention of “time” throughout this section, the socio-material construction of genetically modified organisms, in fact, was not a time-dependent phenomena. There was no linear path of scientific development, but rather what was “simple” or “complex” at any particular time was constituted by the entanglements between plant genetics and socio-material systems of knowledge production and political economy. Moreover, there was no linear translation of agricultural practices into applied research. Despite the historical use of herbicides in agriculture, it was not inevitable that herbicide-tolerant crops would be introduced. These crop varieties were rather enabled by the pairing of multiple contingent elements including scientific knowledge and the simplicity of genes coding for particular traits (e.g. herbicide tolerance).

Both the insect and herbicide-tolerant crop varieties, deemed vital to the agricultural industry's interests in ensuring high crop yields, nevertheless, would engender themselves to be framed politically as potential threats to the non-agricultural environment, reviewed above in section 5.1, garnering criticism from environmental groups and thereby altering the debate over GMOs in the EU (Duke 2005; Sinha 2009). These frames were facilitated by the biological mechanisms of many crops allowing for cross-pollination and hybridization over long distances through pollen drift, recorded at up to 4 km in some instances (European Environment Agency 2002; Hüsken and Dietz-Pfeilstetter 2007). Hybridization with wild species of crops, in turn, can result, with the incorporated "beneficial" genes conferring ecological fitness on particular species over others, enabling them to better survive biotic and abiotic stresses (L. J. Chen et al. 2004). When disseminated in a wild species through sexual reproduction or vegetative propagation, this gene flow could threaten biodiversity, including endangering wild species populations (European Environment Agency 2002; L. J. Chen et al. 2004). In the EU, this is a particular concern for some crops with wild relatives, including oilseed rape.

This narrative indeed highlights the GM crop applications and biotechnology entities promoting these applications as boundary nodal points, constituted between trait technologies, knowledge understandings, agricultural practices, and particular imaginaries of science/society on the one side and public contestation processes on the other. In consort with other material-discursive practices, things like genetic material came to be materialized and agentialized through both the displacement and reification of particular processes. Particular ideas importantly came to be made plausible through socio-material practices, while their accomplishment too was channeled through socio-material alliances. In this regard, specific phenomena (e.g. crop varieties, biotechnology corporation mobilization) are again better understood as broader than the possible outcomes of particular social constructions, but rather as coming together through contingent coalitions between socio-material performances.

5.1.2.3 From the laboratory to the plot and the further socio-material complicating of the agricultural biotechnology research field

Enabling and trait technologies are crucial for the insertion of particular genes that imprint the expression of novel traits in plants. Yet it is important to emphasize that this initial research is

conducted in the confines of the laboratory, with phenotyping being performed in greenhouses that regulate temperature, light, and humidity (Nelissen, Moloney, and Inzé 2014). This environment, significantly, is different from the field conditions that the plants encounter when cultivated in nature though. In the field, such plants come to intra-act with a different set of entities, including fluctuating environmental conditions and variations in soil biophysics and planting density, that come to direct the modes of action of the novel genes in different ways (Nelissen, Moloney, and Inzé 2014). It has, therefore, been noted that field trials are vital to evaluating the stability and impact of concrete modifications on plants in real-world conditions (Usher et al. 2015). Field research is also recognized as important in EU legislation on field trials and the commercial release of GM crops (Romeis, McLean, and Shelton 2013). Indeed while some field trials have verified the efficacy of particular traits, others have found a variation in performance between the laboratory/glasshouse and field plots (Usher et al. 2015). Plant biologists have noted, for example, that transgenic crops modified to require less fertilizers or otherwise boost nutrient uptake are “tweaky”, with the interaction between and expression of a complex array of genes varying in different environments (Gilbert 2016).

This field trial process matters for policy purposes in that it has been noted as an expensive and tedious and different in prominent ways from conventional plant breeding trials, especially in the EU where a stringent regulatory framework has been developed on both the experimental and commercial release of transgenic crops and where field trials encounter additional socio-material obstacles (Lheureux and Menrad 2004). Beyond assessing particular traits for stability and their effects in comparison with conventional and other GM varieties, in the EU, field crop trials are also seen as a crucial step in the evaluation of crops for safety and adverse effects, including to human health, animal health, and the environment (Lheureux and Menrad 2004). They are, therefore, mandated in EU law as part of the application process in attaining approval for commercial release of a GM crop. Such field trials take up an average length of 2.6 years of time (Lheureux and Menrad 2004). They are also expensive affairs with one research institute in the UK, for example, budgeting £732,000 for the field trial stage of a transgenic crop (Sample 2015). In this way, over time, the prospects of scientific research has become ever more entangled with the EU regulatory and societal debates over transgenic crops that escalated with the first imports of GM soybeans into the EU in 1996.

Moreover, in particular contexts, including the EU, the very fragility of crops has rendered them susceptible to destruction both by pests and anti-GM activists. In the 1990s, the maize crops of one Bavarian plant breeding scientist, for example, were cut in half by anti-GM protesters, leaving the scientists unaware that the field trial had been jeopardized until wind blew the crops away several days later (Interview, Gerhard Wenzel, 2015). In another incident, diesel gas was sprayed over the scientist's crops, leaving a foul smell in the area and leaving the field trial mute (Interview, Gerhard Wenzel, 2015). These actions have been facilitated by the mandatory provision of material databases revealing the precise locations of field trials in the EU, a system that doesn't exist in the United States (Gómez-Galera et al. 2012). Anti-GM groups have reportedly used these databases to publish directions to field trial sites with corresponding Google Maps on their websites (Gómez-Galera et al. 2012). The EU catalog system has consequently become a privileged access point, with access to field trial sites constituting the ability of activists to dismantle the very thing they abhor, in the process generating widespread media coverage and publicity, a process that has notably been cut off in other countries that don't have the same transparency standards (Gómez-Galera et al. 2012).

It should be emphasized that the open nature of agriculture, in a context in which GMO vandalism was rampant, came to constitute plant biotechnology research in marked contrast to medical biotechnology, protected in the confines of laboratories, and conventional plant breeding, not hindered by the socio-material activism of opponents. The crop-trashings, as they have come to be known, of GMO field trial sites began at an organized level in France in 1997 (Kuntz 2012). From 2003-2007, around half of field trials in France were reported by scientists to have been destroyed (Doherty and Hayes 2012). Similar high levels of destruction have been noted in Germany, Belgium, Italy, the United Kingdom, and non-EU member Switzerland from the late 1990s through the 2000s (Gómez-Galera et al. 2012; Kuntz 2012). These numbers have only begun to decline in recent years and only on account of the fact that field trials in the EU have nearly disappeared altogether, connected with the risks associated with vandalism (Kuntz 2012). While over 250 field trials had been conducted in a total of 13 European countries in 1997, the number had dropped to 12 field trials in five EU countries in 2014 (Nausch et al. 2015). This compares to figures of over 1200 field trials per year in the United States (Nausch et al. 2015).

The destruction of crop trials has rather mediated the relationship between scientists and their research goals, constraining the completion of specific trials and the development of specialized applied knowledge for the EU context. Those industry actors and public research institutes still wishing to conduct GM crop research have only been able to do it at great additional costs through the construction of physical barriers. In one Rothamsted Institute crop trial held in 2012 in the UK, a two and a half meter chain-link fence was constructed, mediating the relationship between potential protestors and the crops by providing a barrier of protection, albeit at a cost of £400,000 (Sample 2015). An additional £1.8 million on top of that was devoted to further security measures, including policing, to defend the fence against threats from anti-GM activists (Sample 2015). The costs, in fact, amounted to a figure that surpassed the costs of the research itself. A 2011 potato field trial in Flanders, meanwhile, necessitated 100,000 euros for security costs, similar to the costs for the construction of a security cage at the Sainsbury Laboratory in Norwich (Gómez-Galera et al. 2012). A study on Swiss field trials determined that for every euro invested in research, an additional 78 cents was devoted to security measures, thereby financially restricting research possibilities (Bernauer et al. 2011). In light of these findings, the Swiss Federal Council agreed in 2012 to provide an annual budget of 600,000 euros to provide security at a public research site for experimental field trials (Romeis et al. 2013). Yet for most public researchers, the costs have simply been too high to bear, making them an impediment to research compared to conventional plant breeding where such expenses are non-existence (Nelissen, Moloney, and Inzé 2014). The phenomena emerging from these laboratory-societal relations is the withdrawal of especially public research scientists from GM crop trials in the EU (Romeis et al. 2013). Despite past relationships, one industry entrepreneur in France noted that they have now struggled to find public sector scientists with which to collaborate, connecting this problem to the crop destructions (Blank 2008). The situation has as such become a type of paradox, with once anti-corporation fueled protests in the late 1990s, in fact, into the 2000s and 2010s further empowering these corporate actors over risk averse public research institutions.

These additional expenditures in the EU context compound a process already exorbitant in costs. It is estimated that the most cost-efficient transgenic crops require \$10 million in funding for research and development and to get them to market compared to an average \$1 million in expenses for crops developed from conventional plant breeding (Goodman 2002). Expenses include promoter and gene selection, gene transformation, laboratory and greenhouse testing, field trials,

and the production of seeds and the provision of these to farmers. Compositional equivalence studies have also grown especially expensive, reaching up to \$100 million in particular research projects (Nelissen, Moloney, and Inzé 2014). This has made use of GM technology cost-prohibitive for many university and public research scientists in various country contexts (Nelissen, Moloney, and Inzé 2014). According to Director of the Bavarian government-affiliated Institute for Crop Science and Plant Breeding, for example, when they conducted transgenic crop research, their funding was all absorbed into gene technology costs, which constrained the amount of research that could be done (Interview, Peter Doleschel, 2015). A Cornell University scientist who conducts research on potato breeding noted that he uses convention breeding approaches because “I can’t afford it [transgenic crop technology]” (Rotman 2013). He noted that only “a handful of large companies” can afford the costs of research, not to mention the risks, involved in developing a GM crop (Rotman 2013). Some of these many risks have been enumerated elsewhere (Goodman 2002).

Marc van Montagu shared his story and transition from university scientist to start-up business owner, revealing the importance of money in this new burgeoning research field in the 1970s and early 1980s, in the following way.

Americans were starting many start-up companies. Jeff Schnell and I were asked to join AGS [in the United States] in the late 1970s. We then realized that if people in the United States could do that, why wouldn’t we do it? The Minister of Education brought us into contact with what is today called venture capital, here we have state or regional companies that bring in seed money with private companies...In that period we had 45 field trials in Belgium compared to five in the US. We are curious, as we are scientists, so this company wanted not to make one or two products, but they wanted the sky is the limit. We did enormous fundamental research because in such a company, you could have money much easier than in a university where you have applications and you have to wait a year. [In a company], you decide it’s interesting and you take the phone and you buy it. But of course, if you have many subjects, then the bills go up, maybe 5 million euro a year. So during 13 years, we were always losing and had to find people to support the company; they would bring in fresh money. (Interview, Marc van Montagu, 2014)

For the most part, despite their prominent role in some countries in general (e.g. Germany), small and medium-size enterprises though failed to weave out a market niche, unable to sustain the costs and time involved in agricultural biotechnology research (Interview, Peter Doleschel, 2015). As one plant breeding scientist pointed out, “the problem is that it [the regulation] is event-based; if

you have at the very crude beginning of gene transfer, using particle bombardment, you bombard a set of cells with DNA and every single cell is an event. If you select more than one line from your experiment, each selected line has to be treated differently in terms of the GMO regulation. And that makes the procedure very time consuming, very costly. And there is almost no way for a small to medium-sized company to get that done” (Interview, Peter Doleschel, 2015). The former director of the TUM Plant Breeding department noted that in Germany R&D costs ballooned once new regulations on GM crop release were introduced in the 1990s, rendering expenses in some cases of anywhere from 15 to 200 million euros. He further emphasized that while before there were opportunities for small and medium size enterprises, “these small companies are just too small to spend this [the higher regulatory costs]” (Interview, Gerhard Wenzel, 2015). And as pointed out above, the regulatory and protective costs are exacerbated by the patent claims that especially limit SMEs and public research scientists.

In this vein, the shape of the agential landscape in the EU wasn’t only constituted by what was happening in the lab, but also in the ways that particular crops developed in the lab and greenhouse came into intra-action with particular material-discursive practices revolving around EU regulations, anti-GM protest movements, and environmental conditions. Rather than being a simple translation from “pot to plot”, these entities have imposed additional financial and time expenses on the research and development process, particularly constraining European public research scientists and small and medium sized enterprises that are unable to come up with the funding in the particular socio-material context. Despite some interest in pursuing transgenic crop research and field trials, this has essentially been shut down in the EU context and otherwise deemed financially challenging even in more lax regulatory and social environments like the United States.

5.1.3 Assessing the added value of a socio-material constructivist narrative: socio-material relations in the research process as boundary drawing cuts that make a political difference

This section began by raising an area for research inquiry, namely about how the agential landscape in the case of biotechnology actors was constituted in the debate over transgenic crops. The section then highlighted the limitations of rationalist and constructivist approaches that lacked the tools to adequately explain this question. Embedded in the logic of consequences, rationalist approaches

are limited in terms of understanding how particular interests became possible in the first place, in capturing the agency and background constitutive processes that made a difference. Constructivist perspectives, meanwhile, in putting an emphasis on identities and rules are able to make sense of how certain actions (e.g. the constraining of public research institutes and university scientists in the field) became possible or impossible through certain identities and discourses, but fail to account for socio-material origins and nature (e.g. material/discursive practices of soybean production) of particular identities and rules and lack an explanatory framework for understanding how these rules and identities are channeled in specific situations through socio-material practices (e.g. performances of resistance by gene transfer entities).

Equipped with a toolkit that focuses on material-discursive entanglements and the co-constitution of phenomena through intra-actions, the socio-material constructivist approach though overcomes these shortcomings, enabling a better understanding of the case. An examination of these entanglements show that the story of trait technologies is overall a narrative about more than the visions of particular actors in society or the stand-alone power of material entities, but rather the ways in which seemingly disconnected and radically different processes and relations constitute one another and enable and elicit particular framings through their intra-actions. The hurdles erected in the development of trait technologies by gene sequencing and plant tissues, for example, came to constitute a performative role in the context of the GM issue translation once put into intra-action with biotechnology corporations embedded within capitalist logics, public research scientists constrained from pursuing applied research by strict intellectual property regimes, and political economies brimming with accumulated knowledge about particular crops and genetic materials but not others. It was not only vexatious enzymes then that conferred power on biotechnology firms and associated industrial farming applications through their agencies of resistance, but also very contingent, as marked by the 5-4 US Supreme Court vote and subsequent private sector activism in filing patent applications, IP rights claims that conversely constituted the very nature of this power as sites of privileged access. These “lab” processes came to join in an unexpected alliance with socio-material-economic practices of field trials, altogether engendering substantially higher costs for genetic engineering research in comparison to plant breeding research, with access to funding displacing relations between public research scientists and transgenic crop research.

In moving up to a broader level of analysis, what should be especially emphasized is that in steering the configuration of the agential landscape, these processes also plausibly shaped the trajectory of the issue debate that emerged alongside it. Anecdotal evidence, for example, indicates that the greater involvement of small and medium sized firms in the process might have yielded different political outcomes on the issue. In particular, it should be pointed out that one of the only occasions in which GMOs found some consumer success in an EU market was with respect to the then British medium-sized biotechnology firm Zeneca (now AstraZeneca) in the UK and its tomato paste made from GM tomatoes that were designed to remain ripe longer (Kilman and Cooper 1999; Mitchener 1998). Zeneca planned the 1996 launch – before the beginning of Monsanto’s imported non-labelled soy - of its product in a meticulous manner, persuading Safeway and Sainbury’s, two of the largest British food retailers, to sell the tomato paste. Zeneca’s product was clearly labelled on the packaging and leaflets and other signage that was posted in supermarkets, despite the lack of a formal requirement in the UK at that time (Mitchener 1998). The product proved successful, with sales outpacing conventional tomatoes by two to one in some stores (Mitchener 1998). Millions of cans were sold within two years after the product went on sale, with the GM tomato paste being cheaper – a 34 percent price advantage at the Safeway retail chain - than the non-modified varieties (Mitchener 1998). Nevertheless, with the burst of protests, threatened boycotts, and consumer oversight over genetically modified foods in the late 1990s, all transgenic crop products proved anathema for food retailers, with Sainbury’s, for example, removing all GMO goods, including the Zeneca tomato paste, from its stores (Kilman and Cooper 1999).

In another case, relating to public research scientists and concerning the cultivation of transgenic crops at the field trial stage, GMOs similarly fared better – at least in the British context. In 2012, the government-funded Rothamsted research institute in the UK began conducting a crop trial on insect-resistant wheat. Though the field trials were protested, activism was at least partly muted owing to the sacrosanct deference that parts of British civil society provide to scientists. A spokesperson for the anti-GM Soil Association candidly admitted that the organization would have been more pro-active in its protesting if the field trials had been conducted by Monsanto:

The GM PR machine has been very clever in portraying this research as unrelated to corporations such as Monsanto, obviously aware of the negative affect this would inevitably have on public support for the trials. Because Rothamsted carries out a variety of research, we felt the nuances involved in condemning and destroying one

aspect of its work would have led to confusion. This would not have been the case had the research been carried out by a large corporation such as Monsanto (The Land 2012).

The field trial did attract one protest event, with around 200 protesters from the anti-GM group *Take the Flour Back* seeking to “decontaminate” the field trial (Phillips 2012). The public action was widely discussed in the media before and after the event and received significant and rare pushback though from groups advocating for science and public research who organized a counter-demonstration at the same site. The pro-GM group *Sense for Science* also organized a “Don’t destroy research” petition that attracted over 6,000 signatures. Destruction of crops was ultimately prevented by a heavy police presence. The anti-GM speeches at the event largely focused on the negative role of corporations in agriculture. Agreeing, the campaign manager of Sense for Science remarked that “There is a very necessary debate to be had about how some businesses operate, but Rothamsted is the opposite of Monsanto” (Phillips 2012). The approach indeed reflected a broader strategic framing effort of public research scientists seeking to disentangle themselves and the technology from the grip of the corporate discourse that had seeped its way into public understandings of plant genetic engineering.

Although this case is contrasted with numerous other cases across the EU in which public field trials were decimated, it points to the possibility – a notion shared by many public research scientists and EU officials that I interviewed – that the technology could have gained further acceptance if public research scientists had been positioned more prominently in the field. The fact that crop-trashing events were, in fact, generally non pervasive before 1997, the year after the entry of Monsanto into the EU market, indicates that the field destructions of both private and public plots were associated with the private sphere (Kuntz 2012). This understanding is further supported by other evidence indicating that civil society activism would have been muted if the large multinational corporations and their perceived aggressive tactics had been absent. The Corporate European Observatory’s campaigner on GMOs, for example, commenting on the group’s activism on the issue, pointed out to me that if only publicly funded researchers and universities had been involved in GMO research instead of primarily major biotechnology companies, then the fundamentals would have been different, especially with regard to the biotechnology industry’s focus on herbicide-tolerant plants that not only raised alarm with respect to the environmental costs

of GM crops but have reified the power of big agribusinesses over global food chains (Interview, Nina Holland, 2014).

There is also further anecdotal evidence pointing to a public that would have potentially been more receptive to transgenic crops with particular types of value added traits (e.g. in the area of nutrition benefits). A 2014 Rothamsted Institute field trial in the UK – focused on the modification of camelina plants with a gene inducing its seed to produce Omega 3 fatty acids – attracted minimal opposition. A project scientist speculated that the lack of activism was probably associated with the trial’s distance from any connections with agri-businesses in terms of herbicide production or insect resistance, two traditional targets of environmental activists owing to the aforementioned environmental ramifications of these tools of modern industrial agriculture (Knapton 2014). He noted that “consumers find it easier to swallow when they know you are engineering a plant for health benefits rather than to repel insects” (Knapton 2014). Indeed the director of the anti-GM group GM Freeze, while still emphasizing the risks, particularly with regard to the drift of seeds, indicated that “the idea of crops which are engineered to be healthier is very seductive and appears a laudable idea” (Knapton 2014). Nevertheless, on account of the stringent regulations and societal norms against genetically modified foods that arose during the late 1990s and early 2000s Monsanto period, the project scientists emphasized that it is now unlikely that any vegetable oil product could presently be marketed to consumers in the European Union (Knapton 2014). Consequently, projects that might have once been accepted in the 1990s and perhaps even conveyed a positive image of transgenic crops in the eyes of the European consumer have now become obstructed by various regulatory and societal barriers.

With respect to the broader debate, these views are shared among multiple scientists and other actors that have been involved in the process. A Bavarian government plant breeding scientist remarked to me:

Historically, I think it was not a good decision to start with traits like herbicide...this was a big problem. The technology was not really straightforward – it has a lot of drawbacks because you need an antibiotics marker system...So now we have the possibility to create transgenic plants without all this stuff...and you have better traits...but now maybe it’s gone for that because it’s not easy to say to people “now we have better genes because the genes are from the species itself but before we had to use these ‘easy’ traits like herbicide resistance” so it would have been better to wait a little bit (Interview, Volker Mohler, 2015).

A university plant breeding scientist from the Technical University of Munich, meanwhile, pointed out that “It wasn’t a good start to start with herbicide resistance...if people would have started with something else, the public would have accepted this much easier and it wouldn’t be that easy for NGOs to oppose” it (Interview, Gerhard Wenzel, 2015). This position was similarly expressed by another Bavarian government plant breeding scientist who pointed out that “there was always the point that the public wouldn’t see a product that they would like” (Interview, Martin Müller, 2015). Others pointed to the fact that beginning with herbicide related products constrained GM supporters from being able to frame the debate in light of stellar achievements as could be done in the field of medical biotechnology (e.g. insulin and human growth hormone discoveries). In other words, herbicide-resistance “might be a relevant trait for the farmer, but not for society. And the society doesn’t make the point or connection between lower production costs and lower food costs. And of course the food price will not be so elastic that advantage will be given to the consumer” (Interview, Peter Doleschel, 2015). What was needed instead was a “very convincing product” that everyone would want such as maize that would negate the need of taking contraceptives (Interview, Gerhard Wenzel, 2015). Others defined this “hit-me” moment as the development of a hair-loss prevention GMO or a slimming factor/weight loss GMO (Interview, Chris Schoen, 2015; Interview, Garlich Von Essen, 2014). Such comments no doubt draw on the categorically different attitudes of Europeans toward medical biotechnology, enthusiastically accepted, and agricultural biotechnology, unequivocally opposed (Bauer 2015). They also are borne out in multitude studies indicating that consumer-oriented GMOs with tangible benefits for the consumer, as subjective as that might be, were more likely to gain public acceptance (Lucht 2015).

While such interpretations of the debate don’t definitively prove that such factors as the GMO crop varieties being marketed made the pivotal difference, there is plausible evidence that such processes changed the tenor of the debate, especially regarding the mobilization of environmental activists against herbicide-resistant transgenic crops. And it is, in fact, no analytical stretch to argue that the coalition makeup of particular actors and frames could plausibly be expected to influence the nature of issue trajectories. Consequently, by examining the case socio-materially, the narratives presented here have contributed to better understanding the construction of the agential landscape in this case and in turn how the debate could have proceeded differently. Importantly, we can see in this case that it wasn’t only the contestation processes that played out in the public debate that mattered, but also the background laboratory and agricultural practices that pre-

configured and further intra-acted with these processes through the course of the issue trajectory. If particular genetic traits, for example, could have been manipulated more easily, then the agential landscape and the public policy debate arguably could have turned out differently. In this regard, a newfound emphasis on materiality in political analysis puts a spotlight on the notion that politics happens through the boundary drawing cuts enacted both by dense material things like plant cells, laboratory equipment, and genetic sequences themselves and in their entanglements with political economy and other material-discursive practices. In opening up the space of the laboratory, this case analysis has indeed shown that accounting for these processes is integral to understanding issue phenomena.

5.2 A socio-material constructivist understanding of the nuanced positioning and mobilization of farmers in the debate over genetically modified organisms

This section explores a second site of the configuration of the agential landscape of the debate in the EU, one concerning the mobilization of farmers/producers. Similarly to the case of the biotechnology sector, farmers, as the immediate users of transgenic crops, have been accorded an important role in shaping the debate in the EU. This section consequently aims to first outline this role and then interrogate how these field positions were constituted in the first place. It is important to especially take note of the different political divisions within the European farming lobbies divided generally into organizations representing large-scale farmers (COPA-COGECA), organic farmers (IFO-AM), and small-scale farmers (Confédération paysanne and Via Campesina).

Conventional farmers importantly were noted to have initially been supportive of the use of transgenic crops, acting as lobbying forces in favor of the technology in Austria, France, and the UK in the mid-1990s (Lynch and Vogel 2001; Seifert 2009; Toke 2004). However, this position, as reflected in the stances of COPA-COGECA at the EU level, hedged as protests mounted across the EU and the issue was put on the agenda in Brussels. At the European level, conventional farmers were rather later noted as “conspicuously absent” in both the pro and anti-GM movements at the same time that the EU placed a moratorium on approval of transgenic crops in 1998 (Ansell, Maxwell, and Sicurelli 2006, 101). It was also at this time that food retailers, consumer groups, and environmental activists demanded that all food derived from GMOs be labelled, leading to policy discussions in Brussels on legislation mandating labelling and traceability on genetically

modified organisms (Ansell, Maxwell, and Sicurelli 2006). While contesting the low thresholds for mandatory GM labelling on food demanded by anti-GM activists that they perceived as onerous and impractical, COPA-COGECA accepted the idea of labelling in general at a one percent threshold (Toke 2004; COPA and COGECA 2000). In 2002, they further outlined their support for a GM labelling policy, sanctioned use of the “precautionary principle” for the approval of transgenic crops in cases of uncertainty in terms of safety, and noted the importance of protecting biodiversity and consumer safety, while still contesting the designation of “unrealistic” isolation distances between farmers and the imposing of penalties on farmers for field contamination (COPA and COGECA 2002). By the 2010s, COPA-COGECA had endorsed the stringent regulatory framework of the EU altogether (EURACTIV 2002).

The stance of European conventional farmers has importantly been contrasted with that of the American Farm Bureau, the largest organization in the United States representing farmers, which was resolute in its support of transgenic crops throughout the 1990s and 2000s (Ansell, Maxwell, and Sicurelli 2006). The Farm Bureau, notably, has opposed GM labelling and further notes that agricultural biotechnology is beneficial to the environment (Ansell, Maxwell, and Sicurelli 2006). This divergence has, significantly, led to a more inclusive anti-GMO movement in the EU, one that encompasses large-scale agricultural interests to some extent. This has also meant a less inclusive and coherent pro-GMO movement (Ansell, Maxwell, and Sicurelli 2006). This inclusion, in turn, has trickled up to the political level, particularly displacing the positions of right-wing political parties traditionally allied with conventional farmer groups (Interview, Marion Ruppenar, 2015).

Groups representing small and organic farmers, meanwhile, have been noted as central support actors in the European anti-GMO movement, especially in particular national contexts. In Austria, for example, organic farmers, representing ten percent of all farmers in the early 2000s, have been attributed a role in instigating a national anti-GM policy in that country (Seifert 2009). Small-scale farmer movements in France and Italy, meanwhile, were noted to have put pressure on national governments in their respective countries to protect local products and traditions (Ansell, Maxwell, and Sicurelli 2006; Doherty and Hayes 2012). In France, this resulted in tangible effects, including the invitation of the small-scale farmers to government consultations and an eventual shift in the government policy on the issue (Doherty and Hayes 2012).

In light of the farmer positioning in the debate, which notably became more inclined against transgenic crops as the issue trajectory proceeded, and its role in influencing the political process, a question is raised about how these stances were made plausible in the first place. The next subsection consequently lays out the limitations of mainstream rationalist and constructivist approaches, opening up space for intervention with this dissertation's socio-material constructivist lens.

5.2.1 Inadequacy of conventional approaches in explaining the emergence of the field

In terms of understanding the indifferent or anti-GM stance of many different European farmer groups, constructivist perspectives invite focus on the social context, including farming identities premised on connections to “natural” landscapes and the social processes in which GMO-derived foods were rejected by major supermarket chains and the EU developed a regulatory regime on GMO food labelling and how these rules weighed on farmers (Hayes 2006; Heller 2013). With respect to food retailers, it should be pointed out that it has been well-noted that when the first Monsanto non-labelled GM imports began to arrive at European ports in 1996 and 1997, many NGOs erupted in protest, leading to extensive European media coverage of the issue (Levidow and Carr 2009; Schurman and Munro 2010; Bauer 2015). These protests were channeled particularly to the venue of local supermarkets where consumers could “vote as consumers”, exerting direct pressure in their call for GM labelling (Levidow and Carr 2009). NGOs also waged a publicity war on food retailers by conducting their own laboratory surveillance tests of supermarket products and then sharing the results when GM contamination was present (Levidow and Carr 2009). In light of this negative publicity, GMOs were stigmatized and European supermarkets distanced themselves from GM products. European food retailers made swift moves to promote non-GM products and eliminate GM food all together. In 1998, recognizing the growth of the green movement in Europe, the British supermarket Iceland led the non-GMO movement among retail chains. The company announced that it would ban GMOs from all own-brand products and that it would cooperate with Greenpeace on other environmental issues, including the use of ecological freezers and the elimination of preservatives and artificial colors in its products. The Consumers Association applauded the decision, and the company reported financial success as a result of the policy (BBC 1998; BBC News 1999; BBC 1999).

Arguably to avoid market disadvantages, other supermarkets soon followed with similar policies, including Sainsburg and Marks and Spencers a year later, gradually leading to an unofficial ban on GM foods on European grocery shelves (Kilman and Cooper 1999). Sainsbury, which had previously expressed enthusiasm with the widespread success of the transgenic Zeneca tomato paste, all of a sudden reported receiving 12,000 phone calls from concerned customers within a single month (Kilman and Cooper 1999). Within a year of Tesco's earlier statement of tepid support for the sale of GM foods, the company reversed direction. Supermarkets in France, Belgium, Italy, and Germany also declared bans on GM food products. Delhaize (Belgium, Greece, and the Czech Republic), Rewe (Germany), and Carrefour (France) all pledged no-GM in their own-brand products (Jeremy Smith 2003; Agence France Presse 1999). In total, 24 of 30 major European food manufacturers agreed to market only GM-free food (Regester and Larkin 2008). Within a few years, GM material could only be found in a few foods in select supermarkets across Europe. As one European food retail expert told me, retailers made these moves to avoid inviting controversy and protests in front of their stores. A go it alone approach simply wasn't feasible under the risky circumstances (Interview, Anonymous 1, 2014).

These social constructivist narratives of the contestation processes that constituted norms can help, in part, explain the issue outcomes, perplexing from the vantage point of material-rationalist perspectives given the fact that conventional farmers were largely initially supportive of the technology in recognition of its potential to reduce costs (Lynch and Vogel 2001). European producers were further dependent on (GM) soybean imports for feedstock livestock, producing only around six to twelve percent of the domestic soybean crop from 1995 to 1999 (Lynch and Vogel 2001). Any restrictions on genetically modified organisms consequently threatened to make farming more expensive for conventional farmers in the EU. When taking into account the social framework against transgenic crops that developed among food retailers, however, the indifferent stances of farmers becomes slightly more plausible from an interest-oriented perspective given that farmers were limited in their ability of marketing their GM crops to European food retailers. What it does not explain though is why, in fact, farmer groups in many contexts such as Austria or Bavaria not only forwent GMOs but also became adamant critics of transgenic crops as the debate advanced in the 2000s, in many cases becoming part of the anti-GM protest infrastructure. Moreover, it is unclear why farmers didn't actively support the technology for the purpose of growing transgenic soybeans, on account of the fact that the products generated from animals fed

animal feed, reliant on such soybeans, generally didn't fall under the same food retailer restrictions. In explaining the generation of interest in farmers' mobilization against transgenic crops, a socio-material constructivist perspective helps overcome these gaps in knowledge, highlighting how such positions were constituted within relations between various material-discursive practices, including the aforementioned supermarket branding developments, but also importantly the constellations involving the genetic drift of pollen, the spatial distribution of European farmland, and performative role of insects and the wind in transferring pollen over long distances and their entanglements with an EU labelling regime that further buttressed the rules of the food retailers.

5.2.2 The socio-material constituting of farmer interests through pollen and its entanglements with supermarket branding and food labelling

The narrative presented here problematizes and unpacks the politics of the conventional explanations reviewed above, emphasizing the socio-material origins of farmer mobilization patterns and especially putting a focus on pollen as a primary entity that ordered the ways in which farmers engaged with the issue of GMOs generally in Europe through its capacity of displacing the relations between any two or more farms. Importantly, this story revolves not only around pollen though, but how specifically pollen was agentialized in its intra-actions with European regimes on labelling, food demand (e.g. organic food), and developments in the political economy of supermarkets in the European context. This narrative also importantly contextualizes the subsequent chapter focused on how these socio-material complexes were further channeled socio-materially into farmer mobilization decisions within one EU region, that of Bavaria, Germany.

Pollination has been a process of nature for millions of years, enabling seed plants to reproduce when pollen grains are transferred to the female reproductive organs of plants. The process is enabled by other material entities, including insects and wind, which can carry the pollen hundreds of meters from a source plant. Oilseed rape flowers, for example, attract bees through the sugar-concentrated nectar that they produce and color and shape (Hüsken and Dietz-Pfeilstetter 2007). Insects, in turn, are known for complex foraging behavior, itself mediated by numerous geographic and biological factors, which under certain conditions can enable pollen to travel over long distances (Hüsken and Dietz-Pfeilstetter 2007). Overall, the mean foraging distance for pollen-collecting bees has been marked at around 1750 meters in simple landscapes and around 1550

meters in complex landscapes (Steffan-Dewenter and Kuhn 2003). In rare cases, bees have been recorded as travelling over 10 km in search of floral rewards (Hagler et al. 2011). Pollen beetles, furthermore, have been known to travel over even longer distances, often in large numbers (European Environment Agency 2002). Wind dispersal of pollen is similarly mediated by other processes including wind direction, wind speed, topography, and local vegetation. The wind is capable of carrying pollen a range from less than 10 meters (the majority of cases) to several hundred meters and in rare cases even 1.5 km (Hüsken and Dietz-Pfeilstetter 2007). Overall, statistics indicate that the majority of pollen produced by a plant will remain within a 3 meter radius from the donor plant, with the percentage of pollen travel declining at an exponential rate with distance (Hüsken and Dietz-Pfeilstetter 2007).

These processes mean that agriculture is an open system, with there always being the possibility that seed DNA from crops on one farm can be spread to crops on another farm, particularly those within close proximity with one another. In this regard, things like insects, pollen, plants, wind, and plots of land displace the relations between individual farms, putting neighboring farms into contact with one another through the plants that they cultivate. In the annual ryegrass plant, for example, pollen-mediated gene flow has been shown to occur at a distance of 3 km (Busi et al. 2008). And in oilseed rape plants, in some experiments gene transfer occurred at a rate of 1.78 percent near the donor plant (continuous design) and remained constant at 0.1 percent at over 100 meters distance from the donor plant (discontinuous design) (Hüsken and Dietz-Pfeilstetter 2007).

This displacement action has been especially enhanced in certain parts of the EU where small farms (often family-owned) are the norm, enabling pollen – and DNA with it - to drift between farms in an area. Eurostat data from 2013 showed that small farms (between 2-20 hectares in size) were the most common farm size in the EU-28 (Eurostat 2016b). And in fourteen member states, small farms made up a plurality of total farms (Eurostat 2016b). In another seven member states, very small farms (less than two hectares in size) made up the largest share of farms (Eurostat 2016b). Altogether, small and very small farms comprised 86 percent of all farms in the EU (Eurostat 2016b). This compares to 14 percent for medium (20-100 hectares) and large (100 hectares and above) farms (Eurostat 2016b). By comparison, the equivalent number of very small and small farms in the United States was around 39 percent according to 2012 data (National Agricultural Statistics Service 2012). This propensity of small farms to be bunched together in

particular rural areas in the EU, as in Poland, combined with the ability of bees and wind to displace pollen means that gene transfer is unavoidable between farms (Clancy 2016).

Though the transfer of genetic material has been a process of nature for millions of years and needed not necessarily become a controversy, in the European agricultural context, the transfer of genes from GM crops to other organisms came to be called *contamination*, indicating that the admixture was undesired (Binimelis 2008). That it was virulently unwanted in agriculture, unlike prior conventional admixture, owes to pollen's alliance with two other material/discursive practices – the advent of the GMO label and the aforementioned supermarket branding developments that rendered European labelling requirements meaningful. The next sub-section indeed considers the socio-material work put into the constituting of the GMO labelling regime with a particular focus on understanding how their intra-actions with pollen-mediated gene transfer and the policies of food retailers came to constitute the positioning of European farmers in the debate.

5.2.2.1 The introduction of the European GM food label as conferring meaning on pollen displacement

In 2003, new EU regulations were introduced that stipulated mandatory labelling for any food products (including any ingredient in a food product) with a presence of GMOs above a 0.9 percent threshold (European Parliament and Council of the European Union 2003a).¹⁷ These regulations emerged out of a tedious EU policymaking process in Brussels from 1996 to 2003 that focused on the question of whether mandatory labelling should be imposed on GM foods and how precisely to design such a system of labelling (Levidow and Carr 2009). The biotechnology industry and consumer groups in particular argued over competing frames such as “the right to know” – indicating that consumers had the right to know what is in their food and how it was prepared – versus “product equivalence” – the idea that labelling was not needed given that the end product of genetically modified food is the same as the non-modified version in terms of quality and safety (Levidow and Carr 2009). Biotechnology supporters and opponents also argued over the meaning of “consumer choice”, debating whether including information about GMOs promoted or impeded

¹⁷ Although not required by law, several European organic certification organizations enforce a 0.1 percent detectability standard (Brookes 2006).

consumer decisions (Levidow and Carr 2009). For the opponents of GMOs, the label ultimately represented a potential solution to the quandary in which GMOs couldn't be banned from European countries on account of international trade agreements. The label consequently, as a material entity, could make visible in an accessible space the food chains and production system behind particular food products, thereby allowing food retailers and consumers to make informed decisions based on their knowledge (Felt 2015).

The precise nature of the labelling system being constructed was also fundamentally driven by the materialities inherent in the detection and tracing of genetically modified foods, in intra-action with the technological limitations and costs involved. Most GMO skeptics recognized that the labelling requirements would need to reflect the fact that there may always be a slight degree of unintended presence of GMO on account of unavoidable contamination, which can occur in transportation, storage, harvesting, or processing (Levidow and Carr 2009). If the labelling thresholds were set too low, in other words, then almost everything would need to be labelled, which would in turn render the label impractical. In 2003, emerging from this series of exchanges, new EU regulations were ultimately introduced that stipulated mandatory labelling for any food products (including any ingredient in a food product) with a presence of GMOs above a 0.9 percent threshold (European Parliament and Council of the European Union 2003a).

Underlining its symbolic character and performative potential in intra-acting with the European consumer space, the National Grain and Feed Association in the US emphasized that the European labelling requirement was akin to putting a "skull and crossbones on the packet" (P. Mitchell 2003). Context is important to understand why this was the case. Throughout the 1990s, European food retailers had gradually aligned themselves more closely with consumer rights through various marketing and practical schemes. Part of this process involved the development of store own-name brands - designed to provide companies with a competitive advantage over rivals, but which had the perhaps unavoidable effect of placing food retailers more directly under the microscope of consumer groups (Levidow and Carr 2009). As discussed above, in the context of transgenic crops, this meant a hands-off approach, with food retailers eschewing GM food products.

Overall, a policy of containment was solidified, cemented in the double lock of supermarket branding initiatives and mandatory stringent labelling (Felt 2015). These processes of containment

though, in the context of the anti-GM alliance, also would come to play a fundamental role in reshuffling the mobilization patterns in the debate, particularly with respect to the activism of farmers. This was on account of the fact that the label and branding developments became intertwined with the aforementioned processes of nature, represented in the form of pollen, bees, the wind, and farmland, and farmers seeking to protect the market value of their products. While farmers could still use GM products for animal feed – food derived from animals fed GM feed would not be labelled - the market for GM crops generally declined with supermarkets strictly enforcing their no-GM policies. And the potential for the admixture of GM and non-GM crops meant that even farmers seeking to grow GM crops for the purpose of animal feed or export were putting their neighbors at economic risk and raising potential legal issues for themselves. It is this fissure that this section now turns to investigating.

5.2.2.2 Farmer mobilization as emerging through the further entangling of pollen, labels, and food norms

It was at the time when labelling and food retailer restrictions on GM food, in their intra-actions with historically and socio-materially constituted farming systems in the context of pollen drift, arrived that farmers began engaging more in the EU policy debate to protect their products from economic loss. In Germany, there was worry that there might be a “war in the villages” with non-GM farmers potentially turning to the court system to protect their livelihoods (Levidow and Carr 2009, 231). Turning from previous battles over consumer choice, now activists spoke of producer choice, which was at risk of being hindered through contamination. GMO pollen, in other words, in association with European political and market treatment of GMOs, was at risk of turning neighborly relations upside down.

The obstinate and uncontrollable behavior of pollen, aided by intensified activism from groups representing organic and small-scale farmers, nevertheless, encouraged the EU to intervene in 2003 by developing a compromise solution aimed at allowing “the market to operate freely, while reducing the policy conflicts on GMOs” (Binimelis 2008, 437–38). The Commission introduced this principle as co-existence – the notion of an agricultural system based on the segregation of conventional, organic, and GM farms, thereby enabling the methods to exist side by side and farmers to make their own choices between these options (Binimelis 2008; Levidow and Carr

2009). The legislation was proposed as non-binding guidelines that enabled Member States to designate minimum isolation distances between GM and non-GM farms, with the responsibility to conform to these regulations falling to the GM farmers. Spatial separation, in other words, would displace the nodes connecting different types of farms through pollination by cutting off pollen's ability to reach non-GM farms.

Given the fact that the precise separation distances were left to the member states, it has been noted that debate simply trickled down to the national and regional levels (Seifert 2009). The uncertainties involved and hardening European rejection of GMOs gradually constituted changing positions for some conventional farmer groups who had initially been open to the use of the technology. In Austria, for example, organizations representing the majority of conventional farmers were noted to have opposed a strictly GMO-free stance in the country until the late 1990s, with the groups stressing the potential beneficial uses of agricultural biotechnology (Seifert 2009). But as the views of European consumers toward GMOs increasingly soured and the stringent labelling and co-existence policies were imposed, these groups began to recognize the marketing advantages and practical needs of a GMO-free policy toward Austrian producers. This shift was put into motion by groups like the Austrian Mountain Farmers Association (OEBV), which had earlier cooperated with the popular tabloid, *Neue Kronen Zeitung* (NKZ), in the mid-1990s to warn of the dangers of genetically modified food and advance a successful national petition signed by over 1.2 million citizens focused on securing a GMO-free Austria (Felt 2015; Seifert 2009). As the so-called "sacred cow" of Austria, the organic sector, meanwhile, has been credited for playing a fundamental role in the design of that country's co-existence policies, themselves deemed a cynical tool used to pre-empt GM farming through the setting of impractical segregation distances (Seifert 2009). This is particularly the case in a country with dense organic farming coverage, with organic farmers comprising 10 percent of the total number of farmers in the country, thereby leaving a significant area of land ineligible for genetically modified crops. The significant number of organic farmers in the country, in turn, dates back to Austria's 1990s accession into the European Union, which required concessions to gain support from farmers in mountain regions, and to efforts beginning in the late 1980s to develop a more green agriculture system (Seifert 2009).

Overall, throughout the EU, there was a reported increased intensity of the involvement of organic farmers due to the perceived threat that GM crops could potentially undermine organic products (Seifert 2009). In particular, although not required by law, several European organic certification organizations enforce a 0.1 percent detectability standard (the lowest technically detectable), rendering gene transfer especially problematic for organic farmers (Brookes 2006). At one organic tradeshow in Nuremberg, Graefe zu Baringdorf, an organic farmer and then MEP, noted that the notion of coexistence of GM and organic farming was infeasible. “We simply want to keep this rubbish out of our fields,” he said (The Organic & Non-GMO Report 2006). Referring to GM pollen drift, zu Baringdorf framed the issue as one defined by uncertainty. “Nature doesn’t go by legislation,” he said, instead arguing that “There should be an ocean separating GM and non-GM crops” (The Organic & Non-GMO Report 2006). Such views were buttressed by murky science on the issue. A European Environment Agency report, for example, “showed difficulties to spatially isolate maize, oilseed rape, and sugar beet, advising the implementation of barrier crops, isolation distances, and information systems” (Binimelis 2008, 438). Another report from the EC-Joint Research Center, meanwhile, concluded that coexistence was feasible, but required a change in farming practices (Binimelis 2008).¹⁸

The incompatibility of genetically modified foods with the socio-material practices centered around food marketing and agriculture in the EU has been only further cemented with developments since the mid-2000s. The organic agricultural land share has been steadily increasing in the EU-27, from 5.7 million hectares in 2002 to 9.6 million in 2011, and then to 10.3 million in 2013 among the EU-28 (DG Agriculture and Rural Development, European Commission 2013; Eurostat 2016a). The presence of organic farming had reached 5.9 percent of agricultural area in the EU by the end of 2014 (Eurostat 2016a). In Austria, Sweden, and Estonia, the share of organic agricultural land reached over 16 percent by 2014 (Eurostat 2016a). By comparison, 2017 figures in other countries were 0.2 percent in Japan, 0.3 percent in China, 0.6 percent in the US, 0.7 percent in New Zealand, and 1.4 percent in Canada, all largely stagnating from previous years (Willer and Lernoud 2017). A spokeswoman for EuroCoop has confirmed the demand for this farming at the consumer end, noting that consumers have been active in pushing

¹⁸ Other studies though concluded that national isolation distances were often excessive, beyond that necessitated by science (Devos et al. 2009).

for organic products, a market that has exploded in Europe in recent years (Interview, Rosita Zilli, 2014). These trends not only make it ever more technically difficult to cultivate GM crops in accordance with EU law, but also further embolden the anti-GM organic farmer opposition to GM crops, represented in Brussels by the lobby group IFOAM-EU.

While putting farmers into a context in which it was plausible for some to choose to mobilize against GMOs or remain indifferent, there was no guarantee though that the processes would channel action into any particular direction. Instead, what has been observed is the sporadic political organization of farmers throughout the EU, generally against GMO cultivation but with farmers in some regions such as in Catalonia and Aragon in Spain being more accommodating to transgenic crops (Binimelis 2008). In Spain, it has been pointed out there is more utility for transgenic maize given the ecology of the area, the difficulty of spraying maize with insecticides, and the threat of the European corn borer (De la Cruz 2016; Interview, Mute Schimpf, 2014). The large percentage of farmers cultivating GM crops in the area has also sheltered these groups from non-GM farmers, instead putting pressure on organic farmers to withhold any complaints lest they disrupt the peace of a neighborhood (Binimelis 2008). Similarly, the eastern regions of Germany were some of the most predominant areas with GMO farming in the country before the national government banned MON 810 maize in 2009 (Abbott 2009). It should be pointed out that the regional government of Saxony-Anhalt, in fact, challenged – unsuccessfully - in court German legislation restricting the cultivation of transgenic crops through isolation distances (Reuters Staff 2010). In these regions, unlike other parts of the country, there is indeed a legacy of large-scale industrial farms which were previously owned by the government or cooperatives during the GDR. Since the reunification of Germany, a majority of these farms have either remained as large-scale cooperatives or been sold off to companies (Scaturro 2013). In some cases, the farms may reach sizes of over 1000 hectares (Interview, Johann Graf, 2015). This large-scale farming system has inflicted dramatically different implications on how the farms are managed and the type of farming practices that are employed, particularly with respect to GMOs. One environmental scientist pointed out that “with a huge farm, it’s easier to keep a [GMO separation] distance of let’s say 150 meters as required by the law....it’s much easier to abide by these rules if you have a huge farm than if you have a neighbor close by” (Interview, Martha Mertens, 2015). In this regard, the materialization processes of pollen and their movement across socio-materially constituted farmland became inextricably intertwined with the political mobilization patterns of farmers for or

against transgenic crops and in turn influenced the stances of governments. If such constellations had emerged in different ways more generally across the EU, then the issue may have been contested differently, with more adamant support from farmer groups, for example, in the pro-GM EU alliance.

5.2.3 Socio-material entanglements that matter: farmer mobilization and GMO issue outcomes as the contingent outcome of material-discursive intra-actions

This section has sought to unpack the politics of farmer mobilization in the EU debate over genetically modified organisms. A socio-material constructivist approach, in particular, contributes to conventional rationalist and constructivist explanations by situating particular contestation processes within the socio-material entanglements that made particular mobilization patterns feasible and conferred meaning on them. The EU labelling regime and pollen drift, for example, became politically meaningful in a context in which they were together intertwined with branding trends of food retailers, European small-scale and organic farming structures, and societal prejudices against genetically modified organisms. The power of pollen to displace relations between farmers (and in turn mobilize them politically), in other words, was not constituted solely by its ability to transfer DNA between two plots of land, but also importantly conditioned on the socio-material design of farmland and market factors. It is also especially crucial to take into account the different spatial arrangements and socio-materiality of farmland across the EU – climates, topographies, crop histories, scale - in constituting the interest constellations of individual farmers and decisions to take political action in different regions in the first place. This research is, in fact, extended in chapter six with a focus on understanding how the topography, climate, and spatial distribution of farmland in Bavaria, Germany came to constitute political processes in that region specifically and in comparative light with other regions when feasible.

As pointed out above, there is evidence that the views of farmers on the issue have indeed been heeded by politicians both in local contexts and in Brussels, highlighting the importance of examining their contingent mobilization. While farmer groups, in fact, were rather divided and/or indifferent towards the labelling and use of transgenic crops in food and cultivation, respectively, thereby constituting an environment in which it became politically expedient for EU actors to enact stringent regulations against GMOs, it should be pointed out that farm groups have been more

unified in their support of a lax regulatory environment allowing for the import of GM animal feed – generally protein-rich soybeans and soymeal - for the purpose of feeding livestock (Kurzer and Skogstad 2012). The adoption of this stance has, in turn, been attributed a role in shaping the 2011 decision of the EU political institutions to relax the zero tolerance threshold on the import of unapproved GM feed to allow for a low level presence of trace amounts of adventitious GM varieties (Kurzer and Skogstad 2012). This change in policy took shape after a common position was adopted among European feed manufacturers, grain traders, the oil and protein industry, farmers, and biotechnology lobbies following the rejection of numerous ships at EU ports containing unauthorized GM content and the higher costs for feed that resulted (Kurzer and Skogstad 2012). Within the context of farmer movements in Bavaria specifically, this stance on animal feed importantly is itself complicated in chapter six (section 6.2.4) through an examination of the socio-material relations that underline its articulation, including the incongruence between the climate of Europe and the cultivation of soybean crops and the accompanying demand for animal feed on account of livestock practices and the growth of the meat industry. Overall then, in the different stories narrated here, a spotlight is put on the socio-material work involved in constituting political orientation that in turn shaped policy outcomes, processes that are fleshed out in more detail with a focus on specific contexts in the next chapter.

Conclusion

The debate over genetically modified organisms has generally been explored at the level of advocacy and contestation. This chapter instead endeavored to examine the very populating of this field at key nodal points, an inquiry that took me into the laboratory and onto farm plots and into discussions about laboratory apparatuses and multi-gene complexes. The findings here suggest a need in the analysis of politics to, in fact, dig into these often dense and socio-material laden spaces of life if we wish to better understand our politics. For it is not simply that material things or the field of science are steeped in political meaning, but rather that material entities, technologies, and scientific processes are productive toward and intertwined with the socio-material constituted histories of the world. The constituting of the field that other approaches reify in the GMO issue debate was not at all self-evident and nor was it only made possible by particular identities and social constructions, but rather it was a contingent phenomenon in which considerable agency, of both human and non-human origins, was invested.

This agency came through in constellations often comprised of both stable – though contingent - elements (e.g. crop demand; crop threats; farm size/structures) and more unpredictable parts (e.g. contingent claims to IP; skills of scientists). Importantly, to understand how matter was agentialized (e.g. pollen displacing the interests of farmers), that is, how material things came to resist, displace, reify, enable, constrain, and perform, it was also necessary to grasp how particular material/discursive practices (e.g. organic and small-scale farming practices that render gene transfer inevitable) constituted these enactments. At the same time, this chapter has shown that particular material/discursive practices (e.g. IP regime limiting access to enabling technologies) are best analytically understood through the material entities (e.g. limited number of laboratory apparatuses enabling gene transfer) and other apparatuses that in turn confer meaning on them. It is these processes of material/discursive relations that will continue to be central to the politics of genetically modified organisms in the EU, but also to other issue areas. Such processes as entanglements between intellectual property rights regimes and the technologies of emerging fields or between socio-material arrangements of farmland and the integration of particular types of agricultural apparatuses will recur. If we wish to better explain particular phenomena and also understand the place of human agency in the processes that constitute them, as complex as they might be, we must grapple with them.

A socio-material constructivist analysis indeed engages with processes - from the here and now to the broader material/discursive practices that are there and here. This is something that differentiates it from new materialist perspectives (e.g. ANT) and with analytical differences in the conclusions that can be drawn. For by intra-acting with genetic sequences, but also industrial farming practices, we can see that causality in this case was not something that was a linear relationship between two things, as the positivist social sciences might have seen it, and nor was it simply distributed among many entities, as ANT may have posited. Causality was rather something that came through in the entangled performances of intra-acting entities and material/discursive practices. A rerouting of these processes in this case, in turn, may suggest possibilities of tinkering (e.g. Monsanto acting differently; larger investments in the research of public scientists), but it may also mean coming to grips with the powerful apparatuses of global political economy (e.g. food and energy demands; materialist tendencies; neo-liberal/capitalist economies; intellectual property rights) and how they intra-act with socio-material entities (e.g. multi-gene complexes; pollen and insects) that both channel their meaning and underpin their

potentially fragile existence. It is no small wonder that both the global and local socio-material processes through which the technology was constituted rendered transgenic crops unworkable in an EU contextual environment that under other circumstances may have been different. Operating globally and largely beyond the reach of any one political entity, such processes though are surely not at all easy to unhinge, suggesting further similar entanglements and engagements on the road ahead.

CHAPTER 6. THE SOCIO-MATERIAL CONSTRUCTION OF GMO-FREE BAVARIA

While the previous chapter shed light on how the agential landscape emerged in the debate over transgenic crops in the EU both in the biotechnology sector and the field of agriculture generally, a further area in need of clarity regards how these particular entanglements emerged and were further channeled within specific regional and local contexts. The development of the GMO-free regions network in Europe is an illustration of the fact that the constituting of the agential landscape has emerged in different ways in different contexts. Institutionally, regional anti-GM efforts were grouped together when in 2005, twenty regions across the EU, from Tuscany to Wales, established a new political map called the GMO-free regions network through the signing of the Florence Charter (Mammuccini 2013). By 2015, the network had expanded to include 64 regions in the EU¹⁹. The members are regional political territories that have been declared as GMO safe-havens by local governments. In particular, they protect land from GMO cultivation and contamination. The network also facilitates the organization of exchanges between European institutions, Member States, and European citizens and particularly enhances the coordination between governments that aim to shape a GMO-free EU policy. The specific goals of the network are to promote a sustainable farming system, protect biodiversity, support the precautionary principle, and support a “polluter pays” principle in the case of GMO contamination on non-GMO farms (Euroregions 2005).

Yet not all regions of the EU are members and many current members only achieved membership following deeply contested local debates, highlighting the fact that entanglements between pollen and farmers, for example, or the biotechnology agential landscape have both emerged and been further translated in different ways across regions. At the same time, it must be recognized that these outcomes matter both in their political implications for local, national, supranational, and global politics and analytically toward better understanding how certain interests and identities are constituted and come to matter within different settings. The views of regional governments can make a difference in that they can pressure national governments, which in turn may lobby and vote in the EU for specific policies. At around the same time that the region of Bavaria joined the network, for example, the regional government also successfully pressured the national

¹⁹ See the map provided by the network on their website here (accessed July 2017): http://gmo-free-regions-nrw.de/Portals/0/64%20europaregionen_genfrei_20150330_en%20Status%2031032015.pdf

government to shift its position on the issue, leading to a GMO cultivation moratorium in Germany (Spiegel 2009a, 2009b). Consequently, understanding this differential local political mobilization is vital if we wish to not only understand regional politics but also better understand the dynamics of EU politics.

The purpose of this chapter is to delve into some of these processes by investigating one specific regional debate, that of the case of Bavaria, Germany, which became the 61st GMO-free region in Europe in 2014 (Bayerische Staatskanzlei Pressemitteilung 2014). Bavaria especially provides a compelling case given the regional government's initial support for genetically modified crops and the region's status as an intersection of hi-tech and agrarian economies (Schroeder 2004). By examining the case of Bavaria, we can weave a descriptive analysis of some of the key conditions of possibility that taken together in their relationship created a scenario in which certain coalitions could come together (and others not) within the context of processes of pollen displacement and the emergence of the stringent EU regulatory regime. A focus on the coming together of the agential landscape is especially significant given that once coalitions reach a certain level of salience, they could be expected to shape political decisions. While it is outside the scope of this dissertation to understand everything that is going on across all regions of the EU on this issue, by taking this one local case and examining further sub-divisions within the case, we can capture how some of the processes have been negotiated across the EU and in the process make sense of the contributions of the socio-material constructivist approach in providing added value to understandings of politics.

The analytical narratives of this chapter especially foreground the socio-material processes that were central to Bavaria becoming a GMO-free region, putting an emphasis on the socio-material constituting of interests of particular groups of actors and the further socio-material channeling of these interests in terms of the constituting of alliances and mobilization decisions in specific contexts. These processes are, moreover, examined in light of the socio-material constituting of their political saliency and difference-making power with regard to policy formulation on the issue of transgenic crops in Bavaria. In this regard, throughout this chapter, the socio-material constructivist perspective is argued to contribute to understanding the issue debate in three core ways, with a particular focus on the complementarity of the approach with conventional rationalist and constructivist approaches.

First, it provides novel intelligibility in terms of understanding the constituting of farmer and beekeeper interests within Bavaria (when feasible in comparative light with other cases such as Spain and the eastern regions of Germany). Importantly, while rationalist approaches can shed light on rational choice (e.g. economic motivation in both ensuring access to markets and securing cheap source of animal feed) in constituting the mobilization decisions of these groups and constructivist perspectives can situate action within discourses (e.g. agrarian farming identities) and framing endeavors (e.g. co-existence frames employed by environmental organizations), a socio-material constructivist perspective complicates these narratives by unpacking the ways in which the displacement and resistance capacities of matter (e.g. topography of Bavarian landscapes, materiality of soybean), for example, pre-framed and conferred meaning to these discourses and together constituted interests and mobilization decisions through intra-activity.

Second, the socio-material constructivist narratives also complement rationalist and constructivist approaches by providing additional clarity and theorization on how particular interests and identities are channeled or not into particular strategies and actions in specific environments. The chapter does this by way of an examination of two counties in Bavaria, otherwise similar in their agrarian backgrounds and farming structure make-up, in which differences in farmer mobilization patterns into anti-GM movements were observed. Rather than the mobilization decisions of individual farmers being embedded solely in agrarian farming identities and interests within the aforementioned constellations, the narratives presented in this chapter shed light on how endeavors to mobilize farmers in specific regions were further caught up in socio-material configurations involving access to farmer databases and charismatic/well-networked farmer activists, the spatial dimensions of campaigning/lobbying, and the mundane routines of farmers and activists.

Third, the socio-material constructivist approach contributes to understanding how particular coalitions come to matter or not in the policy process. Even after the coalitions have formed, the debate is still shown to be immersed in more than human framing endeavors or the reflective rational political calculus of policymakers in translating the alliances into policy decisions. Rather, the narratives presented here show that political performances are constituted through both human and non-human enactments (e.g. bees as conveying impressions about the environment) and that further such performances are made possible through material (e.g. wind facilitating the movement of balloons in a symbolic protest highlighting the problem of pollen drift and genetic

contamination) and discursive (e.g. perceptions of bees in Bavaria) entanglements. These socio-material performances, moreover, are shown to gradually confer political meaning on the coalitions that emerged by engendering effects on the policy views of political leaders in Bavaria.

The chapter proceeds in the following stages. The *first section* provides an overview of the trajectory of the debate in Bavaria, laying out the shifts in the issue outcomes that make Bavaria a particularly compelling case in need of explanation. The subsequent sections then tease out particular snapshots across the region, with a focus on highlighting some of the contingent assembly work, including discursive/non-discursive underpinnings, which went into mobilizing and conferring meaning on specific entities in the process.

The *second section*, encompassing numerous sub-sections, begins by laying out the field position of farmers and their significance in constituting the shift of the stance of the Bavarian government, also highlighting the not inevitable nature of the political mobilization of farmers. Following from the discussion in the previous chapter, the section then turns to examining the generation of farmer interest broadly across the Bavarian region, taking note of the intra-actions between topography, climate, specific crops, and the socio-material historical construction of the farming system in the region and how these entanglements constituted diffraction patterns that differed from other regions in the EU in a way that made a difference. The section then continues by delving deeper into specific locales – Rosenheim and Augsburg - of Bavaria, illuminating the further entanglement work that went into mobilizing farmers politically in different ways, even across otherwise similar counties. This sub-section complicates interest-based accounts, shedding light on the mundane and banal practices of matter and discourse, including especially the role of gatekeepers and privileged access sites in the form of farmer databases and charismatic leaders, which channeled political action in specific cases, rendering mobility anything but inevitable. The final part of this section examines the non-enrollment of farmers into the GMO-free alliance led by environmental groups, examining how its subtly less radical stance against GMOs was made possible through intra-activity between entities like soybean crops that conformed and displaced actions, topography/climate conditions that displaced possibilities, livestock and meat industry practices, and norms on transgenic crops in soybean producer countries, and notes how this phenomenon made a difference in the debate.

The *third section* explores the beekeeper inclusion within the broader regional anti-GM alliance of the region, similarly elucidating the socio-material intra-activity through which agency was performed and beekeeper mobilization became plausible and also the intertwining of material-discursive practices that became central to the channeling of viewpoints and attitudes in the public performances of these constellations through direct action protest activities.

The chapter then *concludes* with reflections on what taking into account these entanglements might mean for politics going forward, thereby underlining the added value of the approach in contributing to the critical project of international relations and political science. As opposed to attributing causality solely to specific entities or even a notion of multi-causality, instead the chapter reflects on how causality emerged through the constituting of phenomena within broader entanglements involving boundary setting conferred both by the very materiality of things and the ways in which these entities intra-acted with other material-discursive practices. When done so, a range of potential intervention points are illuminated and it becomes challenging to view GMO-free Bavaria as inseparable from broader processes of materialization and discursification in agriculture and food in Bavaria, Germany, the European Union, and globally.

6.1 The contours of the case: from a center for biotechnology to a GM-free region

This section aims to provide an outline of the case, foregrounding certain aspects of Bavaria and the trajectory of the GMO debate that make it an especially appealing case. Bavaria is significant as a prominent region not only in Germany but also in Europe. It has become in the words of the regional government, the land of “Lederhosen and laptops” (Schroeder 2004). On the one hand, Bavaria is an advanced knowledge and innovation economy, underlined by the fact that when the GMO debate was beginning to take off in the region, the area was already considered home to the fourth largest biotechnology industry in the world (Hooper 2002; Wallace 2002). On the other, the economy of Bavaria was traditionally primarily supported by a large agricultural sector. This sector remains vital today, with Bavaria considered the most important agrarian region in Germany. In 2004, when the GMO debate was ramping up in the region, one in eight jobs in the region still depended on agriculture or forestry (Schroeder 2004). Around one-fourth of all milk and one fifth of all grain in Germany is produced in Bavaria (Schroeder 2004). And Bavaria leads

the world in producing hops, closely connected to regional traditions centered around the production and consumption of beer (Schroeder 2004).

In the debate over GMOs, these dual narratives of Bavaria have lent themselves to sometimes competing frames putting innovation and research up against the protection of the environment and small-scale farms. There has always been perhaps the possibility that the debate could proceed in any possible direction. In fact, as pointed out by several Bavarian scientists involved in plant breeding research, as a conservative region, there was probably a perception that Bavaria would have been the most likely region in Germany to be accommodating to GMOs (Interviews with Peter Doleschel, Volker Mohler, and Martin Müller, 2015). And throughout the 1990s, the government was indeed a committed GMO proponent. The Christian Social Union (CSU), the local partner of the similarly politically affiliated national Christian Democratic Union (CDU), has dominated local politics for the entire post-war period and historically supported GMOs, in accordance with their national partners²⁰. The technological centers around Munich were arguably “why they [the Bavarian government] were so much in favor of these things in the beginning” (Interview, Gerhard Wenzel, 2015). In 1996, the head of the CSU working group on genetic engineering emphasized that opposition to biotechnology also meant opposition to solving problems of world hunger, enhanced environmental protection, and medical progress (Miller 1996). As pointed out to me by the former director of the Plant Breeding department at the Technical University of Munich, “In those days [the 1990s], the government was very much in favor of transgenic plants. Bavaria was a leading county in Germany for transgenic release...and they liked it very much that universities stepped into this. And so we had a lot of funding from the Bavarian government...” (Interview, Gerhard Wenzel, 2015). The Bavarian State Research Center and the Federal Center for Breeding Research both conducted GMO research projects on potatoes, maize, and grapes, receiving funding from the Agricultural Ministry of Germany (Müller 2006; Interview, Peter Doleschel, 2015).

While some opposition to GMO began to emerge in the 1990s, it didn’t have immediate policy influence. In 1998, a referendum initiative received only 4.9 percent of a necessary 10 percent of

²⁰ Since 1962, the CSU has secured an absolute majority in all regional elections with the exception of the 2008 elections in which the party fell two votes shy of an absolute majority of 94 seats and instead formed a coalition with the liberal-oriented Free Democratic Party (FDP).

voter signatures to qualify for a vote (Der Landeswahlleiter des Freistaates Bayern 1998). And CSU politicians still espoused pro-GM positions at the time. Repeatedly throughout the early 2000s, turning to the imaginary of “laptops”, the regional Minister for the Environment publicly expressed his aim to help the region catch up to the world in the area of green genetic engineering, noting that research and innovation are important pillars of the resource-poor German economy (Die Welt 2005). The chairman of the CSU, Edmund Stoiber, also rhetorically tied medical and agricultural biotechnology together in framing the future of Germany (Isermann 2009). This happened at the same time that the network of GM-free regions of Europe was established by an initial twenty regions, including neighboring Salzburg and Upper Austria. It also followed years of European protests over the import and approval of GMOs and the 2003 EU decision to require labelling and traceability of GM products (European Parliament and Council of the European Union 2003b). In other words, while much of the rest of Europe was backpedaling on GM, the Bavarian government was doubling down on its support.

Given this background, what is particularly remarkable is that Bavaria would not only become a GMO-free region nine years later, but that it would do so under a CSU-led government. The official declaration of Bavaria as a GM-free region came as the culmination of two decades of campaigning by groups skeptical of GMOs, efforts driven in part by the earlier “failed” 1998 referendum drive. The first prominent shift in the CSU position was voiced in 2006 from Markus Söder, who at the time served as the General Secretary of the CSU. In a newspaper editorial article, he noted the skepticism of consumers and emphasized that the CSU valued the protection of nature, which could not be guaranteed with GMOs given the uncertainty of the technology (Söder 2006). As pointed out to me by one Bavarian pro-GM plant breeding scientist, the later focus of the government turned to “bio-farms” and small-scale agriculture – the motif of lederhosen (Interview, Gerhard Wenzel, 2015). Over the next several years, additional party representatives gradually began to soften their position. Opposition remained strong in the liberal-oriented Free Democratic Party (FDP), which would join the CSU in a government coalition in 2008, though. The then-FDP Chairman of the Agricultural Committee labelled a 2013 anti-GM protest in Munich, for example, unnecessary scaremongering (TopAgrar 2013). Another leading FDP politician argued that the technology was already found in many beneficial products that Germans use daily (TopAgrar 2013). The Bavarian government, nevertheless, began to introduce minor shifts to their position also in practice and CSU officials lobbied the national government for a moratorium on GM maize

production (Spiegel 2009a). In 2011, while taking no action at the regional level, the CSU government in Bavaria initiated a new procedure that would allow municipalities and districts in Bavaria to declare themselves GMO-free by imposing restrictions on the use of transgenic crops on publicly leased lands (Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, 2017). This stance allowed the government to take a hands-free approach as these processes worked themselves out at the local level. Many of these localities would employ this opportunity to become GMO-free, thereby setting the context in which a similar declaration would eventually be made by the Bavarian government on behalf of the entire region. While the Bavarian legislature under the CSU-FDP coalition government rejected a GMO-free declaration for the region in a 2013 vote, the CSU leadership of the regional government, free of its pro-GM coalition partner in 2014, announced that Bavaria would be joining the network (Bund Naturschutz 2013; Bayerische Staatskanzlei Pressemitteilung 2014).

This chapter now strives to engage with this particular process and highlights some of the entanglement effects involved in constituting these outcomes. An emphasis is placed on the anti-GM coalitions as being put together socio-materially and further coming to matter or not through other socio-material constellations, with a specific focus on examining how different groups of farmers, beekeepers, and environmental activists were mobilized or not into particular types of political action. In the next section, I begin by considering the role of farmers generally in Bavaria, including how their plausible emergence became the imprint of socio-material entanglements comprised of pollen displacements, EU labelling practices, and socio-material farming structures in the region.

6.2 The socio-material constituting of farmer mobilization in Bavaria

This section begins by first providing an overview of Bavarian agriculture and establishing the importance of the mobilization of Bavarian farmers against GMOs to the issue outcomes in the region. Following this, the section then proceeds to highlight how this general stance of farmers was not inevitable but rather situated within particular socio-material processes that emerged in different ways from other regions of the EU and further within Bavaria through particular intra-actions of matter and discourse in different counties.

6.2.1 The significance of farmer opposition to transgenic crops and the need for an explanation

The mobilization of Bavarian farmers was set in a context in which the region today (population over 12 million) is considered one of the most important agrarian areas in Europe and with jobs in forestry and agriculture making up a significant part of the local workforce (Statistische Ämter des Bundes und der Länder 2011).²¹ Observers involved in the GMO-free debate pointed to the farmers as a primary source behind the change in the CSU's position from pro-GM to anti-GM. As perceived by one Bavarian environmental activist, for example, the CSU began to oppose GMOs when they saw that farmers, normally a core segment of the CSU electoral vote, were protesting and cooperating with what they would have considered radical environmental groups associated with the Green Party (Interview, Marion Ruppenner, 2015). Given the Green Party's success in national politics – becoming junior partners in the government from 1998 to 2005 - at the time, this was not a development to which a blind eye could be easily turned. A local SPD party leader in Freising in Bavaria framed the farmers as “one of the crucial pillars” of the CSU (Interview, Peter Warlimont, 2015). He identified the emergence of farmers as part of the anti-GM movement in Bavaria as the moment (over several years) “when they [the CSU] started thinking about it...They noticed something was going on” (Interview, Peter Warlimont, 2015). And as a result of this thinking, he conceived they concluded that there was a necessity to be more careful on GMO lest a part of their support in Bavaria break away. Referring to the city of Rosenheim where farmers and environmentalists organized a 3500-person rally, a scientist at the Bavarian State Research Center for Agriculture similarly emphasized the farmers' increasing involvement on the issue and the Rosenheim event as a central moment in the debate, particularly as it embarrassed the CSU (Interview, Peter Doleschel, 2015). Another Bavarian plant breeding scientist involved in pro-GM lobbying observed that the CSU began to shift its position once it realized that there were more votes to be won by emphasizing “biological” agriculture rather than the hi-tech aspects of the technology (Interview, Gerhard Wenzel, 2015).

Importantly though, an engagement with the story of Bavarian farmers reveals that this activism was anything but an inevitable phenomenon. Despite some skepticism toward agricultural

²¹ In 2010, the farmer workforce directly accounted for around 257,000 jobs on nearly 100,000 farm holdings (Statistische Ämter des Bundes und der Länder 2011).

biotechnology, there was a perception that Bavarian farmers were largely initially indifferent to the GMO-free movement (Interview, Peter Doleschel, 2015). A local farming consultant, who has worked closely with farmers in the southeastern parts of the region, meanwhile, pointed out that even in the mid-2000s, when GMOs largely seemed dead at the supranational level, farmers in the region still emphasized that it was inevitable even though they didn't really like it (Interview, Christoph Fischer, 2015). The farming consultant also emphasized that farmers were simply too busy for protests, even if they opposed GMOs, given their multitude of responsibilities, including side jobs. One study of Bavarian farmers confirmed this view with the finding that three-fourths of farms in Bavaria are only operated on the side, managed by so-called "moonlight farmers" who conduct their farming work in the evenings and on weekends (Merkl 2012).

Some participants in the debate even labelled farmers as open to the idea of GMO under certain conditions. A Bavarian MP and Social Democratic Party spokesperson on GMO issues in the regional parliament (Landtag) remarked that Bavarian farmers were very interested in economics and how to survive, not how they could do less harm to the environment, with pollution problems in local fisheries an illustration of this (Interview, Herbert Woerlein, 2015). Owing to the small-scale nature of farms in the region, including the reliance of farmers on side jobs to earn enough income, he pointed out that Bavarian farmers are not self-confident but rather open to whatever benefits them, including GMOs (Interview, Herbert Woerlein, 2015).

The views of the SPD politician receive some credence from historical research which point to the existence of a variety of historically constituted material-discursive practices that have inclined farmers towards economical approaches. Peter Merkl (2012, 38) examined the evolution of small town and village life in Bavaria, finding that "competition with the rising incomes elsewhere has forced Bavarian farmers to treat farming more and more as a business and this explains most of the transformation of agriculture in the last quarter of the [20th] century." These business adjustments, in particular, meant the leasing of land, the pursuit of training, the purchase of modern equipment, and an increase in the number of meat-producing animals instead of draft animals (Merkl 2012). Bavarian farmers increasingly turned to the Common Market to export their products. The smallest farms were run out of business, a problem only exacerbated by the economic crisis of the late 2000s. Staff was reduced with growing labor expenses, and farming was turned into a part-time or side job. It has also been noted by the Bavarian government that

outside jobs were especially crucial for the economic feasibility of this type of part-time farming (Merkl 2012). What was once the tradition of successive family ownership of farm house and land has now faced resistance from younger generations unwilling to take on the responsibility to tend to family farms, instead preferring to pursue education and job opportunities elsewhere.

The inclination for Bavarian farmers to focus on financial matters above other concerns is highlighted in the fact that even today, Bavarian farmers still largely use imported GM animal feed – not included in the GMO-free region stipulations - to feed their animals despite opposition from local environmental groups (Backus 2008; Interview, Johann Graf, 2015; Interview, Marion Ruppenner, 2015) According to a GMO expert at the Bavarian Farmers Association (BBV), the GM soybean is significantly cheaper than the conventional non-GM type, which they say partly explains farmers' preference for GM seed (Interview, Johann Graf, 2015). While advocating against the use of GM animal feed, a local anti-GM group in the Bavarian town of Neumarkt, in fact, encountered this tendency of farmers to weigh on the side of economics. The group initially tried to convince farmers to stop using GM animal feed but “they say that people are not more willing to pay higher prices” (Interview, Zivil Courage Neumarkt, 2015). Following this response and lack of success, the group decided on a change in tactics, “so we thought it was better to focus on consumers to convince them to want better food,” pressure which the activists hoped would eventually work its way through the supply chain (Interview, Zivil Courage Neumarkt, 2015).

Rather than an automatic turn against GMOs in Bavaria, therefore, one can plausibly assert that farmers were much more indifferent to their use. This chapter now turns toward understanding how it was possible that farmers could become mobilized in the first place, tracing their involvement to the movement of pollen, and the ways in which its agency was enhanced specifically within Bavaria on account of its alliance with the dense farming layout of the region and the physical nature of the farmland, and its entanglement with the socio-material practices – laid out in the previous chapter - on the political economy of supermarket branding in Europe and the European regulatory labelling regime.

6.2.2 Socio-material entanglements that mattered in the generation of farmer opposition to transgenic crops in Bavaria

The general story of farmer mobilization in the European Union was already discussed in chapter five. Notably, European farmers unexpectedly became tied up in relations between the actions of the biotechnology industry, environmental activists, food retail and manufacturing chains, EU regulations on labelling, and ultimately pollen and the multiple material entities involved in the displacement of genetically modified DNA from one farm to another. The EU further sought to address the “contamination” issues that were engendered from these mixing of processes through the creation of an agriculture system based on the principle of co-existence – or the segregation of conventional, organic, and GM farms. This system itself though would still come to intersect with the practices of the everyday and the historically constituted socio-material practices centered around farmland in individual regions. The system was ultimately not universally applicable, in part due to continuing uncertainty and doubts regarding the sufficient amount of isolation distances needed and also on account of the configuration of farmland in particular regions such as Bavaria.

In the Bavarian context, political efforts to craft a system of co-existence ultimately did not overcome the symbolic and displacement effects of pollen and labels, undercut by earlier practices of clustering small farms together over many generations of family ownership, according to a Bavarian environmental scientist (Interview, Martha Mertens, 2015). The average size of farms has been estimated at around 35 hectares in Bavaria (Interview, Johann Graf, 2015). The director of the Bavarian Crop Science and Plant Breeding Institute noted that these small farms pose an obstacle for GMOs in Bavaria because it is difficult to protect them from pollen drift (Interview, Peter Doleschel, 2015). This burden is only magnified for some crops in which pollen may drift farther afield. Highlighting the case of canola, he emphasized that it “would be impossible to grow non-GM Canola when your neighbor is growing GMO canola” in Bavaria due to pollen drift and the proximity of farmland (Interview, Peter Doleschel, 2015). When scientists or plant breeders have pursued field trials, farmers have pursued litigation because of these concerns. The result in Bavaria was that crop cultivation, even for trials, was severely limited and even if farmers wanted to plant GM crops, they had to abide by stringent regulations on isolation distances. The farming system in Bavaria, in other words, became a socio-material phenomenon, itself emerging first of all through intra-actions between human and non-human matter, which enacted particular

conditions of possibility on its own agency. Simultaneously, in entering into relations with the planting of particular crops and particular regulatory regimes and political economy practices, these capacities of displacement were further conferred meaning and came to perform agency in these moments of situatedness, displacing pollen and farmer relations in specific ways. This picture contrasts with eastern parts of Germany, discussed in the prior chapter, where the average farming size is larger and where many farmers and local governments chose to support GM crop cultivation before the national ban.

Another unexpected entity enhancing the potency of pollen was the character of the physical topography of the region. The hilly landscape of Bavaria has made mass cash-crop farms, where there is a larger market for GMOs, untenable in much of the region (Interview, Johann Graf, 2015). Instead, Bavarian farmers, especially in the southern and eastern parts of the region, are focused on dairy production, an industry where commercial GMOs have not been marketed (Interview, Johann Graf, 2015). Furthermore, according to a local plant breeding scientist, climate conditions render the one GM crop that has been approved for cultivation in the EU - MON 810 – relatively impractical in Bavaria; the corn borer is not a threat to crops in the region, thereby reducing the need to use Bt or crops expressing the Bt toxin (Interview, Chris Schoen, 2015). Another plant breeding scientist noted that “even the farmers didn’t see in the beginning that there was a product they could use...that was necessary here in our region” (Interview, Martin Müller, 2015). This contrasts with the situation in Spain, where the corn borer is considered a plausible threat to the crop yield of farmers and where around one-third of the maize crop or over 100,000 hectares comprises the GM variety (De la Cruz 2016). In regions of Spain where there is considerable pest pressure, there are even higher levels of GM maize cultivation, highlighting again the power of the corn borer and other pests as entities that displace farmers’ thinking on the issue (De la Cruz 2016). This capacity is in part pre-cut into the maize, constituted by the obstacles of resistance that it puts up to the use of common pesticide sprays. As the GMO spokesperson for Friends of the Earth Europe pointed out, “maize is really tricky, you can easily spray pesticides in weeds and rye, but to spray a maize field when it’s well-grown, you need heavily expensive equipment” (Interview, Mute Schimpf, 2014). This has been especially true for small and medium size farmers in Spain for whom the Bt maize has offered a convenient solution promoted by government and official advisors. Meanwhile, in the Bavarian context in which products could be suddenly deemed

worthless if contaminated with GM, with little gain for allowing GM crop cultivation, it became easy and safe to oppose GMOs in a farmer's own neighborhood.

Arising from the constraining effects of nature, the market, and the legal code, GM farming became less and less socially tenable in Bavaria, in some cases reordering relationships between neighbors.

A Bavarian environmental scientist emphasized this point:

When you travel through Bavaria, you see many little villages and farms...there aren't that many spaces where no one lives. The people are much more confronted with the type of farming. Therefore, even people who don't farm, who just live there, get involved in the discussion about GMO, about growing maize. They are more active....There is much more social control perhaps and discussion because the distances aren't so far, so the neighbor is much more often in contact than with these other farming systems. (Interview, Martha Mertens, 2015)

In the town of Iphofen, a wine-growing area in northwestern Bavaria, a heated local debate erupted after a farmer decided to cultivate MON 810.

The farmers were fighting against one another. One of the farmers wanted to grow MON 810, but others were against it, and they fought against the farmer. And he was alone. The entire city was against the farmer. He became smaller and smaller because of the pressure from outside. (Interview, Zivil Courage Neumarkt, 2015)

The social pressure from neighbors ultimately proved too much to bear for the Iphofen farmer who soon after relented. Another activist emphasized that there used to be many farmers who planted GMOs in Germany in 2007/2008, but now "because of big social pressure, we don't have GMO areas in Bavaria or anywhere else in Germany. And when you look at a map, you see that there used to be areas with GMO seeds grown and now we don't have that" (Interview, Zivil Courage Neumarkt, 2015). A representative of the BBV emphasized that while there was some earlier discussion and interest among farmers about having GMO cultivation in the cash-crops areas of northern Bavaria, these talks didn't get far off the ground due to the problems of separation distances and consumer preferences (Interview, Johann Graf, 2015). The cash crop farmers lost the internal debate among farmers and the official position of the BBV became a GMO-free stance on account of the fact that "the small fields here don't carry separate GM and GM-free crops, so we said okay it doesn't make sense here in Bavaria to grow GMOs" and "Our consumers, the society....they don't want that we grow GM, so why should we grow stuff that we can't sell?" (Interview, Johann Graf, 2015). The story illustrates the ways in which social and technical and

different types of agency come together in the putting together of a coalition; while pollen displaced interactions between farmers, neighbors symbolically conveyed their impressions on what GM cultivation would mean to them. These emergent actors and performances together rendered GMO impermissible in the towns of the region.

Regarding this element of neighborhood control arising from the performances of crops and pollen, similar findings have been noted in other contexts (C. Barry 2010). In fact, where GM maize farming is popular among farmers, social control can work against conventional and organic farmers. Rosa Binimeles (2008) found that in Catalonia and Aragon, where GM maize cultivation was around 50 percent of total cultivation, farmers who were reluctant to use GMOs were shamed as being poor entrepreneurs. Other farmers reported concealing any organic crop plots that they maintained to avoid this shaming. GM and conventional farmers regularly referred to the organic farmers as “careless, dirty, and untidy because weeds can easily be seen in their fields” (Binimelis 2008, 450). Owing to this stigmatization, organic farmers often neglected publicly reporting cases of contamination, in order to avoid any deterioration in social cohesion. One environmental activist pointed out that because of the risk of contamination – combined with the taboo against legal action against neighbors in small towns – conventional farmers are even incentivized to switch to GM maize (Binimelis 2008). In Bavaria, meanwhile, with transgenic crops conferred meaning by the general social consensus among farmers against GMO farming and the proximity of farmland to larger cities, the pressure turned the other way. To be a GM farmer risked destroying neighborly relations. In each case, it was the nature of the landscape in consort with the society’s management of that land that shaped these relations between neighbors.

Overall, this first part of the story of farmer mobilization speaks to how the phenomena in specific contexts emerged as the entanglement effects of numerous material-discursive practices, some of which were pre-ordained in certain capacities of agency (e.g. farm size structure as displacing connectedness between farms, topography as displacing possibilities for certain types of transgenic crop adoption, technical difficulties of overcoming maize resistance as constituting farmer interests in transgenic maize) but also further came to matter in particular ways in specific interactions. Consequently, rather than emerging merely from what may appear at the surface level to be rational interests and being attributable to any particular cause, this narrative further complicates and unpacks the story, showing the potential and direction of political mobilization to

have emerged from complex relations involving different socio-material constituting of farmland and the contingent events implied therein.

Still yet, even within these contexts, there was no direct causation between these constellations of interest generation and political mobilization of farmers through direct action activities, as different Bavarian counties with similar profiles experienced different patterns of mobility. As the next sub-section elucidates, the enactment of political mobility, in fact, became further intertwined with the socio-materiality of lobbying, as particular material-discursive practices further constituted the conditions of possibility for political action, channeling the translation of the farmland-pollen-regulation entanglements in specific contexts.

6.2.3 The socio-material translation and channeling of interests in the mobilization of farmers in Rosenheim and Augsburg counties

The previous sub-section foregrounded how the constituting of Bavarian farmer mobilization emerged against the coming together of multiple entanglements involving biological processes, spatial farming practices, social pressure, and European regulatory regimes. Yet these processes didn't automatically translate into organized political action and the mobilization of farmers in political activities in Bavaria, with farmers represented in formalized anti-GM movements in some communities but not in others. An example of two such regions with contrasting outcomes are Augsburg County of Swabia and Rosenheim County of Upper Bavaria where - despite the common context in which the GMO issue was situated in each county - there were marked differences in terms of farmer mobilization and overall GMO issue outcomes.

Although both county governments in Augsburg and Rosenheim declared their counties as GMO-free zones, the field of actors and power relations between them developed in notably distinct ways (Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, 2017). While farmers in the Rosenheim municipality of Halfing began an initiative in 2006 seeking GMO-free zones, no similar farmer-led projects sprung up in Augsburg (Oberbayerisches Volksblatt 2006). Moreover, while in Rosenheim, there was a significant mobilization of farmers, represented in the formalized Zivil Courage movement that organized regular demonstrations and campaigns and developed content for public communication, in Augsburg, participation of farmers was sporadic (Interview, Christof Rauch, 2015). Unlike the movement in Rosenheim led by farmers, it was instead

environmental activists that organized the movement in Augsburg County and only beginning in 2009 (over three years after the movement began in Rosenheim), with their own barometers of success measuring up differently than that achieved in Rosenheim (Stöbich 2011). In Rosenheim, an online campaign seeking to persuade farmers to declare their land GMO-free received a significant number of pledges from farmers in the region, while efforts to collect similar pledges by environmental groups in Augsburg floundered (Interview, Christoph Fischer, 2015; Interview, Christof Rauch, 2015). In particular, while the Rosenheim farming activists succeeded in attaining GMO-free commitments from both farmers and the county government, the Augsburg environmental activists settled instead on securing GMO-free commitments not only from the county-level government, but also from municipality governments throughout the county (Deibl 2011; Interview, Christoph Fischer, 2015).

These differences came about despite the similar agrarian and political profiles of the two counties. At the level of government politics, county governments have been comprised of similar compositions of political parties, with the CSU dominating local politics in both areas. In terms of the agrarian profiles, meanwhile, forestry and agricultural land importantly make up a similar proportion of overall land in both Augsburg and Rosenheim counties, with the 2004 figures being 85 percent and 87, respectively, and declining to 82 percent and 84 percent, respectively, in 2014 (Das Bayerische Landesamt für Statistik 2016a, 2016b). In terms of agricultural land specifically, the makeup in Rosenheim County was 56.6 percent in 1980, 52.7 percent in 2004, and 48.3 percent in 2014, with corresponding numbers in Augsburg County being 56.2 percent, 51.8 percent, and 48.4 percent, respectively (Das Bayerische Landesamt für Statistik 2016a, 2016b). Both counties also importantly show similar levels of maize production, relevant given that Monsanto's insect resistant maize has been the only GM crop approved for cultivation in the EU since the 1990s, with the figures being 11.5 percent of total agricultural land in Rosenheim and 12.8 percent in Augsburg according to 2007 data (Das Bayerische Landesamt für Statistik 2016a, 2016b). This indicates that at around the time that the debate over GMOs in Bavaria began to take off in the mid-2000s, the potential appeal or costs of GM cultivation could have been expected to have been around the same for both counties. Relatively small scale farms tend to dominate both counties, with the overall average farm size currently estimated at around 35 hectares in Augsburg County and 23 hectares in Rosenheim County (Amt für Ernährung, Landwirtschaft und Forsten Augsburg, 2017; Amt für Ernährung, Landwirtschaft und Forsten Rosenheim, 2017). This compares, for

example, to 2010 figures in Mecklenburg-Vorpommern in Eastern Germany that put average farm size at 286 hectares (Eurostat 2012). County level data from 1999-2010 also shows a similar level of distribution between small scale and large scale farms in the two counties (Das Bayerische Landesamt für Statistik 2016a, 2016b). The potential unintentional drift of GM maize consequently could have been expected to equally affect the two counties.

With this context provided, a question is indeed raised regarding why the political activities of farmers developed differently in two communities that are otherwise similar. Importantly, it should be emphasized that conventional materialist-rationalist and constructivist approaches both face shortcomings in providing an adequate explanation. A materialist-rationalist explanation, for example, such as the resource mobilization theory would expect farmers to seek to rationally maximize their livelihoods based on their material position within the Bavarian and EU political economy structure and the costs and rewards provided from involvement in any campaign (McCarthy and Zald 1977). Interest-based explanations though, in fact, are unable to account for the fact that farmers in Augsburg and Rosenheim were operating under the same regulatory and social frameworks and with the same material positions, consequently having their interests structured in similar ways, yet still produced different mobilization outcomes. In both regions, given the relatively similar distribution of small scale and large scale farms, cross-pollination presented similar risks to conventional and organic farmers. Nevertheless, it was only in Rosenheim that farmers broadly became a part of an activist movement demanding change from the regional Bavarian CSU-led government on the issue and also declared their own farmland as GMO-free area.

Incorporation of constitutive elements such as identity, ideas, and language, as may be suggested in approaches focused on collective identity formation and framing, does no better in helping understand the decisions of farmers (Hunt et al. 1994). Anti-GM activists in both Augsburg and Rosenheim in their public discourse emphasized concerns about the uncontrollable nature of genetically modified crops, the downstream harmful environmental effects inflicted, and the negative role of multinational corporations and the patenting associated with these companies (Chiemgau-Zeitung 2008; OVB Online 2009; Stöbich 2011). In some cases, the exact same events were even organized in both regions, with Percy Schmeiser, a third-generation Canadian farmer and Alternative Nobel Prize Winner who was infamously sued by Monsanto after the company

accused him of stealing GM oilseed rape, headlining demonstrations in both areas to share his personal story (Chiemgau-Zeitung 2008; OVB Online 2009; Carlsson 2010).²² In both regions, moreover, the broader farming community and CSU political party were generally perceived to be the target of such messages and protest events. Despite similar language use and positioning and the underlying agrarian identities of the areas within the broader Bavarian region, there were different outcomes in each case though. Consequently, while the employment of particular storylines or the background identities of actors may have constituted the debate in part, the differential outcomes suggest that it was only in combination with other processes.

It is my argument that the above approaches err in failing to heed the activist coalitions of Augsburg and Rosenheim as rather complex and fragile achievements brought together not only through rational calculus or made possible through historically constituted socio-material farming identities, but also enabled or hindered through the politics of the everyday, including the mundane and banal objects, material and technical processes, and social practices of routine life. It was, in other words, not only identity and discursive framing nor the raw material interests of actors that were involved in constituting the field of actors in Augsburg and Rosenheim, but also the ways in which these relatively stable interests and identities, as contingent as their assembly might have been, became further entangled with similarly contingent, though less stable elements in the field of practice. While interests, for example, may have played a role, such interests were arguably not only constituted by the multitude of performances coming together in the form of pollen, bees, wind, EU labelling, supermarket branding, and laboratory experiments as already illustrated, but once established, were also further realized or not in specific contexts through the coming together of particular assemblies and especially according to how particular contingent elements constituted the translation of such interests to individual farmers. An investigation of the coming together or not of these elements and the various constitutive encounters of both the discursive and non-discursive therein can, in fact, help us better understand the overlooked yet crucial sites of power within these processes that enable interests and identities to matter, an endeavor that will now be pursued in the next two parts examining the GMO coalition stories in first Augsburg and then Rosenheim.

²² Schmeiser had argued that his farm had become contaminated after pollen drifted from his neighbor's farm.

6.2.3.1 The channeling of farmer mobility in Augsburg: when mundane routines and banal matters become integral elements that displace and hinder access

Exploring the case of farmer and political mobilization on GMOs in Augsburg County, rather than contestation processes or identities, this section puts a spotlight on the crucial performative agency capacity of gatekeepers, with examples identified as farmer address databases and key members of the community in regular contact with farmers. In intra-acting with the pre-existing issue salience as discussed above, these entities are argued to have become a primary constituent of the process, with anti-GMO activists obtaining access to them in the case of politicians but not acquiring access to them in the case of farmers. In consort with CSU publicity endeavors and the spatial practices of farming, these processes, significantly, channeled the activities of the GM opponents and the issue outcomes in the county.

The endeavor to mobilize farmers in Augsburg County largely took place under the auspices of the GMO-free movement in the area. The endeavor started with the 2009 launch in Augsburg of a county-wide alliance of 25 anti-GM groups, comprised of environmental, organic farming, civil society, and religious organizations, which was more broadly aimed at opposing GM in the county (Interview, Christof Rauch, 2015). The group met once a month for meetings and organized events to distribute GM awareness-raising flyers and collect petition signatures. To generate interest in the cause, they also organized a major informational event in June 2010, headlined by Percy Schmeiser, the aforementioned Canadian farmer who had legal conflicts with Monsanto, who warned the audience in attendance about Monsanto's aggressive tactics and the potential contamination that may arise from transgenic crop cultivation (Carlsson 2010). The event in Gessertshausen – a municipality in the county – was reportedly attended by around 500 participants and with this success, the group decided that they wanted to do something “profound,” but ran into various geographical, informational, and social barriers that had to be overcome in order to enroll farmers into their network (Interview, Christof Rauch, 2015).

With no history of coordination or cooperation between environmental organizations and conventional farmers, anti-GMO activists in Augsburg County, in particular, struggled to expand farmer membership in their group. The anti-GM alliance, for example, wanted to campaign farm to farm to encourage farmers to come out against GMOs, but lacked personal contacts, including

e-mail addresses or phone numbers of farmers. As pointed out to me by one coordinator in the alliance, one of the few members who lived in the countryside:

Most land is owned by the farmers: we wanted to reach farmers personally. I would go every evening in the restaurant where they drink beer and talk to them. I talked to the ones around me, when they go to plow their field and so on. It was impossible to get the addresses of the farmers [throughout the county] though: there's no ministry database, nothing. (Interview, Christof Rauch, 2015)

The lack of networking opportunities with farmers was compounded by the fact that most of the activists in the alliance lived in the city of Augsburg rather than the expansive countryside of the county where most of the farmers were based. The distance between farms in the county, in particular, functioned to displace relations between anti-GMO activists and the people they wanted to enroll in their network. The lobbying activities of the anti-GM activists were consequently steered not simply by their own ideas and wishes but also by the constraints imposed by the socio-materiality of the lives of farmers, including both the patterns of social engagement of farmers and the physical distances and spatial isolation entailed in the field of agriculture.

Within this context, the alliance struggled to develop practical ideas, but finally settled on a plan focused on lobbying members of municipal councils in the county to prohibit GM cultivation on county-owned land. As the coordinator pointed out to me, "the idea was to put into new contracts that farmers would not be allowed to plant GM plants on these fields" (Interview, Christof Rauch, 2015). This was determined to be a feasible option if only for the fact that direct communication lines were open between activists and government officials; they knew their phone numbers, e-mail addresses, and work addresses. In other words, the possible lobbying actions of the local alliance were constituted not only by their goals, but also the very materiality of communication, including the boundary setting practices therein that constituted the range of potential target audiences. The intention to do something "profound" was conferred meaning and channeled through the possibilities that were engendered through the gatekeepers with which they entered into relations.

These material-discursive practices still intra-acted with other apparatuses yet. The Augsburg GMO-free network coordinator pointed out, for example, that mayors were perceived as particularly sympathetic on account of an opportunity to advance their own political careers

(Interview, Christof Rauch, 2015). This was situated within a context in which the Bavarian CSU party had in 2011 created an institutionalized system for declaring municipality and county land as GMO-free and provided meeting time, memorabilia, and photo-ops to the cooperating mayors (Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, 2017). These GMO-free declarations were seen as serving as symbolic opportunities for positive regional coverage for the CSU, as an opening for the CSU to frame themselves as the central change agent and leader all along in the move to a GMO-free Bavaria (Interview, Peter Warlimont, 2015). The photo-ops functioned as campaign tools not only for the CSU leadership though, but also for the small-town mayors who could declare to their own constituents that they had meeting time with the all-important ministers (Interview, Christof Rauch, 2015). Mayors and local government councils were routinely invited to GMO-free press events and photographed with key CSU government ministers, including Marcel Huber, Markus Söder, and Ulrike Scharf, awarding the municipality and county officials with glitzy medals, seals, and certificates for their status achievement²³. In this way, the photo-op, while serving as a symbolic tool, through its dramaturgical power, also functioned as a practice that displaced how political leaders approached the issue, drawing in otherwise ambivalent mayoral support.

Given that the coordinator was one of the few activists who lived in one of the rural municipalities in the county, he said “Why not start with my village?” His story was narrated as such:

I first started with the mayor: I knew him; it was explained why we did not want GM plants planted here; I asked him to support it at the city council and then he agreed to put it into the contract for farmers.... What is the next step? Getting friends in neighboring villages to introduce the resolutions. (Interview, Christof Rauch, 2015)

By the time the activists concluded their initiative, all but three of the 46 municipality districts of Augsburg had passed the resolutions banning GMO cultivation on public land. Moreover, a total of 29 municipalities were reported to have officially signed on to the GMO-free Bavaria municipality scheme as of 2017 (Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, 2017). This compares to the total figure of 196 municipalities and cities – out of 2056 total municipalities - in all of Bavaria that had signed on as of 2017, eight years following

²³ The Bavarian Ministry for the Environment and Consumer Protection website includes a picture for nearly every municipality (accessed July 2017). See: <http://www.stmuv.bayern.de/themen/gentechnik/kommunen/index.htm>

the German declaration of a moratorium on GM crop cultivation (Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, 2017). As described by the coordinator, “no other county is as green as this one” (Interview, Christof Rauch, 2015).

With respect to broader measures to attain non-GM declarations from farmers for privately-owned land, the movement was not as successful though, in part due to their inability to directly communicate with farmers. With respect to this mobilization of farmers, the GMO-free coordinator said that:

One way was to make contracts; the mayors would agree to send a form to every farmer in the village, dropped into their mailboxes; they could put their names and declare that they did not plant any GMO on their land. We asked farmers to send the forms back to us: we wanted to evaluate the percentage of farmers who don't do GMOs on their own land. (Interview, Christof Rauch, 2015)

The process turned out to be tedious and not particularly productive, especially given the lack of legal guarantees. Unlike a similar effort in southeast Bavaria, discussed below, which was led by farmers who could easily spread information to each other and provided an application for farmers to enter their stances visually (i.e. claiming a plot of land on a digital map), there was minimal momentum in this case. Eventually activist activity receded in Augsburg given the lack of prospects for further success. From the perspective of some activists, “the government said that there would be no more GMOs on farms; all counties agreed that no-GM on their farms,” so there was a question as to why they should bother campaigning more (Interview, Christof Rauch, 2015).

The endeavors of activists in Augsburg on GMOs were but one initiative in the broader GMO movement in Bavaria, but help us understand some of the processes and struggles at work across the region as the anti-GM activists campaigned from village to village. This particular process demonstrated that banal objects like the presence of phone books and mundane practices of the everyday in the lives of farmers can emerge as crucial entities constituting communication channels, both potentially enabling the assembly of a coalition but also posing as barriers. In addition to the aims and message of a campaign, what is also important is the capacity to be able to enter into intra-actions with the key target audience in the first place, which cannot be taken for granted. In this vein, it is not only the experienced intra-actions that generate phenomena, as

typically noted, but also the silences and intra-actions that never come to be – but presumably could have in another context - that engender different diffraction patterns and issue outcomes.

In terms of the specific implications for the GMO debate in Bavaria, the case of the GMO-free movement in Augsburg came at the tail-end of the shift in the CSU position. In tagging itself to the 2011 government approval of the volunteer GMO-free municipality scheme, the GMO-free municipality drive was important as part of a broader effort to visually demonstrate to the central Bavarian government the support behind the movement across the region. While the Bavarian government had already begun to shift its position to a skeptical stance on GMOs by the time the campaign was under way, the local GMO-free declarations provided an opportunity to then stabilize and entrench these views, crucial in the run-up to the 2014 accession of Bavaria into the GMO-free Regions Network. As the director of Bund-Naturschutz, the largest environmental organization in Bavaria, noted, a GM-free Bavaria was far from secure (OVV Online 2010). The next section now turns toward comparing these experiences with that of another locale, that of Rosenheim, where mobilization of farmers was noted to have been more successful and came at a critical time period before the CSU began shifting its position.

6.2.3.2 The channeling of farmer mobility in Rosenheim: recognizing the power of a charismatic leader with privileged access and the socio-material entanglements in which these capacities come to matter

In examining the strategies of anti-GM activists and their enrollment of conventional farmers into the anti-GM alliance in Rosenheim, this section similarly places an emphasis on the role of gatekeepers in constituting access to farmers in the first place. Importantly, while in Augsburg activists lacked access to a gatekeeper that could channel their intentions toward mobilizing farmers in any systematic manner, the narrative here focuses on how the presence of a charismatic leader with relationships with the broader farming community, that is, a privileged access status, made a difference in the activities and ultimately outcome of activists. In constituting a shift in the CSU position on the issue, the story presented here also examines how farmer mobilization in the region became intertwined with both stable (e.g. historical farmer-CSU alliance) and disparate sporadic elements (e.g. the nature of specific protest events) that conferred meaning on these practices.

The development of anti-GM farming political institutions in Rosenheim, it should be pointed out, was not at all a self-evident matter. The mobilization of farmer opposition to GMOs, in fact, only began to gradually emerge when in 2006 an at-first small group of southern Bavarian farmers became more involved on the issue with an initial gathering in Halfing (Oberbayerisches Volksblatt 2006). These 40 farmers in the rolling hill landscape of the Rosenheim district in Bavaria called themselves the Zivil Courage (referring to the courage for people to stand up for their beliefs) movement and were led by Christoph Fischer, a sustainable farming consultant (Interview, Christoph Fischer, 2015). Fischer himself was motivated to start the group after observing an anti-GM demonstration at a port during an unrelated visit to Japan. He also had just received a funding and publicity source after winning a sustainability prize awarded by the Bavarian Lammsbrau organic brewery (Interview, Zivil Courage Neumarkt, 2015).

The project had a slow start as Fischer encountered a wall of farmer resistance. As a consultant, Fischer worked with ecological-oriented farmers, but even they were not convinced enough to get involved. The barriers in this case, in fact, were not in persuading farmers to oppose GMOs, but rather about mobilizing farmers to actively oppose GMOs through demonstrations and other direct action initiatives. As Fischer recalled, “When I came back [from Japan], I talked to many farmers and asked them what they think about GMO. They said it’s dangerous, oh I don’t like it, but it’s coming, you can’t stop it. They said it’s too big and coming from everywhere” (Interview, Christoph Fischer, 2015). The Rosenheim activists particularly struggled to overcome an inclination among farmers to focus on their many other work and family responsibilities (Interview, Christoph Fischer, 2015).

Despite this initial reluctance to take action, Fischer persisted in talking with more and more farmers, framing the issue in light of the problems - previously discussed above – regarding agriculture and nature as an open process.

You change something and you can never go back. When you do something wrong with technology, you can [generally] repair it and change your way, but when you change a plant, you put a gene from an animal or something, the plant grows up, and the pollen goes to another plant. You can’t stop it ever. If you find out years later that it was wrong, you can’t stop it. And so it was my idea that if we don’t know the reason or danger of what’s going on, we said it’s better we wait. And I talked to more farmers and they said it was a good idea that we wait. So I had the idea to start a movement. (Interview, Christoph Fischer, 2015)

The movement would be based on organizing chapters locally, beginning in the Rosenheim area and then spreading out throughout Bavaria. As Fischer emphasized, “People simply had to say that they had Zivil Courage and support GMO-free areas around them. [People had to say] we are for GMO-free regions in my area – not Bavaria, not Germany, not Europe - my small region around me” (Interview, Christoph Fischer, 2015). This focus on the local was perceived by activists as helping feed the notion of personal ownership over the issue (Interview, Zivil Courage Neumarkt, 2015). We can also note that the strategy seemed to help overcome various logistical problems. While the aforementioned GMO-free movement in Augsburg, for example, struggled to enroll participants over vast distances where they held very few personal bonds, Zivil Courage’s strength would be in its networks targeting people in the community. The farmers started their efforts in Fischer’s home district of Rosenheim, placing a billboard near the border that encouraged the community to support GMO-free municipalities in the area. Their initial tactics focused on attaining community support against GMOs from people whose lives crisscrossed that of the farmers in some way. The group sought to organize small events at first, inviting doctors, entrepreneurs, and other professionals, but they found that no one was really interested in talking about GMOs (Interview, Christoph Fischer, 2015).

Not yet discouraged from their mobilization failure, Fischer and his coalition of supportive farmers continued their small-scale organizing efforts. They held numerous presentations throughout different districts in Upper Bavaria, inviting farmers who they knew and gradually winning over a larger supporter base. The role of Christoph Fischer, as a point of privileged access, in enabling these processes of mobilization cannot be understated. As the members of one local chapter noted, the success of the movement would owe to Fischer’s “very long arms” in reaching farmers (Interview, Zivil Courage Neumarkt, 2015). Where there was less personal engagement and connections in the community with a particular Zivil Courage chapter leader, activists emphasized that it was difficult to set up such organizations, underlined by the lack of Zivil Courage groups in the central and northern parts of Bavaria far removed from the Bavarian Alpine Foreland of Upper Bavaria.

Attendance at meetings was particularly large when foreign guests were invited to speak. One of these guests was Percy Schmeiser, the aforementioned Canadian farmer who spoke at a Zivil Courage gathering in the Rosenheim municipality of Stephanskirchen (Chiemgau-Zeitung 2008).

As fortune would have it, it was not too difficult to persuade Schmeiser to appear in the Rosenheim area as his grandparents had emigrated to Canada from the region (OVV Online 2010; Interview, Christoph Fischer, 2015). He was all too ready to share his horror stories about the dangers of the agri-farming companies and GMOs. Local farmers too were interested in the event, as they were intrigued to hear from North American farmers about their practices and experiences (Interview, Christoph Fischer, 2015). The stage, in other words, was set with a speaker-audience dynamic that provided promise to the Zivil Courage leaders. In fact, the event with Schmeiser would attract the largest Zivil Courage gathering yet – a reported 1200 people filled the Antrettersälen of Stephanskirchen past capacity for the first time in the building's history according to the manager of the building (Chiemgau-Zeitung 2008; Interview, Christoph Fischer, 2015).

Despite this success, Zivil Courage continued to face steep barriers to its goals of a GMO-free Bavaria. Not only was it tedious and logistically challenging to organize farmers who were dispersed over a wide swath of land, but the local and regional media also ignored these events, so it was never clear to politicians that opposition to GMOs was growing (Interview, Christoph Fischer, 2015). The communications channels available from websites though would come to function also as a gatekeeper in the process, facilitating the expression of interest in the issue among local farmers. Noting that all Bavarian farmers had computers and online access on account of the fact that this is how they communicated with the government and ordered farming supplies, Zivil Courage leaders devised a plan to connect farmers and politicians employing the Internet (Interview, Christoph Fischer, 2015). The platform took the form of pixel maps for each municipality and district where there was a Zivil Courage chapter. Any farmer could choose a given pixel on a map of their district, darken it, and then make a statement against GMOs. The outcome was particularly visual for politicians – thousands of individuals took time to claim pixels in their districts. The digital platform allowed farmers to express their voice on the GMO issue and make this noticeable to the public.²⁴

The leaders of the Zivil Courage were increasingly confident as the pixel maps became more and more complete. It was clear that there was a large public upwelling of support for their cause. The group was disappointed by the lack of media coverage though and the unwillingness of politicians

²⁴ The maps can be viewed here (accessed July 2017): https://www.zivilcourage.ro/php/gib_dein_ja.php?lg=de

to meet with them (Interview, Christoph Fischer, 2015). Consequently, they decided to organize what they hoped would be the largest event to date, a 2009 demonstration that politicians and the press simply could presumably not ignore. The group invited Vandana Shiva, a well-known global anti-GM campaigner and winner of the Alternative Noble Prize. And they reserved the largest venue in Rosenheim – the 3000 seat Inntalhalle - which was said to have not been filled to capacity for decades. The entire story around the event was laden in symbolic meaning, including particularly around the history of the venue and the size of the audience. As a representative for the Bavarian environmental group Bund-Naturschutz pointed out, “it was a big risk that the hall might not be filled in” (Interview, Marion Ruppenner, 2015). The area newspaper noted that the hall was nearly bursting at the seams, unusual given that it was six months before Oktoberfest (OVB Online 2009). Christoph Fischer expanded more on this drama:

I went to the manager of the assembly hall to reserve it and he then offered to put a wall in the middle of the room to make the appearance look better. It could have been very embarrassing if the hall only seemed half full. But I rejected this despite the manager’s insistence on the issue. I said that we would fill the entire hall. Eventually the day of the event arrived and we brought in people from all around Bavaria. We entered the assembly hall and it turned out that the manager still put the wall up anyway. But it didn’t matter because there were thousands of us. We filled the hall up with 3500 people. (Interview, Christoph Fischer, 2015)

The constellation of physical artifacts in the events venue including farmers in their folk attire – along with the audience and speakers – all became key entities that constituted the response to the event. It was the first time in a hundred years that the assembly hall had been filled to capacity and this did not go unnoticed. Although most leading Bavarian politicians of the CSU had refused invitations to attend the event, the strong presence of not only environmentalists but also farmers and beekeepers – core constituencies of the party – was lucidly observed by these politicians. “Buses brought in people from all the regions: all farmers came; clearly this was a big event” (Interview, Marion Ruppenner, 2015). The central theme of the event, meanwhile, focused on the risks of agricultural biotechnology and the loss of freedom for farmers. Vandana Shiva, in particular, lambasted the greed of multinational companies and highlighted the economic and social costs of transgenic crops (OVB Online 2009).

The event was more than just a few speeches and discussions though, it was a congregation of things, ideas, and people that through their entanglements enacted a performance whose power

was only further magnified when the event heavily outnumbered a major CSU convention that was held concurrently. As one governmental scientist noted, the politicians were embarrassed and even envious of the Zivil Courage success (Interview, Peter Doleschel, 2015). And they feared the potential for electoral decline. Underlining this point, one environmental activist emphasized that Rosenheim was a “very important district for the CSU politics: It is a safe district for the CSU. When that is changing, that causes problems” (Interview, Marion Ruppaner, 2015). A leading official in the CSU indeed acknowledged that the event left a big impression on Horst Seehofer and Markus Söder, at the time, respectively, Chairman of the CSU and Bavarian Minister of the Environment and Consumer Protection (Isermann 2009).

While the emergence of Zivil Courage, of course, didn’t guarantee that the CSU would shift its position, it was a condition of possibility for this transformation. The language of the Zivil Courage on the protection of nature, significantly, would be adopted by CSU politicians (Bollmann and Hägler 2008). It was only a few days after the Rosenheim event that Markus Söder, in particular, remarked that a change of course was needed in plant biotechnology (Isermann 2009). And only two months later, the CSU leadership successfully lobbied for a German ban on the cultivation of Monsanto’s GM maize, the only approved transgenic crop in the EU at the time (Spiegel 2009a, 2009b). It was the German Agriculture Minister Ilse Aigner, hailing from Rosenheim County and therefore said to be coming under extra pressure in private, who ultimately announced this decision despite her earlier support for plant biotechnology and despite division within the German cabinet (Isermann 2009). At a later Munich event attended by Shiva, Schmeiser, and Fischer, meanwhile, a spokesperson for Bund-Naturschutz, the Bavarian environmental organization, pointed out that Markus Söder abruptly used the opportunity to invite them all for a meeting, something the spokesperson emphasized that the CSU had never done before, and organized an impromptu press conference (Schmidt 2009).²⁵ The organized anti-GM movement was crucial to these shifts, especially in light of consistent criticism of the shift in policy from the biotechnology industry and allies in the CDU (Merkur.de 2009; Spiegel 2009b).

²⁵ See the press conference here (accessed July 2017): <https://vimeo.com/5270646>

6.2.3.3 Taking stock of Augsburg and Rosenheim and the socio-material constructivist approach: improved intelligibility of the channeling of interest-identity constellations into strategies and phenomena

This elucidation of the two stories reveal that a socio-material constructivist approach indeed provides added value compared to constructivist and materialist-rationalist explanations. While rationalist and constructivist approaches struggle to make sense of the differential mobilization of farmers in Rosenheim versus Augsburg, the socio-material approach highlights the performative nature of causality, including its articulation through the mutually entangled agencies of various intersecting practices and entities at different degrees of contingency. While the entire story of Zivil Courage was set in the previously discussed background context in which the intra-actions between pollen, labels, supermarket branding, neighborly relations, and Bavarian landscapes rendered GMOs problematic in the region and pre-figured the framing endeavors that came to be employed in Bavaria, these processes were, in fact, channeled in a different way in Rosenheim compared to Augsburg when it came to the actual enrollment of farmers into the anti-GM activist network. In each case, the specific goals of the anti-GM activists to spread the amount of space devoted to GMO-free land was conferred meaning and channeled through the possibilities that were engendered through the gatekeepers with which they entered into relations.

Importantly, in these intra-actions, matter came to perform agency through a gatekeeping function, providing privileged access to anti-GM activists to farmers in Rosenheim, the same access that would evade the anti-GM alliance in Augsburg. In contrast to the situation in Augsburg, where anti-GM activists, hindered by socio-material obstacles, never successfully extended an invitation to farmers to join their alliance, in Rosenheim, this enrollment was made plausible by the very inclusion and leadership in the anti-GM movement of an individual with privileged access to other farmers in the community. These contingent processes not only shaped the configuration of the anti-GM movements in the two regions, but also their paths of difference-making and what constituted success, processes themselves that became further entangled with other both stable and unpredictable elements, including in Augsburg the contingent connections with mayors and other political leaders and in Rosenheim the dramatization of a public spectacle that came to be conferred meaning through the historically constituted alliances between conventional farmers and the CSU in Bavaria. Similar trajectories and patterns of anti-GM direct action can be observed

elsewhere. In the Neumarkt area, for example, rather than directly communicating with farmers to lobby them not to use GM animal feed, given their lack of relationships with these groups, the primary anti-GM group of the town was limited to indirect methods, which included persuading the slaughterhouse manager, a friendly contact point for the group, to (unsuccessfully) lobby reluctant farmers (Interview, Zivil Courage Neumarkt, 2015). As such, processes of political mobilization in these cases are not comprehensible without accounting for these processes of complex intra-activity. More than framing or interest re-orientation, political mobility and lobbying is also contingent on material infrastructures of communication that displace positions of power within different relations.

6.2.4 The case of Bavarian farmer permissiveness toward genetically modified animal feed: refining the specificities of the direction and scope of farmer mobilization

At the same time that farmers began initiating their own mobilization endeavors, other groups in the region also started institutionalizing and coordinating their political activities. While prominent environmental organizations in the region had previously operated largely independently on the issue, without much success, in the mid-2000s, the groups initiated plans to form broader alliances with other groups. In particular, in 2004/2005, Bund-Naturschutz, one of the largest environmental organizations in Bavaria, initiated a broad alliance comprised of 30-40 large organizations to organize specifically on the issue of GMOs, following the end of the European moratorium on GM crop approvals in 2003 (Bund Naturschutz, 2017). The alliance consisted of a variety of groups, including environmental organizations, religious groups, consumer groups, organic food organizations, beekeepers, and organic and small-scale farmers. A noticeably missing group though was the BBV, the largest lobby organization representing farmers throughout the region, which established its own volunteer GMO-free initiative premised only on the notion that Bavaria should be free of transgenic crop cultivation (“no cultivation”), but recognizing the importance of the import of GM animal feed for livestock - “we know that we need to import GMO soybeans for feeding our animals” (Interview, Johann Graf, 2015).

This section seeks to explain how it came to be possible that farmers were generally active in the campaign against transgenic crops in Bavaria, but nevertheless not full members of the GMO-free alliance. Rather than dismissing rationalist and constructivist perspectives, similarly to the

previous empirical sections, my narrative unpacks the particular processes in which interests and identities were articulated in the first place, showing mobilization decisions to be the contingent outcome of entangled agencies comprised of both floating and more stable parts. In this regard, while rationalist explanations, for example, would seemingly be able to provide a straightforward explanation of farmer non-enrollment as being caused by their economic interest in protecting a cheap source of animal feed – genetically engineered soybean imported from abroad – a socio-material constructivist angle toward this phenomenon can contribute by complicating the story, foregrounding the contingent workings and multiple and simultaneous mutually constitutive agencies at play through which the issue outcomes emerged. In these cases, biological processes of soybean and livestock production were conferred meaning by both their non-discursive capacities of displacement and resistance and the ways in which they intra-acted with specific regulatory regimes, political economy practices of trade and agriculture, and other biological processes. After establishing the saliency of these encounters, I also highlight how this path and direction of mobilization mattered in the broader issue outcomes of genetically modified organisms in Bavaria.

6.2.4.1 Explaining the non-enrollment of the BBV into the GMO-free alliance: a matter of farmland-soybean-transgenic crop-discourse entanglements

A particularly key issue dividing the BBV from the members of the GMO-free alliance was constituted by attitudes toward permitting the use of GMO animal feed for livestock. While Bund-Naturschutz had conceived of a GMO-free Bavaria as one without any traces of GMOs in any parts of the food chain, the BBV framed a GMO-free Bavaria in less radical terms, as a region simply without its own GMO cultivation (Interview, Marion Ruppenner, 2015; Interview, Johann Graf, 2015). It was, I argue, multiple intra-acting material-discursive practices that constituted this precise formulation of the BBV position, including resistance of European climates and fields to soybean cultivation, the adoption of transgenic crops in soy-producing countries, and rising industrial/consumer demand for meat and other animal products. These processes, significantly, were set in a context in which unlike the case of food derived directly from GM ingredients, there was no EU legal requirement to label animal products that had been produced from animals grown on GM feed diets.

According to 2013 data, the EU imports around 36 million tonnes of soybean and soymeal every year to meet plant protein needs, with a total of around 60 percent of its total protein animal feed consumption met with imports (European Commission 2015). For Bavaria specifically, the soybean imports amount to around 800,000 tonnes annually (Interview, Johann Graf, 2015). These imports notably come largely from Paraguay, Brazil, Argentina, and the United States, three countries with widespread use of transgenic crops and where societal discourses have generally been accommodating to the technology (European Commission 2015). In 2007, a time period in which the GMO-free alliance was particularly politically active, figures showed that GM soy comprised 64 percent of total soy production in the world (Backus 2008). The numbers had also been gradually rising, from 74 percent in 2002 to 92 percent in 2007 in the United States and from 35 percent in 2002 to 60 percent in 2007 in Brazil (Backus 2008). In Argentina, meanwhile, GM soy made up 100 percent of all soy production in 2013 (European Commission 2015). This use has continued to be pushed upward premised on studies showing a 6.7 percent value gain in soybean crops with the use of herbicide tolerant transgenic crops (Backus 2008). It should be pointed out that these inclines have themselves at least been in part contingent and contested – with one governor in Brazil, for example, sanctioned by federal officials for his initiative to keep the state of Parana GMO-free and Brazil as a whole only beginning to allow GMO cultivation in the early 2000s (Backus 2008). That transgenic crops weren't contested in the same way as they were in the EU context though has engendered implications for EU farmer options, including in Bavaria.

The need for animal feed itself, it should be pointed out, emerged as a phenomenon constituted by global and European practices of meat consumption and the very materiality of soybean in facilitating the achievement of these demands (Henchion et al. 2017). Monogastric animals (e.g. pigs and poultry) have in particular been understood as being dependent on soybean animal feed, which provides the essential amino acid lysine necessary to prevent nutrient deficiencies in these animals (Visser, Schreuder, and Stoddard 2014). The required intake figures for three livestock animals have been reported as 232, 648 and 967 g/kg for beef, pork and poultry, respectively (Visser, Schreuder, and Stoddard 2014). In total, grain legumes are estimated to provide around 23 – 40 percent high protein content (Zander et al. 2016). Consequently, without soybeans, it becomes exceedingly difficult to sustain both growing human world populations that require protein and high quality livestock whose very demand has been rising in recent years, illustrated,

for example, in increased demand in China for Brazilian soybean (Barrionuevo 2007). In this regard, soybean itself has become a boundary setting practice, with its rich nutrient supply displacing the health and well-being of livestock through its incorporation or not into their diets. As discussed in the prior chapter though, its proneness and inability to resist weed populations, in consort with the relative ease with which it could be genetically engineered to withstand the herbicide sprays used to eradicate these weeds, has also made it a primary target for the transgenic crop market. This soybean matter has importantly only now come to matter in novel ways as a political issue in the EU context, through its intra-actions with historical patterns of EU dependency on soybean imports for animal feed and the adoption of GM soybean crop varieties internationally but not in the EU.

With regards to this reliance on soybean imports, it should be acknowledged that the agricultural landscape of Bavaria and more broadly across the EU in intra-action with the materiality of soybeans has importantly functioned to constrain farmers from growing their own protein-rich soy for animal feed locally, as pointed out to me by one plant breeding expert, in the process displacing their interests (Interview, Chris Schoen, 2015). Soybeans are notably short-day plants dependent on both temperature and photoperiod, thereby limiting the range of possible geographical/latitude locations for the crop (Kurasch et al. 2017). In particular, the generally northern growth conditions of Europe have hindered the adaptation of soybeans (Kurasch et al. 2017). Altogether, according to 2011 data, protein crops were cultivated on only three percent of EU arable land (Euractiv 2011). In Bavaria, soybean cultivation in 2015 was around 15,000 tonnes of production on around 5,000-7,000 hectares of land compared to the 800,000 tonnes of soybean imports (Interview, Johann Graf, 2015). This compares to around 25 percent of arable land in the United States for soybean alone (United States Department of Agriculture 2014).

In addition to the technical obstacles placed on soybean production in European climates and the adoption of GM soy varieties internationally, the EU's dependence on GM soy imports has become further entangled with trade terms that have reinforced the material relations through the elimination of tariffs on soy, oilseed, and other protein rich crops through the GATT and the 1992 Blair House Agreement, thereby further entrenching pre-existing external dominance over this market over the past several decades (Euractiv 2011; Zander et al. 2016; Visser, Schreuder, and Stoddard 2014). Not only did these moves further disincentivize soybean production in the EU,

but they were also perceived as resulting in a loss of practical know-how related to soybean farming practices and the end of development of protein seed crop varieties favorable to European climates (Häusling 2011).

These displacements, in turn, have shifted the focus of European farmers away from soybean and toward the import of protein rich feedstuffs to feed livestock and the ever growing demands of the industry. There has been a noted insufficient amount of domestic European feed to replace the GM soybean imports and the little conventional soybean supply available, around 10 percent of all soybean use, has been mostly used for human food products (Backus 2008). It has been estimated that soybean alternatives such as field peas, field beans, and sweet lupines would at most be capable of replacing 10 to 20 percent of EU soy imports (Backus 2008). In the context of Bavaria, this meant that in the 2000s, Bavarian farmers necessarily had to either purchase GM animal feed from abroad or pay a steeper premium for the limited supply of non-GM animal feed available (Interview, Johann Graf, 2015). The use of GMO-free soy products had demanded an estimated price premium of around 2 – 10 percent by 2000, but this figure was noted to have risen to around 5 – 17 percent in the later 2000s (Backus 2008). A 2015 analysis revealed around a 20-40 euro per metric ton price premium (or nearly 5-10 percent) for the non-GMO variety (Danube Soya Association 2015).

In this regard, material-discursive practices in agriculture and food in North and South America and further afield have been inseparable from political processes constituting farmers in Bavaria. The perspective of Bavarian livestock farmers on what it means to be GMO-free rather emerged through the entanglements of their livelihoods with consumer livestock demands, the availability and cost of animal feed, and global and European transgenic crop practices. Similarly, the agency enacted by soybean producers in supply countries was also constituted through intra-activity with demand countries. The agricultural producer practices in Argentina, for example, were conferred meaning in the Bavarian context by the industrial and consumer demand for protein-rich animal products and the resistance of landscapes and soybean crops in the EU toward complying with these demands. Overall, given that a significant number of Bavarian farmers opted for the cheaper GM animal feed and the consequent lack of consensus in their organization, the BBV took a position against incorporating a ban on GM feed within the GMO-free movement, thereby putting them at odds with groups like BUND (Interview, Johann Graf, 2015). Rather than join the alliance,

they led their own anti-GM initiatives separately, targeted toward a more narrow vision of GMO-free Bavaria that would still permit the use of GM animal feed. Nevertheless, the BUND-led alliance successfully recruited and integrated local branches of the BBV, which were perceived as being more outspoken against GMOs than the central Munich office (Interview, Marion Ruppenner, 2015).

These sub-issue alliances were still perceived as crucial in constituting the shift in the CSU stance on the issue though. Particular demonstrations, in fact, showed the power and embeddedness of social-material relations. The alliance, for example, regularly held large-scale demonstrations and marches in cities, which revolved just as much around show as language. Stampeded tractors at these protests not only attracted media attention, but also conveyed a clear symbolic signal to public officials that farmers – a core part of the CSU base - were vehemently opposed to GMOs. Drawing a parallel to the events in southern Bavaria, an environmental activist emphasized that “it was really important that farmers came a long” (Interview, Marion Ruppenner, 2015). Environmental activists, meanwhile, were visualized through their long employed costumes and mascot figures, floats, billboards, and other displays providing frightening depictions of different crops such as corn and tomatoes. As one activist emphasized, “If you have little tomatoes it’s nice, but with a big one, it becomes a symbol” that again appeals to the symbol-craving media (Interview, Marion Ruppenner, 2015). The conglomeration of tractors (i.e. the presence of farmers) and terrifying crop costumes (i.e. environmental activists) in the marches and protests was argued to have conveyed the message to the CSU government that something previously unheard of was happening: members of the BBV were coming over to protest a long side the environmental radicals and others associated with the Green Party, a development that needed to be nipped in the bud before the loss of political support was incurred (Interview, Marion Ruppenner, 2015). However, it should be noted, that in announcing the region’s GMO-free status in 2014, the Bavarian government’s declaration reflected the narrower stance of their traditional ally in the BBV in rejecting local GMO cultivation while at the same time permitting the use of imported GM animal feed (Bund Naturschutz 2013; Bayerische Staatskanzlei Pressemitteilung 2014).

The above story also highlights the fact that there were numerous intervention points through which the outcomes could have emerged differently. Rather than being purely attributed to the surface level price premiums for soybean or the failed attempts of environmental activists to

persuade farmers to abandon GM animal feed, examining this process from the perspective of intra-activity puts a spotlight on how decisions were also embedded within widespread practices of food consumption and production both locally and globally. As one point of intervention, there have been recent initiatives from NGOs, government plant breeding agencies, and private organizations to augment European non-GMO soy production (Krön and Bittner 2015; Kurasch et al. 2017; M. Hogan 2014). In Bavaria, these initiatives have received support from the Bavarian and national governments (Interview, Peter Doleschel, 2015). Moreover, they have received further support from EU Common Agricultural Policy (CAP) reforms that provide subsidies for or otherwise incentivize soybean production (Danube Soya Association 2015). And there has indeed been an accompanying gradual increase in the amount of soybean produced in the EU, from around 4 million tonnes production in 2013 to nearly 6 million tonnes in 2015, with projected further increases expected in the future (Danube Soya Association 2015).

With this said, what a socio-material constructivist approach shows us is that taking into account the intra-actions between soybeans and European climates and their wider entanglements, if anti-GM groups are to achieve their aim of broader shifts in EU GM soy use, it may also be contingent on a shift away from industrial models of agriculture and food dependent on soy production both locally and globally and/or shifting practices of GM use and acceptance in soy-producing countries. Tied up in global processes of materialization and discursification, the issue thus suggests that local environmentalism increasingly also entails exceedingly challenging global activism and coordination across different regions, that local Brazilian discourses on transgenic crops impinge on the goals of Bavarian environmental activists in their own local context. While this is well-recognized and self-evident in the case of climate change, it is also true for more specific issues such as debates over plant biotechnology, reifying recent moves to examine the effectiveness of transnational collaboration of the environmental movement (J. Chen 2010).

6.3 Introducing the case of Bavarian beekeepers: establishing their significance in the debate over GMOs and complicating conventional explanations of their emergence

In addition to farmers, beekeepers were another vital constituency that became part of the anti-GM movement across the region and further integrated into the Bund-Naturschutz-led GMO-free Bavaria alliance. Beekeepers in Bavaria generally belong to three different beekeeping

associations and comprised a total of 27,000 individuals with an estimated 250,000 bee colonies according to the 2010 Bavarian Agricultural Report, a time period in which beekeepers were first becoming actively involved on the issue (Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten (StMELF) 2010).²⁶ As the narrative below reveals, beekeepers left a significant imprint on the debate through the constellations in which they were embedded, generating substantial media coverage that raised pressure on the CSU to shift its stance on transgenic crops. Beyond these enactments, beekeepers were perceived as lending credence to the GMO-free movement through their apparent expertise on pollen and bees. Like farmers, the mobilization of beekeepers seems at first sight to be a relatively straightforward case of actors following the logic of consequences. While in Bavaria, beekeepers became an ardent part of the GMO-free alliance with their honey products under economic threat of GM contamination, when their own material interests were later on the line in Brussels through a vote that rescinded the labelling requirement specifically on honey, many beekeeper groups joined with the biotechnology lobby in support of the non-labelling provision. In this regard, it is difficult to identify any consistent identity-oriented opposition among beekeepers.

These linear materialist causal explanations though belie the not insignificant amount of entanglement work that made such phenomena possible. Specifically, beekeeper enrollment in Bavaria was constituted by intra-actions between numerous material-discursive practices, including EU regulatory regimes, food retailer and consumer preferences, floating elements such as contingent court decisions and the location of transgenic crop field trials, and the foraging behavior of bees and the environments in which this foraging takes place. What is especially important to note in this case is that this constellation of entities came into intra-action with one another in a particular time and setting – around 2007-2009 in Bavaria - in which this mattered. It was only a few years later in 2014, in fact, that the European Union removed the labelling requirement on contaminated honey – one of the entities that conferred meaning on pollen/bee displacement – thereby altering the state of these entanglements, but only long after the transgenic crop debate was decided in Bavaria. These types of socio-material intertwinements indeed highlight the contingent processes often at work beyond rationalist and constructivist mechanisms

²⁶ The number of beekeepers in Bavaria has been gradually creeping upward, reaching 33,400 according to the equivalent 2016 agricultural report (Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten (StMELF) 2016).

of issue outcomes. In terms of further impinging on the development of GMO-free Bavaria, meanwhile, the inclusion of bees and their mattering is shown to have been constituted through the reverent image – notably itself socio-materially constructed – to which they were bestowed in Bavarian society and the ways in which direct action protests – also made possible socio-materially - channeled this imagery in the news media.

6.3.1 The socio-material constituting of beekeeper mobilization in Bavaria

This dissertation has already discussed the role of pollen in enabling the drift of genetic material across land and into neighboring farms or the wild. These processes are, in fact, articulated in the very processes in which honey is produced through bees collecting and carrying pollen over long distances. Pollen-collecting bees are known to have a mean foraging distance of around 1750 meters in simple landscapes and around 1550 meters in complex landscapes (Steffan-Dewenter and Kuhn 2003). However, in individual cases, bees have been known to travel over 10 km in search of floral rewards (Hagler et al. 2011). Consequently, as it were in Bavaria in 2008, beekeepers, like farmers, were at risk of falling victim to GM contamination of their honey in a context in which food retailers would reject GM labelled products. This possibility indeed came to fruition when in a 2008 decision, an administrative court in Augsburg ruled that a beekeeper could not market honey contaminated with GM pollen from MON 810 maize, which at the time was undergoing government research test trials in a 1500 meter vicinity to the bee hive and only approved in Germany for feed but not food (Mayr 2008b, 2008a). The court determined that the GM cultivation, which the beekeeper had challenged, was legal, and rather suggested that the beekeeper move the hives or risk not being able to sell the honey yield. Contesting this decision, the spokesperson for the beekeepers argued that genetic engineering should be banned in order to prevent contamination. And beekeepers further called for mandatory isolation distances of GM cultivation from bee hives.

Within this context, beekeepers became central figures in the anti-GM alliance in Bavaria. Environmentalists in particular strategically played on the nature of bees and honey as positive symbols in order to draw in media coverage and attention from politicians (Interview, Marion Ruppenner, 2015). The nature of bees as a sentinel species and vital pollinators made such appeals plausible, with estimates indicating that around 85 percent of the crops cultivated in Europe are

improved through animal pollination, mostly from honey bees (Aizen et al. 2009). Alarm bells, in fact, had already been ringing on account of warnings in 2007 from a German Beekeeping Association Board of Director that the “very existence of beekeeping” was at stake in Germany, with an official for the Bavarian beekeepers association noting a decline of around twelve percent of the local bee population (Latsch 2007). The national director in Germany also disseminated a study conducted at the University of Jena purporting a link between bee deaths and genetically modified insect-resistant Bt maize that had also been infested with a parasite (Latsch 2007). All together, these reports resulted in consultation with beekeepers in preparations of the creation of the 2007 national policy document on genetic engineering.

These processes of mattering, significantly, were further enhanced through the prominent place that bees had long been given in German society through books and television programs such as *Maya the Bee*, imagery which itself was featured in some of the media coverage of the issue in Bavaria (Bergt 2008). This is particularly the case for Bavaria, with its 250,000 colonies making it the home to around one-third of the German bee population (Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten (StMELF) 2016). One Bavarian folk legend specifically notes that when the peasant of a farm dies, that the son is responsible for visiting the bee hive and informing them of the death and the time of the funeral (Grasberger 2014). In the local dialect, this was announced as “Imp, da Vata is gstorm, jetzt bin i für enk da” or “Father is dead, now I am here for you”, underlining the notable symbolic and identity-oriented connections between people and bees in the region (Grasberger 2014). Bavaria has also been noted as the home to two prominent beekeeping museums and institutes, including the award-winning Bayerische Bienenmuseum im Illertisser Vöhlenschloss and a bee and beekeeper Center for Bees research institute as part of the Bavarian State Agency for Viticulture and Horticulture, which itself provides step by step instructions on becoming a novice beekeeper and opening an apiary in the region (Macketanz 2017)²⁷. The renowned German Bee Museum is also located in Weimar in the neighboring Thuringia region to the north. One listing showed that overall at five museums, Germany had the largest number of any country in the world, further indicating the symbolic importance of the insects to framing endeavors (Crane 1999, 613).

²⁷ See also: https://www.lwg.bayern.de/bienen/natur_umwelt/index.php

Following the aforementioned Augsburg court ruling, various entities came together in Munich, staging a protest event targeted at Bavarian politicians. Not only did the bees and pollen displace the marketable honey production of beekeepers, but it was also heavy duty equipment and human beings that could mediate a possible solution by moving the bee hives away from the maize during their bloom season. The problem was that most of the beekeepers were hobbyists who didn't have access to this equipment. Larger beekeeping associations, therefore, stepped in, facilitating the process by providing a truck and crane to move the hives (Mayr 2008b). The temporary location of the bees might not have been what everyone expected though. Upon the invitation of allies in the Munich municipal government, over 50 bee hives comprising two million bees were rather moved to public "refugee camps" around the city of Munich, including particularly around the Bavarian parliament and government buildings (Heinzle 2008). Some members of parliament were also cooperative, welcoming the bees and providing them "asylum" (Bergt 2008). The bees were the stars of the spectacle though. Once their hives were opened, the bees refused to obey the security parameters and barriers of parliament, with the organizers using this fact to underline their argument that isolation distances couldn't be trusted (Haefeker 2008). The beekeepers also added to the performance by entering the parliament – upon the invitation of friendly MPs – with their white beekeeper suits.

The bees and their keepers picked up wide coverage in the local and national media, with the story presented on political TV shows, radio programs, and various newspapers, including the front page of the nationally distributed *Tageszeitung* (Bergt 2008). The story demonstrated the power of bees in not only being capable of displacing pollen, but also as symbolic performers that actively shaped impressions in intra-action with popular myths of these insects in Bavarian society and the legitimacy to which they were assigned owing to their important functions in nature (Interview, Marion Ruppner, 2015). At the same time, the story demonstrates the precarious lives of the bees, capable of channeling the debate over transgenic crops in Bavaria and engaging in reciprocal relations with their human handlers, being more than simply tools, but also still unable to voice their own opinions or transform the practices through which they are managed.

Furthermore, the dramatic play performed by bees and allies highlighting the problem of isolation distances gained resonance not on its own, but rather through the continuous political work and the repetition of these frames village by village throughout Bavaria. In fact, it was reported that

following the Augsburg ruling, the Bavarian parliament rejected attempts by the Green Party to consider providing government assistance to the beekeepers until after the then upcoming elections (Haefeker 2008). The CSU spokesperson on GMO issues - Christian Meißner – also reiterated that the GM field trials would continue in the future despite calls from the SPD and Greens to halt GM crop cultivation in the area (Heinzle 2008). Overcoming this resistance was a constant struggle for the Alliance. The emergence of an alliance between beekeepers, some farmers, and environmentalists, however, enabled a number of further large-scale protest activities.

The attempts to change the narrative continued at a protest event held in 2008 in Kitzingen, one of the only places in Bavaria where GMO cultivation was present at the time (Meyer 2008). The demonstration specifically targeted MON 810 – Monsanto’s BT maize product – which was farmed on a sliver (nine hectares) of land in Kitzingen. Outlining their goals on posters at the protest, anti-GM activists emphasized that “only a ban of GMOs guarantees protection” (Meyer 2008). It was again a constellation of material objects that took center stage in framing the debate though. The basic premise of the event was that demonstrators would release 1000 yellow balloons at the same time, wait for them to fall back down to the ground, and then measure how far they travelled. In this regard, the balloons performed a spectacle, highlighting the possibility for GMO pollen (the balloons) from maize to drift in the air in unpredictable ways and consequently contaminate neighboring areas. The success of the event relied on the power of the wind, which cooperated with the balloons to send them far from the starting point. And the balloons were particularly powerful performers because of their size, which enabled them to host anti-GM messages/warnings and be noticed in the sky. A key message of the event was that GM contamination could result even in spite of efforts by politicians to contain nature. This point – the doomed attempt to create a system of co-existence – was conveyed by the addition of an inflatable blow up version of Horst Seehofer – the then Federal Agricultural Minister - who held a net trying to contain the balloons, but inevitably failed in vain, just as coexistence legislation did in the eyes of the GMO-free movement. Furthermore, a prize was awarded to the individual whose balloon travelled farthest from the launch point, underlining the argument that it is difficult to set a precise separation distance on pollen in the presence of uncontrollable factors.

The human organizers also played a facilitating role in the process by blowing up and releasing the balloons to the wind, taking photographs, and sharing the event with the press. Like the bee

hive assemblage in Munich, the constellation this time again contributed in also enrolling the media into the assemblage, thereby bringing the issue into contact with new ears (Meyer 2008). It was reported that the scene was dominated by photographers, journalists, and camera crews. The demonstration was also importantly not a stand-alone event, but rather the first “eye-catcher” in a series of protest activities targeting Seehofer (Bautz 2008). The groups behind the balloon protest, consisting of members from the coalition that had been formed between beekeepers, farmers, and environmentalists, continued trailing Seehofer at his public election campaign events. The large scale nature of these events was enabled because of the coalition that had been formed between beekeepers, farmers, and environmentalists.

Empowered by these socio-material constellations, the organizations of the Alliance also played a support role through their framing of the issue toward politicians and the media. The Alliance, for example, launched a 2008 petition drive aimed at stopping the cultivation of MON 810 maize, which had been approved by the EU, in Bavaria (Bündnis Bayern für gentechnikfreie Natur und Landwirtschaft 2008). They framed the debate in terms of the risks of GMO contamination, a not so subtle appeal to farmers and a reminder to the CSU government that this issue would potentially drive a wedge between them and their supporters. Beekeepers were particularly valued in the alliance at that moment given their expertise on pollen drift (Interview, Marion Ruppenner, 2015). The campaign argued that German law on genetic engineering could not guarantee a GMO-free Bavaria because it set arbitrary rules on co-existence distances of 150 meters for conventional farms and 300 meters for organic farms with respect to maize cultivation (Bündnis Bayern für gentechnikfreie Natur und Landwirtschaft 2008). The campaign pointed to its neighbors in France, where President Sarkozy had suspended GM maize cultivation, and highlighted an unnamed French investigation that detected pollen from GM maize travelling more than a kilometer. With that context in mind, the anti-alliance called for immediate legislation – requesting minimum isolation distances of 1000 meters - to address the incalculable risks of GMO contamination. Furthermore, the groups demanded that the government ensure the implementation of the “polluter pays principle” – meaning that the contaminating farm should pay all the costs of damage in the case of contamination. The direct result of the petition drive was a Munich meeting and photo op

with CSU Secretary General Christine Haderthauer with the delivery of a box of 33,000 signatures in February 2008, seven months before regional elections in Bavaria²⁸.

The efforts of BUND exerted additional pressure on the governing CSU. They were struggling against multiple fronts of well-organized coalitions in the northern and southern parts of Bavaria. It was around the time of the elections in 2008 that local Bavarian politicians began speaking publicly against GMOs despite national public support for the technology coming from Angela Merkel and other leading politicians in the CDU. Markus Söder, regional Environmental Minister, in particular, publicly rehearsed the imaginaries of the environmental groups, proclaiming that Bavaria was all about having the best air, cleanest water, and most beautiful scenery and that the protection of nature was a hallmark of his party from its beginning (Bollmann and Högler 2008). Rehashing their precise focus on agriculture/nature as an open process, he emphasized that green engineering had to be limited, because contrary to red (referring to medical) biotechnology and its confinement to the laboratory, any genetic changes in nature resulting from GMO cultivation could not be reversed. Following a decline in electoral support in the 2008 Bavarian regional elections, the Bavarian party was also reported to have exerted pressure on its national governing partners in the CDU, culminating in a 2009 decision by German Agriculture Minister Ilse Aigner of the CSU – and successor to Seehofer - to ban the cultivation of GM maize in Germany on account of its "danger to the environment" (Spiegel 2009b). Greenpeace applauded the declaration, highlighting scientific studies demonstrating this possibility for environmental damage (Spiegel 2009b). The decision was not without controversy though. It was reported that Seehofer – the new Chairman of the CSU and Minister President of Bavaria – in a major shift had all of a sudden actively lobbied for the ban in order to win over votes ahead of EU and national elections. The deputy chairwoman of the CDU/CSU parliamentary group labelled the moves as the "CSU's irresponsible, cheap propaganda," which could prove a detriment to German industry (Spiegel 2009a).

The importance of the linkage between beekeepers and environmentalists and their contingent coming together in the anti-GM alliance is especially underlined by another case at the level of EU politics. The issue was a 2014 vote in the European Parliament in which MEPs decided that honey shouldn't be subject to GM labelling requirements if it contained GM pollen by classifying the

²⁸ See the following for pictures (accessed July 2017): <http://www.bund-naturschutz.de/gentechnik/buendnis-bayern/aktionen-2008.html>

pollen as a constituent, rather than an ingredient, of honey. The vote was intended to override a 2011 ruling by the European Court of Justice finding that pollen was an ingredient, not a constituent of honey, thereby stipulating that any food products containing GM pollen should be labelled. The final vote was 283 votes in favor, 248 against, and 45 abstentions, one of the rare occasions when the EU Parliament didn't vote on the side of more stringent regulations for GMO agriculture (BEUC 2014). In this case, the usual anti-GM coalition, consisting of consumer protection groups, environmental groups, organic and small-scale farmers, and transparency organizations, was splintered. While the Greens group in the EP and the European Consumer Organization (BEUC) worked to lobby MEPs to support labelling and transparency on the issue, the broader movement was divided. The GMO Campaigner for the Greens-EFA grouping in the European Parliament pointed out that this division started first of all with a split in the views of beekeepers.

And when I say it's divided, it's because some beekeepers who are against GMOs were thinking that they had been taken hostage in a fight and they would be the victims if they had to label...they thought they would have to make analyses [of their honey to determine if it was contaminated] and were convinced that it would be bad for them, which I don't agree with. I think it would have been good for them in the long term, but in fact, the whole thing was: how much is the analysis going to cost? What will I do with my honey if it's labelled? (Interview, Arnaud Apoteker, 2014)

Some of the beekeeper organizations favored the view that labelling should be required (and that they should be compensated for any damage incurred by GM cultivation), while others simply preferred the convenient option of avoiding the risk of labels (Interview, Mute Schimpf, 2014). The lack of unity among beekeepers ultimately had cascading effects in the decisions of other groups to participate politically on the issue. The environmental group Friends of the Earth, generally among the most involved anti-GM organizations in Brussels, for example, decided not to become especially active in following the legal steps in parliament, lobbying MEPs, or spreading campaign information against the proposal. The GMO campaigner for Friends of the Earth emphasized that their decision to steer clear of the debate was influenced by the factioned views among beekeepers.

For us, if there would have a very unified demand from the beekeepers, then we probably would have supported them....If there is a big joint demand from the key stakeholders, then we support them. But in this case, they had different opinions, so

we decided that we would [only] support them if they came up with a clear message and campaign. (Interview, Mute Schimpf, 2014)

The Green Party coordinator in the EP perceived that the failure to incorporate the beekeepers and some environmental groups in the usual lobbying alliance made a difference, pointing out that the pro-labelling groups lost votes in the later readings. He emphasized that “even parliamentarians, even the Greens in some countries were lobbied by some beekeepers saying that it would be very bad for them. And generally we are very sympathetic to beekeepers, and even people working for the protection of bees and beekeepers didn’t understand the arguments” (Interview, Arnaud Apoteker, 2014). While the pro-labelling side worked to lobby MEPs to vote against the proposal, using their networks and connections to appeal to particular parliamentarians, the now smaller than normal coalition was easily overwhelmed by the lobbying efforts against labelling led by honey importers. One of the more dramatic displays of this effort was the placement of small honey pots, distributed in the pigeon holes of each MEP by an unknown source, just before the vote. The simple message on the jars was “Pollen is a natural constituent of honey,” a decidedly anti-labelling framing that won the vote that day, also highlighting the importance of the inclusion of beekeepers in the anti-GM coalition (Interview, Arnaud Apoteker, 2014).

While the anti-GM coalition was not put together successfully on the honey vote in Brussels, hindered by a divide in reactions to the proposal, in Bavaria, where beekeepers were universally agreed regarding the damage of GMO contamination and at a time period in which these non-labelling requirements hadn’t yet been set by European law, the situation turned out differently. This illustrates the ways in which phenomena emerge through particular configurations and the performances of agency therein articulated by both the discursive and non-discursive. While particular framing efforts in this case helped constitute protest events and the overarching transformative agency that enabled Bavaria to be declared as a GMO-free region – bar GM animal feed – it must be emphasized that these demonstrations were also made possible and powerful by the contingent coming together of various elements, which may have been different if the debate had emerged in Bavaria only a few years later or if the local court ruling had never been necessitated through the precise spatial placement of the government field trial near bee hives. Bees were especially shown to be vital matter that through their mobility and their life-constituting role as pollinators were able to displace both pollen and the interests of beekeepers, thereby

constituting the very feasibility of the frames that were employed in the debate, and perform particular ideas to a Bavarian public that generally conferred positive meaning on these enactments.

Conclusion

In interrogating the story of GMO-free Bavaria, this chapter endeavored to laser in on the particular sites of a regional process in which the issue was negotiated, examining how the agential/coalition landscape was constituted, especially concerning farmers and beekeepers who were deemed vital actors in transforming the CSU policy stance, and further how it came to gain meaning in shaping issue outcomes. The process stories narrated in this chapter have particularly documented some of the performances by and the necessary relations between different entities and practices, which came together in contingent ways to generate particular diffraction patterns or policy outcomes in the GMO debate in Bavaria. Engaging with the process in socio-material terms especially provided added value in complementing conventional constructivist and rationalist approaches in several ways.

First, the socio-material constructivist approach was able to contribute to unpacking the constituting of interests that rationalist approaches tend to take for granted. Rather than a social constructivist take on this process though, in this chapter, these processes were revealed to have been the entanglement effects of different material-discursive constellations, including Bavarian topography, the movement of bees, the drift of pollen, the physiological attributes of soybeans, the spatial distribution of farmland, EU regulatory regimes, supermarket practices, meat demand, and global practices related to the use of transgenic crops. Examining these particular entanglements helps clarify how certain interests are made possible in the first place and sheds light on overlooked points of intervention upon which alternative outcomes rest. In this vein, as one contribution, it invites further attention toward analyzing how other similar entanglements (e.g. crop viability in one country and the incompatible practices in which crops are grown in another) may emerge in other issue areas and what they will mean for politics.

Secondly, the socio-material constructivist narratives presented here helped understand what happens with particular interests and identities once constituted. Despite similar contexts and interest constellations, for example, farmers in different areas of Bavaria mobilized politically in

different ways. A socio-material approach highlights how GMO-activists were instrumental in mobilizing dissent, but only in intra-action with human and non-human gatekeepers and spatial divisions of (non)-displacement that channeled access to particular target audiences, underlining the socio-materiality of campaigning and lobbying. Overall, intelligibility was provided in understanding the boundaries and constitutive conditions of possibility for human intervention in these situations.

Third, the effects of particular contestation endeavors were constituted in the socio-material constellations (e.g. displacement and performance capacities of bees in consort with the Bavarian image of bees) in which particular ideas were performed and garnered media attention and altered viewpoints of audiences. In other words, even after particular coalitions were struck, it wasn't only human framing endeavors (e.g. environmental activists and the frames of unpredictability of gene flow/contamination and corporate greed) – themselves pre-figured and conferred meaning by socio-material processes - that came to displace the views of policymakers, but also entanglements between various material things (e.g. wind, balloons, bees, humans) and discourses (e.g. Bavarian views on bees).

The findings of this chapter indeed suggest much further contemplation is needed in our political systems. If power is constituted through sites of privileged access, both human and non-human, then a central question for democracy is whether gatekeepers should be made more accessible and prevalent and if so how? Similarly, if particular socio-materially constituted spaces and political contexts are to be constantly tied up with the perceived harmful practices of other contexts, then are recent moves into transnational civil society coordination adequate and beneficial to intervening groups or are there alternatives that may better reroute issue outcomes in these cases? At the very least, when intervening, engaging with discourse-material intra-activity highlights the need to look also beyond seemingly direct causal attributes and related solutions to particular processes (e.g. increased domestic soy production as a solution to dependence on foreign soy) to also the broader diffraction patterns and socio-material processes (e.g. industrial livestock farming and meat demand) that confer meaning on these performances. It is through this type of engagement that we can begin to grapple with power as a phenomenon coming through in banal everyday material sites and objects – and the mundane practices that often emerge with them - and their ahistorical and historical entanglements with language.

CONCLUSION

This dissertation has set out a socio-material constructivist framework for engaging with politics and demonstrated its added value in examining different sites and phenomena connected to the debate over genetically modified organisms in the European Union. The need for this endeavor first of all emerged from my review of the constructivist and the more recent materialist turns that have been articulated in international relations. In this regard, this dissertation noted that in a world once conceptualized in static terms guided by the brute force of materiality and the incentivized rationalistic behavior of human beings, the constructivist turn in social and political theory has contributed to problematizing these presumptions, showing political orders to be socially constructed phenomena that can be transformed anew. While providing intelligibility in highlighting this social angle of politics, including the role of language and performance in constituting issue outcomes, this dissertation has argued though that these approaches are at the same time limited in their capacity of making sense of phenomena on account of their neglect of the non-language material processes operating alongside and intra-acting with framing endeavors in conferring meaning. This was demonstrated in this dissertation, for example, in the movement of pollen through insects and wind that constituted the very possibility of particular frames on genetic contamination to be employed in the first place and the further meaning that these frames attained in specific contexts through the topography and spatial distribution of farmland in particular areas.

The recent materialist turn in social and political theory has indeed put to challenge many of the conventions of social science scholarship. While matter has traditionally been conceived of either in managerial terms as particular things that are coped with by human beings or in a social sense as passive objects upon which meaning and purpose is imposed by humans, matter has been increasingly recognized in the academic literature for its vibrancy and agentic capacities. In taking this turn though, ANT and new materialist approaches have encountered their own limitations, including related to the displacing of the role of history, context, and discourse in explanations of politics. These approaches tend to be focused on the here and now, highlighting the affective and sometimes immense subsuming power of non-humans, but negating the historical constituting of discourses on, for example, political economy that confer meaning on these processes. Moreover, this dissertation has noted that ANT and new materialist approaches, in their

presumption of *a priori* symmetry, provide a problematic non-differentiation between human and non-human possibilities of agency. This dissertation has followed Cudworth and Hobden (2015a) in arguing that this stance, in conflating agency, fails to take into account the different capacities of humans and non-humans in struggling over rules and making decisions that constitute the dynamics of political orders.

These analytical maneuvers have consequently hindered the possibility of understanding how matter – human and non-human - comes to matter. A lack of understanding of discourse and its entanglements with matter in particular situations conceals an understanding of the ways in which matter comes to take shape and enact agency in specific ways in these contexts. In the field of agriculture, for example, it is not only that farmers are steered by the materiality of agricultural technologies, topography, climate, and the growing conditions of different crop varieties, but these processes are also situated within socio-materially constituted farming, food, and political economy structures, including consumer needs and preferences, that confer meaning on what is feasible or preferable. And in not engaging with the differentiation between human and non-human agency, in treating all things as equally capable of performing power roles, these approaches cede an opportunity to interrogate and draw out crucial knowledge across different cases regarding how the reciprocal relations between humans and non-humans can plausibly be performed in different contexts with particular effects. In the laboratory, for example, genetic materials and laboratory apparatuses – in consort with a variety of knowledge and other practices - affect the trajectory of research in significant ways, but it should be noted that this agency takes the form of resistant and gatekeeping capacities, which renders different implications for constructive intervention than if the material objects were to employ language and make decisions.

Taking into account these characteristics of constructivist and new materialist theorizing, this dissertation sought to develop a socio-material constructivist approach for analyzing politics, drawing especially on Karen Barad's (2007) agential realism perspective, an approach that has already shown promise in different fields in making sense of, for example, the development of health epidemics, the securitization of infrastructure, digital self-imaging, and primary school bullying (Wilbert 2006; Aradau 2010; Højgaard and Søndergaard 2011; Warfield 2016). Agential realism and the socio-material constructivist approach proposed here importantly rest not simply on the idea that both matter and discourse matter, but rather than it is what they do in their intra-

actions, in their interplay and entanglements, that constitutes the diffraction patterns that we observe in everyday life. The world is rather in a process of constant becoming, continuously reconfigured through material relations, through the enactment of agency in the articulation and re-articulation of material-discursive entanglements. This dissertation though differentiated itself from Barad's approach in its presumption that humans and non-humans differ in their capacities and that the meaning conferring processes not only occur through the intra-activity between matter and discourse but also through the boundary-drawing cuts that include and exclude arising from materiality itself. This move provided an opportunity to engage with what Aradau (2010, 510) referred to as the inequality in entanglements – not addressed in Barad's research - the notion that it is not only that intra-actions are performative in constituting differences, but that they themselves are also differentially enacted. Even as phenomena are the effects of boundary drawing practices between matter and discourse, this dissertation noted that particular material entities demarcated in these intra-actions are at the same time also separate entities capable of certain capacities and not others. Analytically, this meant engaging with the ways in which possibilities for agency are constituted in the very fabric of matter and consequently approaching the empirical field with an understanding that particular material entities come pre-incised, as it were, in their conditions of possibility, while also still being further conferred meaning in their material-discursive relations. This was demonstrated in, for example, soybean crops that were at once pre-ordained in their capacities for growing in certain climates and environments and further constituted through their intra-actions with plant breeding knowledge practices, food and energy demands, and discourses on transgenic crops.

While Barad (2007, 178) warns that “Holding the category "human" ("nonhuman") fixed (or at least presuming that one can) excludes an entire range of possibilities in advance, eliding important dimensions of the workings of agency”, so too does a decision not to recognize the differential *a priori* capacities of humans and non-humans foreclose analytical opportunities to examine how different capacities (e.g. language) make a difference or not in the field of practice. But by both recognizing the presence of boundary-drawing practices inherent in matter itself and allowing for an examination of its further configuring in its entanglements with other material-discursive practices, this dissertation was able to engage analytically with different types of capacities of matter, capturing how the pre-enacted cuts (e.g. ability of bee to fly over long distances and displace pollen) made a difference while also not losing sight of other possibilities of agential

emergence articulated in intra-activity (e.g. bee flight gaining meaning in context in which there are transgenic farms and mandated labelling requirements for crops). Overall, drawing on my own empirical research and the theoretical and empirical insights of others, this dissertation conceptualized four modes of action through which affective agency is enacted, including resistance (opposite of compliance), displacement (opposite of reification), gatekeeping, and symbolic action.

It should be emphasized that the added value of a socio-material constructivist approach is not simply to say that “everything matters”, to add more elements to a potentially never exhausted “everything but the kitchen sink” list of explanatory factors, but rather to contribute specifically to existing narratives by helping to make better sense of how these complex relations and overlooked sites of power are involved, for example, in interest/identity construction and their channeling into concrete strategies and actions and engendering of specific outcomes. This dissertation has shown that the socio-material constructivist approach can provide added value to political and social theory, clarifying gaps in knowledge that are left unexplained by conventional material-rationalist and constructivist narratives in interrogating particular phenomena. In examining particular sites within the debate over genetically modified organisms in the European Union, the dissertation showed that socio-material constructivist narratives can provide improved understanding regarding how the agential landscapes and power relations between actors that other approaches take for granted in exploring contestation over the issue were, in fact, populated through socio-material constellations that came together in the laboratory, agriculture, and society. These processes of emergence couldn’t be adequately captured through an emphasis on identity or economic interests alone, instead benefitting from being complicated and unpacked with regard to the complex relations between relatively stable and contingent moving parts, discursive and non-discursive, that constituted interest-identity configurations and the agential landscapes that emerged alongside them.

In chapter five, by taking into account enabling and trait technologies in their intra-actions with regimes on intellectual property rights, scientific knowledge practices, neoliberal capitalist political economies, and political contestation processes, it became possible to clarify, for example, how Monsanto and other biotechnology corporations and associated industrial-oriented transgenic crops, deemed crucial to issue outcomes, were able to emerge in prominent positions

while public research scientists, plausibly a better spokesperson on the issue, and value added transgenic crops (e.g. nutrition-enhanced crops), also perceived as more appealing to the public, didn't despite the interest of public plant breeding scientists in developing the technology and the potential utility of crops modified to withstand climate change or offer a nutrition boost. The case of the generation of farmer interest, also deemed crucial to the regulatory and social rejection of GMOs in the EU, was shown to be similar in its origins, emanating from the intra-activity between processes of nature (e.g. movement of pollen and topography) and their entanglements with the socio-material constituting of farmland (e.g. spatial distribution of farms, crop cultivation decisions) in different parts of the EU and material-discursive practices on transgenic crop acceptance in the EU.

The socio-material constructivist approach also revealed promise in getting at a better understanding of how interests and identities come to be channeled into particular strategies, actions, and mobilization decisions in specific situations. Chapter six highlighted how in Bavaria, while agrarian interest-oriented identities enabled the possibility of the mobilization of farmers against transgenic crop cultivation - within a context in which interests were constituted through the intra-actions of pollen, bees, wind, farmland, topography, EU labelling regimes, consumer preferences, etc... - these identity-interest constellations weren't automatically translated into direct action mobilization. The narrative presented in this dissertation rather highlighted how the plausible interest generation of farmers in Augsburg and Rosenheim counties, two proximate and similar areas, for example, came to be further constituted through socio-material relations and tied up with elements like access to farmer address books, activist leadership charisma, the spatial distribution of farmland, and the social habits of farmers. Within these processes of intra-activity, different types of matter came to perform gatekeeping functions, represented in human beings with access to farming networks, but also banal objects like address/phone number databases that became privileged access points, enabling or constricting access to farmers among anti-GM activists. The entanglements between these various material-discursive practices each conferred meaning on one another, constituting differential action or diffraction patterns in different contexts. The mobilization of farmers in specific areas, in other words, emerged out of configurations encompassing both interest-constituting entanglements between elements like climate, agricultural characteristics of landscapes, and underlying political economy practices and the strategy-channeling intra-activity between these very interest-constellations and additional

floating elements like leadership personality style or the access of activists to contact information necessary for outreach.

Beyond an understanding of the coming together of coalitions, another contribution that was articulated in the narratives in the dissertation was the highlighting of the socio-material work involved in constituting the broader effects of these alliances and their (non)achievements in public debates. In Bavaria, the membership of Bavarian farmers and beekeepers in anti-GM coalitions and the employing of frames on contamination and environmental harm didn't on their own enact a shift on the government stance on transgenic crops. Instead, the changing position of the CSU was contingent also on the repeated articulation of opposition to GMOs among these groups through demonstrations that were conferred meaning through the dense material relations between bees, balloons, wind, tractors, costumes, and humans. The frame on genetic contamination, for example, itself socio-materially pre-figured, was further agentialized in its entanglements not only with the environmental activists who voiced particular arguments related to this theme, but also bees and balloons that reified the conveying of these messages and garnered media attention and sympathetic public reception in consort with Bavarian societal discourses, for example, related to bees.

The focus on matter, human and non-human, and its relations with other material-discursive practices, therefore, contributed to problematizing traditional accounts of power, illuminating it instead in overlooked sites and intra-actions. Capturing such processes provides crucial knowledge in terms of analytically understanding the constituting of phenomena and normatively highlighting potential points of intervention that could have steered such situations in different ways. This knowledge, in turn, matters given the plausibility that similar processes may recur in different issue areas. Indeed there has already been speculation about the future of novel genome editing (GE) or new plant breeding techniques such as the CRISPR (clustered regularly interspaced short palindromic repeats) Cas9 nuclease system, which consists of guide RNA that binds to DNA and an endonuclease that then incises the DNA, allowing for the editing of DNA (Sprink et al. 2016). These novel GE techniques have been noted to demonstrate promise in their ability to enhance the nutrition of crops or their defense against disease (Specter 2015a). They are also notably distinct from transgenic crops though in that genes are edited internally rather than through the insertion of genes from another organism. A central question, nevertheless, though that has been posed is

whether the lessons from the transgenic crop debate (e.g. what has been labelled the “Monsanto problem”) can be applied to these emerging fields or whether such methods will ultimately fall under the umbrella of a similar regulatory regime to that of GMOs despite the different scientific processes involved in the technology (Specter 2015b, 2015a).

In the case of genetically modified organisms, the technology became anathema to significant swaths of the European Union, despite the fact it has been noted to have received generally widespread support among public research scientists and was portrayed as promising in terms of the development of crops that can grow under adverse climate conditions or provide nutritional benefits (Funk and Rainie 2015). Instead, what has been witnessed is the development of a (relatively) stringent regulatory and societal framework that has by and large, with the exception of GM animal feed and a minimal amount of cultivation of GM maize in five countries, made the EU a GMO-free area. In engaging with the process not in a singular causal manner but rather through the entanglements between matter and discourse, the dissertation has been able to pinpoint broader material-discursive practices that brought meaning to the constellations. A convergent point in this regard was the patterns of difference that were introduced once material entities (e.g. soybean crops, enabling/trait technologies, etc...) came into contact with practices of modern political economy and life, including protein-dependent meat production and the industrial farming conventions (e.g. optimizing soybean and maize production) associated with meeting this very need and capitalist practices of intellectual property rights. The findings from this case showed that the biotechnology industry capture of the research process through herbicide and insect-resistant soybean and maize crops, for example, came through the recalcitrance of the technological apparatuses to particular objectives and their accompanying conformity to other intentions in a context in which they intra-acted with intellectual property rights that turned them into privileged access sites, with the *Agrobacterium*-mediated transformation method at the same time being crucial for conducting research on plant biotechnology but limited to those with patent claims.

In this regard, particular material entities steered the process, as did certain discourses, and more importantly they together conferred meaning upon one another, enabling the continued import of transgenic soy into the EU – something opposed by environmental organizations – and the development of the technology in such a way that it would be opposed by various groups in the

EU when it could have very plausibly been accepted under other circumstances. As such, in the context in which particular genetic materials and topographies resisted human intentions, the debate over genetically modified organisms was constituted through processes related to the content of global, national, and local political economies and the socio-material work therein. These findings go beyond a typical rationalist or constructivist analysis of the debate that would tend to explain opposition to GMOs as the outcome of the protectionist interests of farmers or the result of contestation processes involving how different actors framed and conveyed impressions regarding the technology within discourses on globalization, precaution, and food. Following the entanglements in the laboratory and agriculture, the socio-material constructivist narrative presented here instead put a spotlight on alternative, though no less meaningful, paths of intervention that underlined the development of the debate in the first place. If the issue debate were to start over from scratch, a different debate trajectory may indeed be contingent on a revisit of global political economy practices, shedding light on the complex nature of power in socio-material politics, embedded within both local and global sites and within discursive structures that are difficult to unhinge and material sites that are not easily manipulated.

In reflecting on these stories, it should be noted that this dissertation's notion of responsibility differs from that proposed by Barad (2007, 178), who conceives of cuts as "agentially enacted not by willful individuals but by the larger material arrangement of which 'we' are a 'part'". For Barad, we participate in boundary drawing actions in our entanglements with other material-discursive practices and as such, responsibility is not something that is reserved for human matter or something that operates outside of the intra-activity in which differences are made. Rather, for Barad, human beings, as part of the material reconfiguring of the world, shouldn't be distinguished from non-human matter. While indeed recognizing phenomena as constituted in the intra-activity of material-discursive practices and agency as a practice enacted in this intra-activity, this dissertation tracked closer to the position of Cudworth and Hobden (2015b) in conceptualizing a greater role for human responsibility in these complex relations. While power can be performed by bees that convey impressions or human beings that frame issues, when examining the world ontologically, it is human beings that are capable of subjugating animals and objects to their rules. Even as cascading cycles of affective agency bombard and confer meaning on human action, thereby constituting the possibility for the enactment of transformative agency, non-human matter is limited in its capacities in terms of enacting transformative agency. An enabling technology can

participate in entanglements in drawing exclusions that make a difference and therefore become in part responsible for the continuous constituting of the world in its material becoming, but it cannot imagine an alternative future and struggle to enact it. On account of its pre-cut materiality, its responsibility for the process is articulated in different ways than for humans who, despite the exclusions enacted on their performance of agency, possess the ability not simply to resist or displace, but also to use language to rethink the past, present, and future.

In this vein, it should be acknowledged that human responsibility is not complete, as constrained and structured as it is, but it is articulated in different ways than for non-humans with both analytical and normative consequences. The particular unique characteristics of humans compared to other matter, in fact, entail that societies can act to strategically introduce diffractions that reorient action as discussed above, something not available to non-humans that rather influence the process, nevertheless, in their own profound ways. The socio-material constructivism articulated in this dissertation, in other words, leaves space for human agency in a world immersed in never ceasing processes of materialization, opportunities for thinking through the entanglements of the world and altering them to overcome systems of domination, exploitation, and faulty policy, as subjective as these categories and as difficult as such intrusions may be. While this dissertation has engaged with the case of genetically modified organisms in the EU for analytical reasons in terms of demonstrating the added value and intelligibility of the framework alongside alternative approaches, the overall lessons on responsibility and power and their complex constituting both in entanglements and pre-cut materiality is something that could apply across a range of different phenomena.

Other empirical examinations employing similar analytical frameworks have indeed also shown value in tracing relations between matter and discourse and between humans and non-humans. Nancy Tuana (2009), for example, showed Hurricane Katrina to be a phenomenon not only constituted by tidal flood waters that overpowered dams, but also systemic practices of discrimination, poverty, and racism. Chris Wilbert (2006) similarly highlighted the avian flu outbreak as tied in not only with the habits of migratory birds and the practices of small-scale farming operations where the birds were traced but more significantly also with large-scale intensive farming and slaughtering practices and associated discourses on food production and consumption. Erika Cudworth and Stephen Hobden (2015b), meanwhile, examining human-

animal relations in conflict zones, have shed light on the reciprocal relations between different species that go beyond the notion of animals as functioning simply as tools in their agency while at the same time recognizing their vulnerability and the human responsibility for the well-being of animals.

What a socio-material constructivist approach steers analysis toward is this type of intelligibility that both takes into account the often neglected relations between non-human and human matter, including the active capacities of each, while also conceptually and empirically unpacking how the agentic and power relations are performed within these relations. This means that the effects of a hurricane, to take an example, should indeed be traced socio-materially and that further the creation of such phenomena as poverty should in turn also be interrogated through the intra-activity between discourse and matter, but that the process should also be approached from an understanding that different types of matter are capable of enacting agency in different ways in the entanglements that constitute poverty. The socio-material constructivist approach doesn't subsume the construction of non-human matter to objects that are simply managed or upon which meaning is imposed, but at the same time recognizes and seeks further understanding regarding the range of capacities of both human and non-humans in particular entanglements, knowledge that is deemed crucial for making sense of the plausible maneuvers for human agency and the transformation of politics within, for example, constellations of entities and practices that constitute practices of poverty. When employed responsibly, socio-material constructivist perspectives, therefore, provide the potential to generate useful knowledge that could be used to improve – admittedly with all the conceptual and contested nature of what constitutes “improvement” - the world, one that is indeed of “our” making, both human and non-human and discursive and material through their relations.

In engaging diffractively with cases in a way that may influence the political world, this nature of the process also underlines the responsibility on the part of the researcher to attentively read the empirical field and numerous theoretical insights against and through one another to develop optimally trustworthy accounts and conclusions. As outlined in chapter four, it must be acknowledged though that with limited resources and limited access, especially to the non-human material world, it was impossible to ensure a completely comprehensive account that fully captured all perspectives of every process in the debate over genetically modified organisms. My

findings were guided by my observations and interpretations of the process from a symbolically representative sampling of scientific texts, newspaper articles, press releases, websites, interviews, and so on that I engaged with. It is possible that interviews with additional activists or policymakers may have led the research in different directions, to exploring different sites or cases of the process, or that those I did interview struggled like fish in water to make sense of their surroundings. The inability to speak directly to non-human objects may have also hindered the possibility of appropriately grasping the content of their capacities and actions. Although these limitations can never be completely overcome, in accordance with interpretive research practices, this dissertation has suggested and employed an abductive methodological approach premised on the notion of exposure by reading different sources intermaterially through one another and then examining these narratives alongside alternative explanations, argument, and counterfactual reasoning. When feasible, processes were also explored and compared across similar cases diverging in particular material or discursive aspects. In this regard, the limitations of socio-material constructivist analysis were mitigated to the best extent possible by ensuring exposure to different sources and sites and constantly adjusting my narratives in an iterative recursive fashion with the empirical field.

There is space, importantly, for further conceptual and empirical research. Within the transgenic crops case itself, there are opportunities for exploration of additional sites or interrogation of other campaigning endeavors, including, for example, of the pro-GM lobby in Bavaria. On an anecdotal basis, as an illustration, one of the central university scientists supportive of the technology in Bavaria pointed out that pro-GM scientists sought to create their own initiatives, but generally failed on account of the lack of infrastructure of “pro-science” NGOs and scientists’ own lack of capacities in terms of public campaigning (Interview, Gerhard Wenzel, 2015). In this regard, one area of inquiry for further exploration consequently would be examining how such differences emerged between agricultural and scientific groups and in general the divisions and power relations within the scientific community and how these processes engendered issue outcomes. Another theme that came up anecdotally in my fieldwork but was not systematically explored relates to the significance of matter in conveying feelings of satisfaction in activists and reifying their will to campaign. In other words, beyond the external performative element of conveying impressions and generating media coverage and attention, banal material-discursive entanglements also arguably became instrumental to the success of the GMO-free alliance by playing an integral

role in sustaining the satisfaction levels of protesters. This reinforcement of interest was especially vital given that the GMO-free movement in Bavaria at times struggled with fatigue and lulls in activity, as interest was first generated and then declined often following initial success, with two of the three anti-GM groups that I examined (Zivil Courage Rosenheim and the anti-GM alliance in Augsburg) largely ceding their activities entirely and another (Zivil Courage Neumarkt) continuing their monthly meetings and activities but in smaller numbers. In this regard, the GMO representative for Bund-Naturschutz remarked that the crop costumes, billboards, and balloon competitions were not only a symbolic ploy to change the opinions of politicians, but also functioned to enable activists to play on their creative side, thereby making the demonstrations more appealing to attend; “people want to have some fun” (Interview, Marion Ruppenner, 2015). Other environmental groups and cooperating farmers made crop artwork in their fields opposing GMOs (Interview, Zivil Courage Neumarkt, 2015). These anecdotes highlight the perceived role that such floating elements performed in the process and invite further attention in future research towards examining the extent and ways in which they make a difference in everyday practices and the stabilization of protest movements, thereby offering a potential contribution to the literature on social movements.

With regard to the case of novel gene editing technologies, referenced above, there is indeed also a question as to whether the issue translation will proceed differently, especially as the EU is currently reviewing whether these techniques will be put under the same regulatory framework as GMOs given the distinct scientific processes in which they’re developed (Fladung 2016; Sprink et al. 2016). Three plant breeding scientists that I interviewed were skeptical that the issue outcome will be any different, pointing to the fact that the first oligonucleotide-directed mutagenesis system crop application submitted in the EU, from the American company Cibus, is related to herbicide resistant canola, one of the crop varieties that is presumed to have sparked the ire of the environmental movement with respect to conventional GMOs (Interview, Peter Doleschel, Volker Mohler, and Martin Müller, 2015; also see Fladung 2016). Indeed, the Corporate Europe Observatory, one of the same NGOs that has contested GMOs, headlined an article “US company railroads EU decision-making on new GM” (Corporate Europe Observatory 2016). On the other hand, it has been pointed out that new plant breeding systems like CRISPR-Cas are considerably more affordable and more rapid in altering genes than traditional genetic engineering techniques, requiring less laboratory equipment and coming with fewer patent restrictions, thereby providing

opportunities for smaller and medium companies and universities to become involved in the research (Interview, Peter Doleschel, Volker Mohler, and Martin Müller, 2015, see also Jones 2015; Specter 2015b; Ledford 2015). Consequently, the emerging debate could offer the possibility of examining the ways in which different constellations of matter and discourse constitute agential landscapes and the accompanying issue outcomes.

More broadly, there are opportunities for evaluating the travel of the findings and the utility of the framework across different issues. The endeavor here was to conceptualize and demonstrate the added value of a socio-materialist constructivist approach and in the process conceptualize and unpack some of the ways in which matter can enact affective agency. As such, I was able to draw out resistance (compliance), displacement (reification), gatekeeping, and performance as particular capacities of both human and non-human matter. Within the case itself, as noted above, I was able to tease out a variety of entanglements that mattered in the process and in which interventions could have made a difference. More broadly, while I was able to draw out some tentative conclusions such as the notion that gatekeeping entities – human and non-human - can serve as a condition of possibility and strategy-channeling constituent in the success/failure of mobilization campaigns or the argument that non-humans can generate media coverage and alter attitudes when immersed in a context in which they are deemed vital species, these findings should be examined across additional sites and cases to develop experience-distant knowledge regarding how different types of entities operate in different contexts and the conditions under which such enactments of agency come to matter. In engaging with issue debates, this knowledge could then be taken into account in terms of developing expectations regarding how particular material entities could engender particular effects in issue campaigns. Having identified technological apparatuses in the laboratory as constituted by different capacities of being resistant/compliant - boundary-drawing cuts that come to further matter politically in particular entanglements with political economy practices - their participation in different intra-actions could be analyzed across different research processes in numerous fields. With this initial conceptual work, in other words, there are many opportunities opened up to further explore various cases of entanglement effects and the intermaterial work behind them.

The fields of political science and international relations provide fertile space for the employment of a socio-material constructivist framework, with the potential for scholars to make use of the

approach to revisit well-researched phenomena or make sense of emerging phenomena such as the adoption of nanotechnology and novel genome editing techniques, cyber security practices, contemporary debates over migration, drone warfare, and responses to health epidemics. Socio-material constructivist analyses can be employed to complement constructivist and rationalist perspectives, leading to novel intelligibility with respect to these issue phenomena. Whether such investigations are to indeed amount to meaningful knowledge will need to be determined empirically, but there is the promise in each case of uncovering overlooked sites of power that have been crucial to how political processes have been steered, consequently imparting lessons on how these processes can be altered and rescuing the human potential to construct a better world.

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APPENDIX

List of Interviewees

The interviewees are listed in alphabetical order based on their last name. The dates of the interviews and the relevant positions and affiliations are included in parentheses. In any case in which an interviewee requested anonymity, key identifying information related to the individual was omitted. Unless indicated otherwise, the interviewees are identified based on their relevant position at the time the interviews were held.

Interviewees

Anonymous 1 (July 2014, EU food industry lobbyist)

Martin Alberti (July 2014, District Chair of the Free Democratic Party in Freising, Germany)

Arnaud Apoteker (July 2014, GMO Campaigner, Greens/EFA Group in the European Parliament)

Philippe De Backer (July 2014, Member of the European Parliament representing Belgium)

Sarah Brown (July 2014, Policy Officer, Biotechnology, DG SANCO)

Tomasz Calikowski, Research Programme Officer, Bio-based products and processing, DG Research and Innovation)

David Sánchez Carpio (July 2014, Campaign Officer at Food and Water Europe)

Gérard Choplin (July 2014, former coordinator at European Farmers Coordination)

Marco Contiero (July 2014, EU Policy Director on Agriculture, Greenpeace European Unit)

Nilsy Desaint (July 2014, Public Affairs and Communications Manager - Green Biotechnology Europe (GBE), EuropaBio)

Peter Doleschel (July 2015, Head of Institute, Institute for Crop Science and Plant Breeding, Bavarian Research Center for Agriculture)

Alain Dominique Quintart (July 2014, Head of Government and Public Affairs EAME, Syngenta)

Mihail Dumitru (July 2014, Deputy Director General of DG Agriculture and Rural Development)

Garlich Von Essen (July 2014, Secretary General of European Seeds Association)

Christoph Fischer (July 2015, Farming Consultant, Founder of Zivil Courage in Bavaria)

Patrick Fox (June 2014, Manager Food Policy, Science and R&D, FoodDrinkEurope)

Johann Graf (July 2015, Bavarian Farmers Organization, Representative for Kartoffel, Zucker, Hopfen, Gentechnik und Risikomanagement)

Nina Holland (July 2014, Corporate European Observatory GMO researcher and campaigner)

Martha Mertens (July 2015, Environmental scientist and expert on genetic engineering for NGOs)

Ladislav Miko (July 2014, Deputy Director-General for the Food Chain)

Volker Mohler (July 2015, Geneticist, Institute for Crop Science and Plant Breeding, Bavarian Research Center for Agriculture)

Nathalie Moll (July 2014, Secretary General, EuropaBio)

Marc van Montagu (July 2014, Emeritus Professor, IPBO – Institute of Plant Biotechnology for Developing Countries, Ghent University, Department of Molecular Genetics, Belgium)

Jan Marco Müller (July 2014, Assistant to the Chief Scientific Adviser of the European Union)

Martin Müller (July 2015, Molecular Biologist, Institute for Crop Science and Plant Breeding, Bavarian Research Center for Agriculture)

Arnaud Petit (July 2014, Director of the Commodities Department, COPA-COGECA)

Jonathan Ramsay (July 2014, Government Affairs & Industry Affairs Lead, EMEA, Monsanto Europe)

Christof Rauch (July 2015, Deputy Chair of the Augsburg GMO-free Alliance)

Marion Ruppner (July 2015, BUND-Naturschutz, Head of Agriculture section)

Chris-Carolin Schoen (July 2015, Head of Plant Breeding at the TUM School of Life Sciences Weihenstephan)

Mute Schimpf (July 2014, GMO spokesperson, Friends of the Earth Europe)

Gisela Sengl (July 2015, Green Party, Member of the Bavarian Parliament, organic farmer)

Jan Verhaert (July 2014, Regulatory Affairs Manager, Monsanto Europe)

Peter Warlimont (July 2015, District Chair of the SPD in Freising)

Gerhard Wenzel (July 2015, Emeritus Professor, Former Dean of Science Center and Former Chair of Plant Breeding, TUM School of Life Sciences Weihenstephan)

Norbert Wittmann (July 2015, Manager of Catering and Butcher Shop at the Gasthof Wittmann)

Herbert Woerlein (July 2015, Member of the Environmental Committee of the Bavarian Parliament)

Rosita Zilli (July 2014, Deputy Secretary General at EuroCoop)

Zivil Courage Neumarkt (July 2015, Coordinator: Christa Joch; numerous activists participated in a group interview before the start of the group's monthly meeting)