May 2018

Negotiating Matters of Concern: Expertise, Uncertainty, and Agency in Rhetoric of Science

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NEGOTIATING MATTERS OF CONCERN:

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by

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A Dissertation Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

in English

at

The University of Wisconsin-Milwaukee

May 2018

ABSTRACT

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The University of Wisconsin-Milwaukee, 2018
Under the Supervision of Professor S. Scott Graham

Debates over GMOs, vaccines, and climate change are but a few examples that highlight a growing body of high-stakes scientific controversies and the manifest difficulties inherent in communicating about them. Addressing these and similar issues requires navigating a wide array of competing scientific, technological, social, democratic, environmental, and economic exigencies. The development of scholarly approaches that can account for the complexity and dynamism of these cases is an essential part of ensuring effective, ethical interaction between scientists and publics. In this dissertation, I explore one such case, the L'Aquila earthquake controversy, in which seven technical experts were charged with manslaughter for failing to warn the public. With the addition of the trial, this earthquake overflowed the boundaries of seismology, entangling the public, political, and technical and foregrounding the specific challenges of public-expert communication about risk and uncertainty. To better account for and negotiate public-expert interaction, my dissertation develops rhetorically-oriented approaches for improving communication about risk and uncertainty. In so doing, I explore new synergies among three concepts – agency, expertise, and uncertainty – which have previously been treated separately by rhetoricians but are inextricably entangled in situations like L'Aquila.

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ACKNOWLEDGEMENTS

First and foremost, I would like to thank my advising professor, Dr. S. Scott Graham, who, since his first seminar at UW-Milwaukee, has guided me throughout this process. He was the first to introduce me to the rhetoric of science and the first to see the potential in this project. His encouragement, collaboration, generous mentorship, and expertise have shaped my work. His deft incorporation of memes and other visuals has brightened my inbox.

I am also very grateful to the members of my committee – Drs. Anne Wysocki, Bill Keith, Rachel Bloom-Pojar, and Ryan Holifield – for their mentorship, availability, and support. A special thanks to Anne, who has challenged me and cheered me on from near and far throughout my time at UWM.

Thank you, also, to the rich network of mentors and peers – including Drs. Alice Gillam, Jason Puskar, Liam Callanan, Dave Clark, Donna Pasternak, Marija Gajdardziska-Josifovska, Tracey Heatherington, Jean Creighton, Dyanna Czeck, Caroline Gottschalk-Druschke, and Lynda Walsh – who have brought me here and seen me through coursework, teaching, research, writing, interviewing, childbearing, and parenthood.

I am grateful to the UWM English Department, the Scientific and Medical Communication Laboratory, and the Graduate School for the funding that allowed me to teach, research, write, and support myself during the course of the PhD program.

Thank you to the members of my family, especially my parents. You laid the foundation that made this possible, and your unwavering confidence, love, and patience have propelled me to this point.

To the man that is my rock, my *terra firma*. And our beautiful children. You are my life and my light. Thank you for the regular reminders that there are things far more important in this world than a dissertation.

Introduction

"How do we talk about earthquakes?
How do we even approach them, let alone integrate them into our lives?"
– David Ulin (2004)

Figure I: Yarn bombing quilt covering up a broken historic building in downtown L'Aquila: "A red zone, wherever it is, it's a national matter. Let's fix it." Photo retrieved from GreenMe.it

Amid the gray, desolate city center, the dug-up pavement, and a maze of scaffolding, blocks of color and warmth hang in Piazza Duomo (Figure 1). In stark contrast to the pale, fractured façades, this large, vibrant quilt was stitched together from knitted squares of yarn. It dresses up the main square, covering the metal barricades that block citizens' entrance to some areas of the city and bringing life to a place that – before the earthquake – used to be the social, economic, and political heart of the Italian city of L'Aquila. But these are not just random, playful patches providing cozy coverage for damaged buildings.

This quilt, a part of "Mettiamoci una pezza" [*Let's Patch It!],* is one of the first urban knitting (or yarn bombing) actions in Italy. This action was organized by five women from a local acting company, Animammersa, in 2012 to 1) commemorate the third anniversary of the 2009 earthquake, 2) draw attention to the state of the city, and 3) protest the lack of

reconstruction in the three years since the quake. Viral circulation of the project call resulted in the donation of about 5,000 pieces from knitters and crocheters around the globe. Hanging in contested "red zone" space, this multi-authorial patchwork makes visible the challenges and tensions in post-earthquake L'Aquila – how to manage and use city and public spaces, who should be allowed in these spaces, who or what can speak, who or what should act, how to remember and think about the earthquake and its aftermath. It also specifically calls for political action and renewed civic engagement: "UNA ZONA ROSSA, DOVUNQUE SIA, È UNA QUESTIONE NAZIONALE. METTIAMOCI UNA PEZZA!" [*A red zone, wherever it is, it is a matter of national concern. Let's patch it!*]

This is quite different from how earthquakes and their aftermath are typically portrayed, which is to say, technically. Since 1935, scientists have described earthquakes in the briefest of terms: an epicenter and a magnitude, a neat, quotable number that can be calculated from the readings of measuring instruments. The first magnitude scale, created by Charles Richter, was an attempt to eliminate the need for human observers and their uncertainties. Indeed, the history of seismology since the mid-eighteenth century "is traditionally seen as a progressive liberation of natural knowledge from the subjective impressions of earthquake victims" (Coen, 2013, p. 15). It is, of course, easier to deal with earthquakes as technical objects. Objects, as Bruno Latour points out in his rumination on the famous Heideggerian distinction between objects and things, stand against or apart; they are "out there, unconcerned by any sort of parliament, forum, agora, congress, court…" (2004, p. 236). When earthquakes are technical objects, they stand apart from the social, political, and economic. Placed within scientific contexts, the manifest uncertainty of earthquakes becomes manageable because it is subordinated to the puzzle, to the normal processes of inquiry.

But the yarnbombing of L'Aquila is a vibrant reminder that earthquakes and their aftermath are not just technical objects. Rather than standing apart, they are at the center of gatherings, imbricated in the personal, social, technical, political, economic, spiritual, material, and so forth. The Piazzo Duomo quilt, a message placed at the literal center of the city and in a literal public gathering space, is a direct reminder of this fact. Challenging expectations, "Mettiamoci una pezza" [*Let's Patch It!]* asks people to think about and see the L'Aquila earthquake and its aftermath differently. It is a reminder that disaster is "a hopelessly hybrid entity: inextricably entangling the natural and the social, freighting objectivity with subjectivity, and binding global science to local contingencies" (Coen, 2013, p. 3). Earthquakes are not just sterile quantifications, and they are not just discourse; they are done and lived.

As the yarnbombing hints at and as I will show, the situation in L'Aquila illustrates many of the matters facing experts and publics – what do we know and what don't we know about particular disaster situations? How do we communicate about events that have a low probability of occurring but very high consequences (e.g., earthquakes, landslides, volcanic eruptions, tornadoes, hurricanes)? How can experts communicate with publics about the changing nature of scientific conclusions as new evidence is presented? How can experts and publics interact most productively with the press, politicians, and community leaders?

A case like L'Aquila highlights the specific challenges of public-expert communication about risk and uncertainty. Natural hazards such as earthquakes are inherently uncertain; they involve complicated systems that are, by in large, invisible and uncontrollable on a time scale that is often at odds with human time. While challenging to talk about, this uncertainty can act as an intersection for expert and non-experts (Walker and Walsh, 2012), raising questions about who should be included in deliberation and decision-making and how to determine that. As

mentioned above, earthquakes and their aftermath are sites at which the technical, political, and public intertwine. These hybrid situations make it abundantly clear that agency is distributed among technical experts, computer models, instruments, seismic activity, governmental policy, the media, citizens, and more. As the boundaries between these sites and actants become increasingly blurred, situations like what has transpired in L'Aquila may become more common.

The Case of the L'Aquila Seven

Riddled with geologic faults, Italy has a long history of earthquakes and other seismic activity. So, the 6.3-magnitude earthquake (and its ensuing damage) that struck the central Italian city of L'Aquila on 6 April 2009, while tragic, is not unexpected. Italy does not, however, have a history of holding trials over such seismicity. In the wake of the 2009 earthquake, seven technical experts were charged with manslaughter for failing to warn the local residents.[1] They endured lengthy public trials from 2011-2015. Found guilty in 2012, six of the seven defendants were acquitted by an appeals court in 2014. This sentence was confirmed by the Italian Supreme Court in 2015. Now, more than eight years after the earthquake, the dust in L'Aquila has still not settled. Tangential legal cases and citizens' activism is ongoing. Also, major central Italian earthquakes in summer 2016 thrust the spectacle of L'Aquila back onto the global stage as parallels were inevitably drawn among the three places.[2]

Like "Mettiamoci una pezza," the trial is further evidence that this earthquake has overflowed (Callon, Lascoumes, and Barthe, 2009) the boundaries of seismology. The

[1] I will describe these key events and others surrounding the L'Aquila earthquake in more satisfying detail in the next chapter.

[2] As Lynda Walsh (2013) points out, this case should not be written off as a "vagary of Italy's legal system" (187). In *Scientists as Prophets*, she offers an example closer to home – the federal and civil fraud investigations of atmospheric scientist Michael Mann following his publication of the infamous "hockey stick" climate-change graph. Similarly, Lauta (2014) argues that there is an increasing trend globally in seeking legal action and criminal liability following natural disasters.

indictment, conviction, and now partial-acquittal have elicited international uproar, adding earthquakes to a growing body of high stakes scientific controversies – such as GMOs, vaccines, toxic waste storage, FDA hearings, and climate change – in which publics must interact with experts. While there are certain overlapping themes or concerns among these accumulating issues, L'Aquila provides a unique opportunity for study. Seismology as a science is young, and, when it comes to earthquakes, rather uncertain with no resolutions on the horizon; it involves complicated systems on a time scale that spans billions of years. People hunger for prediction, and yet the most earthquake scientists can offer is earthquake forecasting, which is particularly convoluted and often delivered in extended timeframes that complicate communication about probability. Communicating about these technical aspects alone is inherently difficult, let alone accounting for the social, environmental, economic, and so forth. Furthermore, publics may not have experience with earthquakes as they would with more common natural disasters, such as tornadoes or snowstorms. Despite this, Nigg (1982) shows that people are still likely to compare earthquakes to other natural disasters, thus skewing their understanding of seismic risk. Earthquakes, however, are increasing in frequency due in part to human activities, such as wastewater injection, deep mining, and hydraulic fracturing (Petersen et al, 2016). As the unprecedented addition of a criminal trial indicates, the stakes surrounding the communication of risk and uncertainty – for experts and publics alike – have never been higher.

With these exigencies in mind, I argue that the development of scholarly approaches that can account for the complexity and dynamism of these cases is an essential part of ensuring effective, ethical interaction between experts and publics and a necessary step towards saving future lives. Rhetorical scholars have done much work to consider public-expert interaction, writing, and other practices in the realm of science. This work has often

demonstrated a persistent interest in three principle theoretical areas: expertise, uncertainty, and agency. As topics of study, these concepts have been taken up by many and in association with many different conversations. While scholars continue to grapple with fundamental, definitional questions, the discussions in which expertise, uncertainty, and agency have been invoked range widely – epistemology, trust, materiality, authority, embodiment, risk, *kairos*, and public inquiry to name a few – reflecting the vibrancy and complexities of these concepts. As I will argue, the issues present in this dissertation project are squarely situated within the long tradition of scholarship and practice in rhetoric, particularly around notions of uncertainty, expertise, and agency (which I will expand upon in more detail in the following chapter).

Inspired by these conversations, I am interested in how material-discursive situations such as L'Aquila can be negotiated by a variety of stakeholders. As I will argue, these hybrid situations defy the binaries that are embedded in many of our traditional analytical tools because they entangle fact and value, expert and non-expert, human and non-human. Therefore, in this dissertation I work to develop methods and frameworks that do not replicate the dualisms that are rejected by these rhetorical imbroglios. Given calls in the rhetorical community to ensure the broader impacts of our research, I hope that my dissertation can contribute to the development of novel approaches that foster public-expert communication about risk and uncertainty. In the remainder of this introduction, I will more thoroughly outline the contents and arguments within the chapters as well as how each of them relates.

Outline of Chapters

Each of the following chapters contributes to the development of rhetorically-oriented approaches that can more adequately attend to the entanglement of expertise, uncertainty, and agency in hybrid situations.

Chapter One

To begin, I provide a thick description of the L'Aquila earthquake controversy, the primary case study through which I explore these three key concepts. A rich site for inquiry and analysis into issues of science policy, communication, and decision making, the L'Aquila earthquake and its ensuing controversy has been described as one of the more momentous events in the history of modern science and also one of the most misunderstood due to factors such as disjointed international coverage, the circulation of incomplete, second-hand information, issues of language access, and the wide range of settings in which the case has played out (Alexander). I use this chapter, then, to stitch together a more coherent narrative of the case's key events and issues – the concerning increase in seismic activity beginning in 2008, the unofficial predictions and alarmism prior to the earthquake, the emergency meeting of scientific advisers and politicians, the press conference, the devastating earthquake and subsequent public outcry, and the ensuing trial.

I will then use this thick description of the L'Aquila controversy to begin to show not only the relevance of expertise, uncertainty, and agency to these hybrid cases but also the relationships among them. As I will argue, when treated in isolation, each of these concepts only gets rhetorical theory so far in its attempts to address high-stakes sociotechnical imbroglios and the manifest difficulties inherent in communicating about them. Specifically, I will orient the reader to the most recent developments regarding these three key concepts in rhetoric of science and science and technology studies (STS). In outlining this work, I hope to demonstrate the need for greater dialogue between these three areas. I will use this theoretical excavation and explanation to establish the needed foundation for the case analysis and my ensuing efforts to begin integrating these previously isolated bodies of work.

Chapter Two

Chapter two, *Expertise as Doing*, takes up the challenge of both recognizing marginalized voices and leveraging expertise appropriately. Negotiating this tension is especially important because of the blurring of technical, personal, and political boundaries. While recognizing multiple expert classes, many of the proposed alternative models retain epistemic challenges, namely they perpetuate the very binaries (subject/object, culture/nature, words/things) that are defied by these hybrid situations.

One way forward, I argue, is to move beyond the epistemic register and approach expertise as doing or practice-based. Therefore, in this chapter, I draw on the work of philosopher Annemarie Mol to theorize a practice-based model of expertise. Such an approach extends the possibilities for legitimacy and agency and provides a more flexible conceptualization that can adapt to these varying material-discursive situations. Turning to L'Aquila, I will ruminate on what an expertise of doing might suggest about how to reconfigure such a controversy.

Chapter Three

Just as cases such as L'Aquila necessitate a reconsideration of the participants in deliberation, they also require a reconsideration of deliberative practices and the rhetorical tools used to account for them. One of the primary reasons for this is the deep uncertainty in which this deliberation occurs. Even though rhetoricians have worked to explicate the nature of uncertainty and its distinction from risk, traditional analytical tools often have difficulty accounting for the complexity and dynamism of deliberation under and about uncertainty.

To this end, chapter three, *Uncertain Deliberation*, investigates a key event in the L'Aquila controversy: the emergency meeting of scientists and politicians over whether or not an

advanced warning should have been issued to the area residents. In this chapter, I draw upon one of the primary analytic tools deployed in rhetorical investigations of science-policy deliberation – stasis theory. While traditional stasis theory application comes with the side effect that complex and messy stasis moments are disentangled and purified into separate questions, I employ a "functional" approach that will analyze the dynamic flow of issues in situ (Graham, 2015). While I must limit myself to one analytic tool, this approach to stasis theory aims to serve as a model to reflect on implications for broader issues of accounting for uncertainty in deliberation. Accounting for deliberative practices in uncertain situations also has ramifications for issues of inclusion and expertise. As I mentioned earlier, the risk/uncertainty distinction has been proposed as one criterion for determining participation and relevant expertises. Situations of uncertainty warrant a more open (but not unlimited) approach.

Chapter Four

As described earlier, hybrid cases require the consideration of "a complete set of new actors," actors that are both human and non-human. Whereas the previous chapters emphasized human actors, chapter four, *Agency Visualized*, considers the non-human and its role in how rhetorical agency is perceived, distributed, and fostered. Indeed, the recent interest in agency scholarship over the role of objects and technologies and the distribution of agency across networks is well-suited for exploring a variety of associations between human and nonhuman actors. Continuing this work, I use this chapter to explore the rhetorical, agentive nature of seismic risk visuals, such as those referenced in the L'Aquila controversy. I offer agentive modeling, a mixed methods data visualization approach for networked modeling of agency, applying this method to a collection of technical and public-facing risk visualizations from the websites of key seismic risk organizations. Such a method aims to help make visible *how* these

visuals act. Through this analysis, I identify potential agential configurations and rhetorical strategies in seismic risk visuals. I will show that these visuals most often configure people as passive in the face of seismic activity, but interventionally, we need visuals that configure humans as agentive, that help them to reduce danger. These visuals mediate how earthquakes are thought about and seen and have material consequences for catalyzing future actions and realities. Traveling across personal, technical and public spheres, visuals are ideal artifacts for unifying agency, expertise, and uncertainty because they can be used to visualize uncertainty, construct expertise, and condition possibilities for response or action.

Conclusion

In "Why Has Critique Run out of Steam?," Latour suggests that critics should be redefined as the ones who bring things together when the personal, social, technical, political, economic, environmental, and material intertwine. In that spirit, I use the final chapter to synthesize the results of the previous chapters, including a detailed theoretical reflection on what the L'Aquila case suggests for rhetorical theory and possible ways forward for integrating uncertainty, expertise, and agency.

In so doing, I also take seriously Ceccarelli's (2013) call to more explicitly address how rhetoricians engage in public scholarship in order to more effectively transform scholarly findings into action in non-academic fora. Therefore, an additional purpose of the conclusion is to begin to transform the insights from this dissertation into practical suggestions for those engaged in communication and deliberation about seismic risk. To offer a contribution to this applied rhetoric of science that can walk the path from understanding to critical engagement, I describe key practices to effectively scaffold civic agency and the design of spaces of interaction.

Such a movement to engage in broader areas of science communication is not only possible but also part of the rhetorical tradition.

Chapter 1: The L'Aquila Controversy

There is an old saying in Italy, "Chiedi alla polvere." Literally translating to "ask the dust," this phrase usually refers to something unknowable. There is certainly much about the L'Aquila case that has been unknownable or unknown. As one of the more momentous events in the history of modern science, the 2009 earthquake and its ensuing controversy has also been described as one of the most misunderstood due to factors such as disjointed international coverage, the circulation of incomplete second-hand information, issues of language access, and the wide range of settings in which the case has played out (Alexander, 2010). I use this chapter, therefore, to give the dust a voice, to stitch together a more coherent narrative of the case's key events and issues – the concerning increase in seismic activity, the unofficial predictions and alarmism prior to the earthquake, the emergency meeting of scientific advisers and politicians, the press conference, the devastating earthquake and subsequent public outcry, and the ensuing trial. I will then use this extended description to demonstrate the relevance of expertise, uncertainty, and agency to this case.

Before the Earthquake

L'Aquila lies in the seismically active region of Abruzzo. A mountainous area in central Italy, Abruzzo has a documented history of disastrous earthquakes dating back to at least 1315, including more recent major events in 1703 and 1915 (Cello et al, 1998; Guidoboni et al, 2012; Molin et al 1997). This part of Italy is undergoing what seismologists call crustal extension; eastern central Italy is moving to the north-east relative to Rome. As a result, this region experiences normal faulting earthquakes as the land is torn apart. As part of this faulting, in October 2008, the area surrounding L'Aquila experienced intermittent seismic swarms, or low-

magnitude tremors. By late winter, several alarming shocks had occurred, but none was powerful enough to cause major damage.

In late March 2009, Giampaolo Giuliani, a resident of the neighboring village of Coppito, publicized unofficial predictions of an impending earthquake via interviews with the press and personal phone calls to local officials. A retired laboratory technician of 40 years, Giuliani based his predictions on increased radon gas levels, which had been recorded by four homemade radon detectors he had installed throughout the area. Giuliani predicted that a strong earthquake was possible "within a week and probably centered on Sulmona." On both counts he was wrong, but, as word of Giuliani's unofficial predictions spread, the local residents, or Aquilani, became increasingly uneasy (Kerr, 2009). Local officials issued Giuliani a citation on 30 March 2009 for disturbing the peace and, on the same day, issued a press release stating that

> *Nell'aquilano* ***non sono previste altre scosse sismiche di alcuna intensità.*** *Lo rende noto la sala operativa unificata permanente della protezione civile, evidenziando che "tutte le informazioni diffuse di altro contenuto sono da ritenersi false e prive di ogni fondamento.* [In the L'Aquila region no earthquakes of any size are forecasted. The information comes from the unified, permanent operations room of the Regional Civil Protection, saying that 'all other information contrary to this one are to be taken as false and without foundation.'] (Stucchi and Cavallo, 2014).[3]

Responding to the growing public alarm and the ill-advised press release, Guido Bertolaso, head of Italy's Department of Civil Protection (DPC), called a meeting of the Commissione Nazionale per la Previsione e Prevenzione dei Grandi Rischi [National Commission for the Prediction and Prevention of Major Risks] (Commissione 'Grandi rischi' or CGR, for short).[4] The CGR is composed of 21 representatives, including experts in evaluating geological, chemical, nuclear, and environmental risks. Appointed by the DPC, the CGR

[3] Unless cited otherwise, I thank Louise Zamparutti for her help with the translations.
[4] There is some disagreement about the official nature of the gathering on 31 March 2009 (See Stucchi, Pinho, & Cocco, 2016).

typically holds lengthy closed meetings bimonthly in Rome (where most of the then-members resided) to provide technical and scientific recommendations regarding public risks (Civil Protection Department, 2006).

However, this specific session was rather uncharacteristic. The meeting was held the following day, 31 March 2009, in L'Aquila; it was opened to local and regional authorities; and the minutes were made available quickly thereafter. Additionally, the exigencies for this particular meeting were both conflicting and, at times, fell outside the stated purpose of the CGR. According to the 30 March 2009 meeting summons, the purpose of the meeting was to provide

> *una attenta disanima degli aspetti scientifici e di protezione civile relativi alla sequenza sísmica degli ultimi quattro mesi, verificatasi nei territorio della Provincia di L'Aquila* [a close examination of the seismic events of the past four months in L'Aquila and its surrounding area, from the perspective of scientists and civil protection agencies] (Bertolaso, 2009).

This exigency is reflected in the opening remarks of the meeting as Bernardo De Bernardinis, then-vice president of the DPC, states that the meeting was called, '*con l'obietivo di fornire elementi per informare I cittadini sull'attivita' sismica delle ultime settimane* [with the objective of putting together the facts needed to inform the public about the seismic activity of the past few weeks]' (Commission, 2009, 1). However, further into the meeting minutes, Franco Barberi, vice-president of the CGR and a volcanologist, shared an outline for the scope of the meeting that is slightly different from the original stated objectives:

> *La CGR si è riunita e si deve esprimere su due questioni: 1. fare una valutazione oggettiva degli eventi sismici in atto, anche in relazione a quanto si possa prevedere, 2. discutere e fornire indicazioni sugli allarmi diffuse nella popolazione* [The CGR has gathered to address two issues: 1. making an objective evaluation of the ongoing seismic events and the extent to which predictions can be made, 2. discussing and making recommendations regarding the current public warnings being issued throughout the population]. (Commission, 2009, p. 3)

Other communication between members of the DPC indicate additional exigencies in the form of political maneuvering. In a telephone call that was captured as part of an unrelated political corruption investigation, Bertolaso was recorded telling Daniela Stati, a regional DPC official, that, unlike what he said in his faxed meeting summons, he was calling the meeting

> *in modo da stare zitto, subito, qualsiasi imbecille, di calmarsi congetture, preoccupazioni e così via ... stiamo facendo questo non perché siamo preoccupati, ma perché vogliamo tranquillizzare la gente* [so as to immediately shut up any imbecile, to calm down conjectures, worries and so on…we are doing this not because we are worried, but because we want to reassure people]. (Caporale, 2012)[5]

Conflicting with the meeting summons, the wiretap transcript seems to be a strong indication that Bertolaso and the DPC set out to deploy the CGR as a technocratic method of exclusion, one that "shut up" both Giuliani and the public, at great cost not only to the public but also to the CGR experts who appear to have been co-opted, perhaps unwittingly, in this exclusionary agenda.

Meeting minutes, summarizing the discussion that took place were not available before the night of the earthquake. While some have interpreted this as evidence of further manipulation, others have argued that this lag time is typical when documents from meetings involving several participants need to be finalized.

Immediately following the meeting, a press conference was convened by Barberi, De Bernardinis, Stati, and Massimo Cialente, the mayor of L'Aquila. Two of the seismic engineers from the meeting were also in attendance, though they sat in the audience. Exactly how much information was shared with the public is unclear. Video recordings from the press conference itself did not emerge until after the trial began.

[5] In my research, I have come across multiple versions of the minutes from the emergency CGR meeting. There are several discrepancies across the versions, most notably the omission of all conversation regarding Giuliani. However, the overlap of later versions of the minutes and the recorded wiretap allows me to conclude that these additional exigencies were present.

The four press conference speakers also gave brief interviews. Aired by local TV station Abruzzo24ore, Barberi, Cialente, and Stati's interviews all emphasized the impossibility of predicting earthquakes, discredited Giuliani, and acknowledged that while swarms rarely result in a large earthquake the possibility could not be excluded. De Bernardinis' post-meeting comments emphasized seismic safety measures, specifically concerns about building safety. But De Bernardinis gave another interview, the infamous "glass of wine" interview. While both of his interviews were broadcast after the meeting, the glass of wine interview was recorded before the emergency meeting, a key detail that is not particularly obvious to viewers (Cocco et al, 2015, Stucchi and Cavallo, 2014). In this pre-meeting interview, De Bernardinis, in contrast with the other interviews, indicated that the seismic swarms were "favorable because there is an ongoing discharge of energy," a claim that was never discussed in the CGR meeting (Woodman, 2013, p. 55). Pre-meeting De Bernardinis, implying the positive state of affairs, asked the Aquilani to "be and remain calm" and even recommended that they go home and enjoy some local wine, "a Montepulciano, absolutely" (Woodman, 2013, p. 55).

Five days later, on 6 April 2009 at 3:32 am, a 6.3 magnitude earthquake devastated the medieval town of L'Aquila, killing more than 300 people and generating more than €10 billion in damage.

After the Earthquake

Compared to other seismic activity in the world, the earthquake in L'Aquila was a moderate seismic event with a fairly unremarkable magnitude (Alexander, 2010, "An Evaluation"). But, given the high vulnerability level of the area's poorly maintained and unreinforced masonry buildings (many of which are concentrated in the historical city center), the earthquake had a disproportionately large human impact. The 2009 earthquake wreaked

massive destruction on L'Aquila, reducing much of the historic, economic, and social heart of the city to rubble.

Downtown L'Aquila was declared a *zona rossa*, a red zone; the seismic crater, as it became known, was closed to the public and garrisoned by the Italian army.[6] In addition to the 309 deaths, most of L'Aquila's residents lost their homes and many lost their businesses and jobs. Approximately a third were temporarily relocated to government-sponsored tent camps, a third were put up in hotels on the Adriatic Sea coast of Abruzzo, and the remaining third found their own makeshift accommodations (Alexander, 2010, "The L'Aquila Earthquake").

While the emergency response and work of the DPC was praised by some, the Italian authorities' promises for a quick recovery and their top-down approach to reconstruction has attracted significant criticism. Reconstruction, by and large, has been held up by bureaucracy and corruption. Commentators have extensively criticized the official reconstruction policies for inefficient use of resources, prohibitive amounts of red tape, and more broadly, for the political exploitation of the disaster, rampant corruption, and misappropriation of public funds. More than €2 billion were spent in 2009 on managing the aftermath and providing for the nearly 70,000 evacuees. Now, eight years after the catastrophe, the seismic crater remains. There are still 10,739 people living in temporary, government-subsidized housing according to a city report ("Popolazione Assistita," 2016). L'Aquila's residential neighborhoods are still undergoing reconstruction, and the work on the heart of the town, the heavily damaged historic city center, has only begun. The Progetto C.A.S.E. and Progetto M.A.P. housing projects resulted in the

[6] Seismic crater is an expression that denotes the area affected by a seismic event. Here, it is used to identify the urban area of L'Aquila, where the earthquake generated damage to things and people. "Seismic crater" or simply "crater" is also often used by the Aquilani, with a more specific connotation to identify the community of people affected by the quake and still residing in the area.

construction of temporary homes on the outskirts of the city, displacing residents from city resources and their homes and disrupting their social and civic lives. Many Aquilani, upset at being excluded from post-earthquake planning and decision-making, have led various protests and activist movements, including yarnbombing the city center, the "Yes We Camp" and "Last Ladies" protests, the "People of the Wheelbarrows" movement, and the "Rubbles of Democracy" rally.

In the wake of this disaster, the Aquilani also took the unparalleled step of bringing charges against a group of technical experts from the emergency CGR meeting, now known as the L'Aquila Seven.[7] Late in 2009, relatives of some of the victims pressed charges, arguing that the victims changed their habits (i.e., staying at home the night of the earthquake) after hearing the interviews and press conference. In June 2010, the Seven were indicted for the manslaughter of 29 earthquake victims.

Over the next five years, a series of three trials ensued, following Italian legal proceedings. The first trial, beginning in September 2011, was held in L'Aquila and adjudicated by a single local judge. The Seven were found guilty by the presiding Judge Marco Billi on 22 October 2012, sentenced to six years in jail, ordered to pay financial compensation of €1 million, and banned from working in the public sector. Approximately two years later, the appeal trial, arbitrated by three judges in L'Aquila, took place. Six of the seven defendants were acquitted on 10 November 2014, on the grounds that the alleged conduct was not committed. The seventh defendant, De Bernardinis, received a reduced two-year sentence. At the request of both parties,

[7] The 'L'Aquila Seven': Franco Barberi, volcanologist, vice-president of the Commission of Grand Risks (CGR); Enzo Boschi, seismologist, former president of the National Institute of Geophysics and Volcanology (INGV); Giulio Selvaggi, seismologist, president of the INGV's National Earthquake Center; Gian Michele Calvi, seismic engineer, president of European Center for Earthquake Engineering; Claudio Eva, seismologist; Mauro Dolce, seismic engineer, president of the Department of Civil Protection's (DPC) earthquake risk office; Bernardo De Bernardinis, government official, former vice-president of the DPC.

a third trial was held before the Supreme Court of Italy, which is responsible for assessing whether any formal errors have been made in the appeal trial. If errors are found, the appeal sentence can be revoked and a new appeal trial requested. On 20 November 2015, the Supreme Court confirmed the appeal sentence.

Several tangential legal cases also arose after the L'Aquila earthquake. While the Seven's trial was taking place, investigations into Bertolaso's role in the pre-quake reassurances began, following the release of the wiretap in January 2012. Bertolaso, who at the time was the head of the DPC, was cleared of manslaughter charges in October 2016. A number of civil trials, connected with compensation requests, are ongoing.

The indictment, conviction, and now partial-acquittal has elicited fervent worldwide international discussion, certainly far more than the earthquake (and its ensuing damage and aftermath)[8]. Following key case developments, scientific listservs, the blogosphere, and global media lit up (See for example: Block 2013; Bone 2012; Brown, 2012; "Earthquake Scientists Guilty," 2012; Hall, 2011; Krueger, 2012; "L'Aquila Earthquake Trial," 2012; "L'Aquila Quake," 2012; Mullen, 2012; Nosengo, 2012; Ropeik, 2012; Smekens, 2012; Wolman, 2014). An open letter, signed by more than 5,000 members of the broader scientific community, was sent to Italian president, Giorgio Napolitano, in support of the L'Aquila Seven following the initial charges. A number of prominent professional organizations, including the International Association of Volcanology and Chemistry of Earth's Interior (IAVCEI) and the Geological Society of America (GSA), wrote statements of support for the Italian defendants (American Geographical Union, 2012; Cas, 2012; Davis, 2012; Executive Committee, 2012; Holm-Nielsen

[8] Overall, the events (and lack thereof) in post-earthquake L'Aquila have gone unnoticed by the global community and media. A series of recent 2016 earthquakes in Central Italy, however, has drawn attention back to the city, the people, and their plight.

& Tindemans, 2012). In a statement issued following the indictment in 2010, the American Association for the Advancement of Science (AAAS) wrote to the Italian President:

> Years of research, much of it conducted by distinguished seismologists in your own country, have demonstrated that there is no accepted scientific method for earthquake prediction that can be reliably used to warn citizens of an impending disaster. To expect more of science at this time is unreasonable. It is manifestly unfair for scientists to be criminally charged for failing to act on information that the international scientific community would consider inadequate as a basis for issuing a warning. (Leshner, 2010)

Reflecting much of the professional commentary and media reporting on the L'Aquila trial, the AAAS, in this excerpt, construed the issue as one of prediction, as technical.

Rather than prediction, the prosecution and the Aquilani they represented perceived the issue to be communicative. In a 244-page document detailing the charges, the prosecution accused members of the CGR of providing "incomplete, imprecise, and contradictory information" and, thus, failing to fulfill their duties as government-appointed technical experts serving on an advisory panel (Hall, 2011, p. 266). After gaining access to the CGR's meeting minutes, multiple seismologists have contested this allegation, saying that the scientific presentation was "clear, measured, and scientifically accurate" ("Earthquake Scientists Guilty," 2012). From the written statements of professional scientific organizations to the coverage of the mass media to the blogosphere and listservs to the arguments presented at trial, much of the discourse and energy regarding the L'Aquila controversy has been focused on both scientific and communication issues. In addition to the failure of science communication, the L'Aquila case has also commonly been interpreted as an attack on science, a confusion of roles, and a commentary on the conflation of science and politics (Yeo, 2014).

A Matter of Concern

The development of the L'Aquila case has been a difficult one to follow, both nationally and internationally. In light of this widespread lack of familiarity with the details, I have

provided this overview in order to establish from the outset a more coherent narrative (See Alexander, 2014 and Ciccozi, 2013 for even thicker contextual framing). But I have also provided this overview to begin highlighting the entangled challenges of expertise, uncertainty, and agency. Expertise, uncertainty, and agency have captured scholarly attention in varying ways, but there is a notable absence of conversation directly integrating these bodies of work.[9] Treated in isolation, each of these concepts only gets rhetorical theory so far in its attempts to address high-stakes sociotechnical imbroglios and the manifest difficulties inherent in communicating about them. In other words, the treatment of agency, expertise, and uncertainty in rhetoric fails to account for what Bruno Latour has called "matters of concern."

A matter of concern exists when an unanticipated event that had been demarcated as a technical concern overflows or escapes those boundaries and extends into the public sphere; it's

> what happens to a matter of fact when you add to it its whole scenography, much like you would do by shifting your attention from the stage to the whole machinery of a theater…Instead of simply being there, matters of fact begin to look different, to render a different sound, they start move in all directions, they overflow their boundaries, they include a complete set of new actors, they reveal the fragile envelopes in which they are housed (Latour, 2008, p. 39).

Though highly uncertain, matters of concern are just as real as matters of fact; but they are also "livelier, more talkative, active, pluralistic, and more mediated" (Latour, 2005, p. 115). The move to understanding a rhetorical situation as a matter of concern does not mean forsaking facts or accepting relativism; rather it puts facts in a larger context, a context in which they appear and are to be judged differently.

[9] This is not to say that there has been no conversation, just a limited one. For example, Sauer (2003) utilizes research on mines in the US, UK, and South Africa to argue for more complex understanding of documentation practices, ones that, in her case, can account for the embodied expertise of the at-risk miners and better manage safety in uncertain environments. Madjik (2009) and Kelly and Maddelena (2016) explore how publics acquire agency via technology, hinting at issues of expertise. Walker and Walsh (2012)'s article on the use of uncertainty as a *topoi* to invite public participation in science, likewise, begins to bring agency and uncertainty into conversation by suggesting the agential possibilities of uncertainty. Callon et al (2010) propose a model for acting more effectively and ethically under uncertainty.

Recognizing their complex and fraught nature, matters of concern require new and integrated scholarly approaches. Therefore, in this dissertation, I begin the process of exploring new possible theoretical synergies among these three crucial concepts –expertise, uncertainty, and agency – in order to better account for and negotiate the rhetorical, material dynamics of these particularly sticky science-policy situations in which complex networks of competing stakeholders, initiatives, and values intersect. Fully achieving this synthesis will require an interdisciplinary scholarly effort greater than any one dissertation; however, I will use a focused case study and agentive modeling – a mixed methods data visualization approach for networked modeling of agency – to begin the process and open new avenues of intersectional inquiry.

Specifically, I aim to address the following research questions: 1) How is our understanding of expertise and stakeholder inclusion in situations of uncertainty altered by contemporary rhetorical theory, with its recent attunement to materiality and practice?; 2) How can we account for the deliberative practices in uncertain science-policy controversies in an ethical, effective manner?; and 3) Particularly in situations of potentially cataclysmic geologic events, how is the perception of agency and communication about risks and uncertainty influenced by visualization? These questions guide the analysis of this project and frame the thinking about each case presented.

In the remainder of this first chapter, I will orient the reader to the most recent developments regarding these three key concepts in rhetoric of science and STS. First I will explore different models of expertise, including those based on knowledge and credentials and those based on practice and experience. Then, I will unpack competing approaches to uncertainty in the rhetorical scholarship. Finally, I will trace the recent history of agency theory as it has worked to move beyond the tension between individual agency and ideological forces, "the

permanent anxiety over the meaning and potential of rhetorical agency" (Greene, 2004, p. 188). I will use this theoretical excavation and explanation to establish the needed foundation for the case analysis. In outlining this work, I also hope to demonstrate the need for greater dialogue between these three areas. Especially if we are to more fully explore the complexities of these concepts, rhetoricians need to more consciously probe the relationships among them.

Expertise

In the first case, rhetoricians have given sustained attention to questions of expertise and who is fit to speak in deliberative matters. In *Gorgias*, Plato (through the mouthpiece of Socrates) emphasizes the importance of experience and formal, institutional expertise. Attempting to counter the mere flattery of rhetoric, Plato argues that without credentials and a track record of accomplishment, a true politician cannot lead the polis to the truth in matters of civic deliberation. In other words, only through the correct experiences, certified by the correct institutions, can an individual be said to possess expertise. This emphasis on institutional accreditation over the individual or their experience, what Lyne and Howe (1990) call a "structural account," has been widely accepted by western civilization as the measure for expertise. Arising only "after mastering the special knowledge and techniques of a field," expertise is constructed, regulated, and certified by disciplines and institutions (134).

But scholars have pushed back on this structuralist account of expertise. Responding to this positivistic view, which positioned scientists to weigh in broadly on socio-political issues, scholars in STS and rhetoric of science, technology, and medicine (RSTM) have, at length, critiqued the marginalization of non-expert voices (Callon, Lascoumes, and Barthe, 2011; Farrell & Goodnight, 1981; Gieryn, 1983, 1999; Herndl et al, 2011; Jasanoff, 1990; Koerber, 2006; Majdik and Keith, 2011; Teston and Graham, 2012; Wynne, 1989). Arguing for "lay-expertise"

and the inclusion of all affected publics in decision making is the hallmark of this scholarship, which still continues today. This "second wave" of science studies has challenged traditionally sanctioned systems of expertise, advocating for a more democratic approach to policy and decision making and the inclusion of knowledges located outside of those traditions (Grabill & Simmons, 1998; Miller, 2003; Perrault, 2013; Teston et al, 2014). Scholars like Latour and Woolgar (1986), Barnes and Bloor (1995), Fox Keller (1995), Haraway (1997), and Shapin and Shafer (2011) have demonstrated that scientific knowledge is like any other form of knowledge; it is constructed, and thus, does not have special access to the truth. This approach legitimizes all knowledge—and flattens expertise.

Latour (1999) frames this clash between credentialed expertise and the push for more democratic participation as the struggle of Right against Might. Tracing this struggle back to its origins, he contends that Plato's credentialed, structural account of expertise (Right) was designed to safeguard the political process from mob rule (Might). Plato's expertise relies on a natural, objective law that exists independently of humanity, a move Latour calls using "inhumanity against inhumanity" (217). These natural laws (and the knowledge they contain) are safeguarded by institutions and institutionally-sanctioned experts, thus deflecting the might of the masses and solving the problem (to Plato) of democratic participation. "The Greeks," Latour argues, "made one invention too many! They invented both democracy and mathematical demonstration…we are still struggling, in our 'mad cow times,' with this same quandary, how to have a science and a democracy together" (218).

In light of this continuing struggle, a more recent trend has been to examine the role of credentialed experts in the science-policy nexus (Archer, 2014; Bijker, Bal, & Hendriks, 2009; Ceccarelli, 2011; Hoppe, 2005; Latour 2004; Prelli, 1997; Pielke Jr., 2007). In response to

invented controversy cases like global climate change, Ceccarelli (2011) recommends that technical matters should remain the province of credentialed, scientific experts, and that those stipulated facts can then be folded into the political process wherein an inclusive debate about values can be had. Similarly, Collins and Evans (2002) voice concerns about the lack of "clear limits to the widening of the base of decision-making" (237). Like Ceccarelli, they are concerned about the consequences of wide-spread delegitimization of scientific and technological expertise. While Collins and Evans acknowledge the value of deconstructing the epistemological privilege of scientific knowledge and demonstrating that expertise extends beyond the work of formal scientists and technologists, they note that this research is more descriptive in nature, and as such, does not specify or prescribe how much further the grounds for inclusion extend.

One line of inquiry in response to these conversations has been the imagining of alternatives to credential-based expertise. Lyne and Howe (1990) began this work by demonstrating the rhetorical nature of expertise. They argued that the widely accepted view of the expert as simply a possessor of special knowledge must be altered into a more complex notion which embraces the person's relationship to an audience as well as to subject matter (135). Similarly, Hartelius (2011) offers a framework of expertise as a situated, rhetorical construct that blends both symbolic and "real" knowledge. More recently, DeVasto (2016), Graham and Herndl (2013), and Majdik and Keith (2011) have proposed practice or experience-based approaches to expertise. Instead of being based on what is said or known, these approaches ground expertise in what is done. It is from these practices that experts derive credibility, experience, and knowledge.

Material and embodied rhetorics have also been used to explore how expertise develops.

For example, Fountain (2014) has applied this embodied understanding to how expertise is acquired in medical education. His study of cadaver labs shows that learning is not just epistemological; anatomy students learn "to see, think, and even embody knowledge" through bodies, multimodal displays, and vision (124). Working within the context of marine policy, Dixon (2016) draws upon Latour's ontological concepts of mediation, translation, and inscription to investigate what constitutes non-credentialed expertise and how to assess its quality in policy settings. He conceptualizes expertise as an accretion of material experiences and offers a materially oriented heuristic for identifying and evaluating stakeholder expertise.

Uncertainty

Along with expertise, uncertainty has been a foundational issue since the ancients placed rhetoric within the realm of the contingent. That is, whenever there is pressure to make decisions under constraints and uncertainty, rhetoric is called upon. For Aristotle, rhetoric is enmeshed in "the contingency of a moment, the motivations of an audience, and the imperatives of judgment" (Crick, 2014, 21). Or, as G. Thomas Goodnight (1982) put it, all arguments can be understood as attempts to discipline uncertainty: "Whatever else characterizes an argument, to be recognizable as such, a statement, a work of art, even an inchoate feeling must partake in the creative resolution and the resolute creation of uncertainty" (199). Perhaps most recently, Ulrich Beck's (1999, 2009) notion of a world risk society has brought contingency and uncertainty back into focus as an effect of the advancement of technical, scientific knowledge and their attending controversies. Compared to the uncertainty of Aristotle's time, the uncertainty that society now faces, Beck argues, has changed. And its severity has deepened.

With the proliferation of high-stakes controversies (e.g., nuclear energy, nanotechnologies, GMOs, Zika, etc.) over the last several decades, rhetorical understandings of

uncertainty have broadened from a lack of technical information (Doheny-Farina, 1992) to a boundary object (Sauer, 2003; Scott, 2006) to varied and multiple *topoi* (Walker & Walsh; Walsh). Despite this evolving understanding, uncertainty is often conflated with risk, as I will discuss in further detail in Chapter 3. This inconsistent approach to uncertainty is explained in Walsh and Walker's (2016) insightful review:

> Recent work in technical communication has, for the most part, been done without principled, rhetorical frameworks for handling uncertainty. Even some of the finest studies of risk communication in recent years have presented negative definitions of uncertainty (Sosa, Eppinger, Pich, McKendrick, & Stout, 2002); used the term without explicit definition (Ding, 2009; Ding, 2013, p. 133, p. 145); used the term to cover distinct rhetorical functions (Ding, 2013); or conflated technical uncertainty, which expresses the probability of outcomes, with risk, which assigns values to those outcomes (Frost, 2013) (71).

Though their review focuses on research from technical communication, their argument can be extended to rhetorical scholarship. Walsh and Walker call for "a more nuanced and pluralistic treatment of uncertainty" (71). To demonstrate this point, they describe an array of uncertainties – linguistic, technical, scientific, epistemic, rhetorical, sociopolitical. Drawing upon Goodnight, they offer a spheres model as a heuristic for locating and tracking the uncertainties of a particular rhetorical situation across genres, communities, and forums. They propose that a more granular approach to uncertainty will help scholars to more clearly examine the effects of uncertainties on risk communication, "produc[ing] better risk analyses and strategies… [and] better-targeted interventions" (72).

Often entwined with issues of risk, the scholarship demonstrates a persistent interest in uncertainty's rhetorical possibilities.[10] Its role in facilitating doubt has been established by

[10] For many, the work on uncertainty has been more indirect. For example, Heimtum and Lovelock (2017) analyze strategies for communicating with tourists about uncertainty. Uncertainty is a factor in or a condition of the rhetorical situation, but it is not being analyzed. Similarly, in Koerber's (2006) examination of how the speculation over the benefits of human milk transformed into certainty, her focus is on the transformation of the medical discourse and strategies for responding to scientific uncertainty.

scholars such as Danisch and Mudry (2008), Oreskes and Conway (2010), and Paroske (2009). Primarily, this production of doubt has been characterized more negatively (i.e., use of uncertainty to obfuscate scientific consensus about the dangers of smoking). But Heazle's (2006) study of international whaling policy shows how uncertainty can be strategically deployed for opposing political purposes. In his case, the role of scientific uncertainty dramatically shifted from protecting the industry and its interests to eventually protecting the resource and banning all commercial whaling. The rhetorical possibilities of uncertainty to foster action and engagement is also well recognized (Sauer, 2003; Walker & Walsh, 2012; Walker, 2014, 2016, 2017; Zehr, 2000). Others have sought to construct a specific rhetoric of uncertainty. For example, Danisch (2010), building on Beck's notion of world risk society, views uncertainty as a problem of social definition and negotiation that requires engaged, rhetorically-savvy citizens.

The literature also demonstrates a consistent interest in methodology for dealing with or managing uncertainty. Traditional approaches advocate settling or reducing technical uncertainties first as the best way to provide useful information to decision makers (Pielke, Sarewitz & Dilling, 2010). Such approaches have been thoroughly critiqued as impractical in light of contemporary risks (Crick, 2014; Keranen, 2013; Pilkey and Pilkey-Jarvis, 2009; Prelli, 2013; Scott, Segal, and Keranen, 2013; Wynn and Walsh, 2013). Rhetoricians, by and large, have offered deliberative approaches, which support an understanding of context and the articulation of common interests, as another way forward.

Agency

Finally, issues of agency have a long tradition in rhetoric as well. Classical rhetorical tradition established individuals as powerful agents of change. Gorgias, for example, touts the

superior persuasiveness of rhetoricians: “For not a single craftsman is able to speak in a crowd, on any subject in the world, more persuasively than the rhetorician” (Plato 456). Similarly, Cicero in *Orator* describes the ideal orator as one who has worked to develop wisdom and eloquence so that he (definitely he) may be a moral guide. Such an orator – the good man speaking well – would be able to stir the emotions of, prove the thesis to, and delight the audience via carefully crafted rhetoric (93). From this perspective, rhetorical agency is something possessed by an individual human subject, a subject whose persuasive efforts are in alignment his intentions.

However, postmodern critiques undermine this classical idea of agency, emphasizing the role of ideological structures and the illusion of agency. Taking up a Marxist position, Louis Althusser famously held that a person’s choices, desires, and judgements are the products of social practices. These social practices, or ideological structures (e.g., religious, familial, legal, political, educational, cultural) “interpellate concrete individuals as concrete subjects” (115). This subjugating is generally unrecognized by individuals, who believe their actions and thoughts are freely chosen. Although he presents the idea of interpellation in a linear sequence, Althusser makes it clear that “individuals are always-already subjects” even before they are born (119). In other words, because of ideology, we are all subjects and our freedom is just a product of ideology. This paints a bleak and drastically different picture for rhetoric, one in which agency is only ever imagined.

Responding to this apparent dichotomy, Lundberg and Gunn (2005) argue that humanist and postmodern subjects are not polar opposites but offer different explanations of agency. Consequently, many scholars since have explored models that entwine individual agency and ideological forces. Agency, for example, has been described as the ability of agents to martial the

structures of authority (Winsor, 2006). In her study of automated assessment systems, Carolyn R. Miller (2007) suggests that agency can be understood as a social contract, "as the kinetic energy of performance that is generated through a process of mutual attribution between rhetor and audience" (137). In her conception, agency is not possessed by the individual but a property of the event, one in which an individual must both intend to act *and* be accepted as an agent by the other agents operating in the rhetorical situation. With a shared emphasis on the relational, Carl Herndl & Adela Licona (2007) reconceptualize agency as a rhetorical space, as "the conjunction of a set of social and subjective relations that constitute the possibility of action" (6). In this understanding, agency is kairotic. It is shifting and diffuse, and it can be constrained or supported by authority. As their analysis of texts from women's studies and professional writing shows, agency arises from the strategic occupation of subject positions within material-discursive networks. Still today, many of our approaches to agency draw upon rhetorical tradition, incorporating ideas about the freedom to make choices and take action, while also acknowledging social, political, and material influences on individual agency.

Another significant arm of agency scholarship seeks to destabilize the focus on the individual, human speaker. As Karlyn Kohrs Campbell (2005) points out, speakers may be "points of articulation rather than originators" (5). For some, this has meant acknowledging the rhetorical agency of the audience to shape the speaker (Defossez, 2016; Leff, 2012). But primarily, it has meant drawing attention to the agency of the non-human (Bogost, 2012; Bennett, 2010; Coole and Frost, 2010; Graham, 2015; Latour, 1999; Mol, 2002; Pickering, 1995; Rickert, 2013). Accounting for human and non-human actants, Karen Barad (2007) defines agency as a provisional and radically relational arrangement between objects. Influenced by network theory and new materialisms, rhetoricians have also been examining the distribution of

agency and the boundaries among personal, technical, and public agency (Condit et al, 2009; Cooper, 2011; Grabill & Pigg, 2012; Graham, 2009; Keranen, 2007; Kelly & Maddalena, 2015, 2016; Kessler, 2017; Koerber, 2009; Rawlins & Wilson, 2014; Wolford, 2011; Wynn, 2016). While we continue to wrestle with fundamental questions, like what is rhetorical agency and who possesses it (if it is, indeed, possess-able), this scholarship emphasizes the "interlocked, organic complexity of rhetorical agency" (Walsh et al, 2016, p. 3).

Embracing the Imbroglio

Thus far I have argued for the need to explore issues of expertise, uncertainty, and agency in conversation with each other. I have also contended that matters of concern require new and integrated scholarly approaches if rhetoricians are to more ethically and effectively intervene in these situations. As I proposed in the introduction and as the above extended case description shows, this earthquake, marked by the addition of the trial, has overflowed the boundaries of seismology and metamorphosed from a matter of fact into a matter of concern. As a matter of concern, the L'Aquila case is a rich site for rhetorical inquiry and analysis into issues of science policy, communication, and decision making. Indeed, as a site of inquiry it promises to add significantly to the rhetoric of science's evolving understanding of issues of expertise, uncertainty, and agency. With these claims as my foundation, this project will explore the interwoven issues of expertise, uncertainty, and agency in a series of cases stemming from the L'Aquila controversy.

Ultimately, I hope to shed insight on the ways in which we can understand and intervene in matters of concern by taking a closer look at L'Aquila and seismic risk communication. My goal is to better understand the complexity and dynamism of these rhetorical situations. Each of the subsequent chapters in this dissertation, therefore, explores entangled examples of expertise,

uncertainty, and agency in the L'Aquila controversy in order to open up possible theoretical synergies among them. Identifying these possible synergies is merely the first step in what surely must be an interdisciplinary effort to cultivating adequate rhetorical theory, methodologies, and strategies for matters of concern.

Specifically, in the next chapter, I will take up the challenge of leveraging expertise appropriately under conditions of deep uncertainty and distributed agency. As part of my effort to develop methods and frameworks that do not replicate the dualisms defied by matters of concern, I offer a practice-based model of expertise that extends the possibilities for legitimacy and agency while providing a more flexible conceptualization of expertise that can better adapt to the varying material-discursive situations of matters of concern. Turning to L'Aquila, I will ruminate on what an "expertise of doing" might suggest about how to reconfigure such a controversy. While some of this work will lead me into deep theoretical waters, it is my goal that the arguments I lay out here will move our discipline a little further toward drawing practical conclusions from our complex theories.

Chapter 2: Expertise as Doing

As sometimes happens in the cases of scientific controversies, "the narrative of controversy thus produced identifies skeptics as heroes in an unfolding scientific revolution, oppressed by mainstream scientists who are ideologically deaf to their appeals and who try to silence them so that others are not exposed to their heresy" (Ceccarelli, 2011, p 198). This pattern, in many respects, is present in the L'Aquila case. Giampaolo Giuliani, who does not hold any scientific degree and has never completed any official scientific training, claimed that he could predict earthquakes through the measurement of radon gas variations underground, specifying that he could make those predictions between 6 and 24 hours before the event and with 80% accuracy. As I have briefly discussed in Chapter 1 and will elaborate on further, government officials and scientists did not judge him to have appropriate expertise. Though unlike the controversies studied by Ceccarelli, where the skeptics promote uncertainty and the mainstream scientists argue for certainty, in this case, the scientists were the ones defending uncertainty. Prior to the earthquake, each group worked in different ways to silence and exclude him.

Even after the quake, Giuliani remains a controversial figure. At times, he has been portrayed as a local "prophet" who had predicted the earthquake but had not been listened to by the authorities. Giuliani's neighbors, friends, and Facebook followers claimed to have survived the earthquake because he encouraged them to remain safe outdoors and sleep in their cars. Other people claimed that Giuliani adjusted his prediction only after the disastrous earthquake had already happened, and consider him a local charlatan.

Giuliani's case, in particular, draws attention to several key issues – What counts as expertise? As evidence? Who should and do we listen to? The L'Aquila controversy adds

earthquakes to a growing body of science-policy decision-making issues (e.g., toxic waste storage, FDA hearings, catastrophic climate change) dealing with the ever-pressing dilemmas of who gets a seat at the table and what happens once they get there.

Issues of Expertise and Inclusion

As mentioned in Chapter 1, problems of expertise and inclusion in scientific, technical, and health policy disputes are long familiar to rhetoricians of science and science studies scholars more generally. Despite the prominent call in STS and RSTM scholarship for more equitable inclusion and a democratic approach to scientific and technical decision making, a more recent trend has been to question the benefits of total democratization. This research tends to highlight the detrimental effects of unlimited inclusion (Ceccarelli, 2011; Collins & Evans, 2002; Latour, 2004; Graham et al, 2015). In "Manufactured Scientific Controversy: Science, Rhetoric, and Public Debate," Ceccarelli raises serious concerns about the uninhibited inclusion of non-experts in technical decision making, demonstrating that in cases such as global climate change the inclusion of non-experts has led to the denial of the scientific community's consensus on the matter. Ceccarelli documents a strategic leveraging of arguments regarding undemocratic marginalization by those who would invent controversy.

Equally concerned about these dangers, Latour (2004) tackles American academia head on and questions the value of our now-traditional approach. He argues that "a certain form of critical spirit has sent us down the wrong path" (231). Himself included, Latour is concerned about the effects of academia's efforts to demonstrate the lack of scientific certainty, "that there is no such thing as natural, unmediated, unbiased access to truth" (227). While this effort to show the construction of facts was initially an attempt to push back against experts' privileged access to the truth and make room for marginalized voices, Latour (like Ceccarelli) worries about how

these arguments are being strategically used to artificially maintain controversy and flatten expertise.

In light of these critiques, a call to provide guidance for incorporating diverse perspectives in science-policy decision making has been taken up in more recent scholarship (Blythe, Grabill, & Riley 2008; Callon, Lascoumbe, & Barthe, 2010; Dixon, 2016; Graham, 2011; Joss and Durant, 1995; Kleinman et al, 2007; Mitchell & McTigue, 2012). More recent work, especially in STS and STP, has taken an explicitly normative turn, recommending specific taxonomies of inclusion for non-expert stakeholders (Collins & Evans, 2002) and deliberative practices such as science courts or consensus conferences. In a similar contributory vein, scholars in rhetoric and technical communication have offered modes of participatory research designed to actively facilitate more equitable modes of inclusion and deliberative practices in science-policy decision making (Blythe, Grabill, & Riley, 2008; Koerber, 2006). Much of this work, however, is focused on developing models for inclusion, not rethinking how we understand and evaluate expertise.

One notable exception is Collins and Evans (2002, 2007, 2017) normative vision for science-policy debate. Broadly characterizing STS, Collins and Evans (2002) incorporate a more nuanced notion of expertise, one that admits different kinds of practical and experience-based expertise. Their account of expertise provides a foundation for "investigating how expertise functions in a time where people are constantly asked to engage with complex technical information" (Keith & Majdik, 2011, p. 372). They propose deploying a hierarchy or continuum of expertise, so that scholars and policy makers can develop a system that values and incorporates multiple expert classes—not just scientists – while avoiding charges of anti-science or the dangers of technological populism. In their first attempt at articulating a model of

expertise, Collins and Evans (2002) develop a four-part taxonomy of expertise that emphasizes the importance of including non-credentialed or experience-based experts, including those who may not be recognized by certification. As the terms suggest, these are experts who have direct experience with the technical issues at hand but not the typical MD or PhD appended to their names. In developing this taxonomy, the authors explore now canonical work such as Brian Wynne's (1989) exploration of Cumbrian sheep farmers. Examples such as the Cumbrian sheep farmers demonstrate the manifest need for certain types of experience-based experts to participate in science-policy decision making but in no way imply that a public opinion poll would generate more ethical or effective results. This four-part taxonomy of expertise would later be developed into what they call the "Periodic Table of Elements," which I will discuss in greater detail shortly (Collins & Evans, 2007). Collins and Evans's model provides a useful starting point for deciding who gets to come to the table. While Collins and Evans do not seek to entirely bar non-expert classes from deliberation, they divide decision making into technical and political spheres. The technical phase emphasizes the production of knowledge about the world and provides resources for wider debate/guidance about what is known. The political focuses on questions of preference and priorities (i.e., what should be done given the uncertainty/facts in technical as well as many other exigencies) and developing policies and frameworks within which technical phase takes place. The broader (not just scientific) pantheon of experts contributes to addressing scientific controversies in the technical phase, while all stakeholders can contribute in the political phase to determine the societal values which will engage with scientific consensus in the formation of public policy.[11]

[11] See Collins and Evans (2002), Evans and Plows (2007); Collins, Weinel, and Evans (2010) and Collins, Evans, and Weinel (2015) for additional delineation between the technical and political phases. It is worth noting that the authors argue that while these two phases may seem to be separating fact from value, we should not take this to be the case because they allow for values to be present in the technical phase – just Mertonian ones.

An important and valuable touchstone in the science-policy scholarship, Collins and Evans' model is not without its challenges.[12] Critics have cited a range of concerns, including the mischaracterization of a body of scholarship and the unresolved question of how to determine pertinent experts (Keith & Majdik, 2011; Jasanoff, 2003; Rip, 2003; Wynne, 2003). However, I would suggest that a deeper and unaddressed challenge inherent in the model is its epistemic demons, which I will take up in greater detail shortly. Responding to the call to provide guidance for incorporating diverse perspectives in science-policy debate, Collins and Evans' (2002) normative model of expertise provides a useful starting point for deciding who gets to come to the table – expertise and experience. However, new materialist critiques highlight the epistemic challenges of such an approach. Drawing on the work of philosopher Annemarie Mol, I propose that the theory of multiple ontologies and a practice-based orientation can enrich conversations about expertise and inclusion in science-policy decision making, particularly in matters of concern. In what follows, I describe the theory of multiple ontologies and the associated materialist critiques of epistemological practices in science studies. I then explore the analytic possibilities of this theory by applying it to the L'Aquila controversy.

As a science-policy controversy involving issues of expertise and inclusion, the case of the L'Aquila earthquake is ripe for ontological inquiry. It has a material dimension that should be taken into account. "Don't attend to what is loudest, the fight," writes Annemarie Mol (2002), "but shift your attention a little, widen it, and try to see what all this noise is part of" (144). In the case of L'Aquila, there is an actual fight, the trial, which has gotten much of the official and unofficial attention. But what is all this noise part of? And how could attending to that impact

[12] According to Collins (2016), a search for the term "interactional expertise" on Google will reveal a flourishing secondary literature and citations to Collins and Evans (2002) and (2007) together are approaching 3000.

how criteria for inclusion in decision making are determined? Applying Mol's shift to the work of rhetoric, S. Scott Graham and Carl Herndl (2013) suggest that "the rhetorical question ceases to be 'What is your disagreement?' and becomes 'Where does your problem come from?'" (123). Following their suggestion, I will attempt a similar shift in question. Much of the conversation about L'Aquila has been focused on words and miscommunication. However, this focus on the language surrounding the L'Aquila earthquake has resulted in overlooking how it was done. So, rather than solely analyzing the communication breakdowns (an important point I will take up in greater detail in the next chapter) between stakeholders in the L'Aquila controversy, my concern rests first with the patterns of practices, specifically those pertaining to expertise, which shaped and informed the discourse in this instance of science-policy decision making.

New Materialist Inquiry

Recent scholarship in a range of disciplines, including STS and RSTM, demonstrates a renewed and widespread interest in ontological inquiry. Responding to Bruno Latour's question of the missing masses, a strong concern for materiality, objects, ontologies, and the concrete have come to the foreground under what Diana Coole and Samantha Frost (2010) are broadly calling new materialisms (Bennett, 2010; Bogost, 2012; Bryant, 2011; Harmon, 2009; Mol, 2002; Pickering, 2010; Reinberger, 2010; Rickert, 2013). This embracing of new materialisms reflects a shifting of the postmodern emphasis on the linguistic and the social construction of reality through language and culture. In other words, new materialisms is a direct response to what could be seen as the problem of the perspectival.

In general, the postmodern position that all knowledge is perspectival acknowledges the existence of things but argues that humans cannot access them except through language. This

emphasis on perspective, according to many new materialist critiques, is a continuation of the modernist separation of subject and object or nature and culture. While modernists focused on questions of objects or substances, postmodernists rejected the notion that material reality could be known and, instead, privileged the "other" side, favoring subjects over objects, words over things, culture over nature.[13] However, as noted most famously by Latour (1993), in the postmodern world of the perspectival, subjects are still divided from objects. Therefore, the perspectival, linguistic emphasis does little to overcome the binaries the postmodern position purports to challenge. There are still two separate worlds – one material and one perspectival. In the words of Michel Serres (1995): "An idea opposed to another idea is always the same idea, albeit affected by the negative sign. The more you oppose one another, the more you remain in the same framework of thought" (81). Postmodern theories of paradigms are deeply perspectival and peppered with visual metaphors that reinforce these binaries. In an attempt to resolve this separation, new materialists have broadly rejected inquiry into the perspectival and its underlying logic of representation. Rather than seeing and representing, new materialist approaches emphasize doing and intervening.

Transcending the issues evoked by Latour's brain-in-a-vat, philosopher Annemarie Mol offers multiple ontologies, a strain of new materialisms. Embracing a pragmatic, practice-based methodology, Mol (2002) characterizes multiple ontologies as "shifting from understanding objects as the focus point of various perspectives to following them as they are enacted in a variety of practices [and] impl[ying] a shift from asking how sciences represent to asking how

[13] An extended discussion about the postmodern extension of the "two-world problem" can be found in the following sources: Bogost (2012), Bryant (2011), Graham (2015), Haraway (1991), Harmon (2011), Latour (1991, 1993, 1999, 2004, 2005), Mol (2002), Pickering (2010), Rickert (2013).

they intervene" (152). The theory of multiple ontologies emphasizes that reality is not seen or represented through multiple perspectives but is, itself, multiple:

> It is possible to refrain from understanding objects as the central points of focus of different people's perspectives. It is possible to understand them instead as things manipulated in practices. If we do this—if instead of bracketing the practices in which objects are handled we foreground them—this has far-reaching effects. Reality multiplies. If practices are foregrounded there is no longer a single passive object in the middle, waiting to be seen from the point of view of seemingly endless series of perspectives. Instead, objects come into being—and disappear—with the practices in which they are manipulated. (Mol, 2002, p. 4-5)

According to the theory of multiple ontologies, it is not just that there are different perspectives on a single object but that there are different, multiple objects: "If reality is *done*, if it is historically, culturally and materially *located*, then it is also *multiple*" (Mol, 2002, p. 71, emphasis original). Scholars pursuing multiple ontologies all argue, in one way or another, to reject the notion of a singular ontology for a multiplicity of realities rooted in and developed out of practices (Gad & Jensen, 2010; Graham & Herndl, 2013; Gruber, 2014; Mol, 2002; Pickering, 2010). As both Mol's *The Body Multiple* and Pickering's *The Cybernetic Brain* establish through extended, careful observations, ontologically-speaking, knowledge becomes a phenomenon of practice. The locus of analysis, then, becomes practices – what is done or enacted, not what is said or known. Highlighting the importance of practice to multiple ontologies, both Mol and Pickering employ theatrical metaphors (i.e. enactment and performative, respectively) instead of visual ones. In this way, an emphasis on perspective is replaced with one on practice.

Demonstrating her praxiographical approach, Mol maps enactments of atherosclerosis across various sites of practice in a Dutch hospital, including the surgical ward, pathology, hematology laboratory, and clinic exam rooms. Because each site enacts atherosclerosis differently, Mol argues that there is not one disease looked at from different perspectives but different atherosclerosis. For example, in the hematology lab, atherosclerosis is a deviance in the

blood clotting mechanism, an interaction between blood and vessels, which hematologists enact through experiments, flow chambers, and centrifuges. However, the atherosclerosis enacted in the clinical setting contrasts with the chemical details observed in the hematology lab. In the clinic, atherosclerosis is pain. It is the weak pulsations felt in a patient's leg. It is enacted through patient narratives, doctor-patient interviews, and physical examinations. In the clinic, where doctors interact with people, the practices of hematology and its emphasis on blood, not the person, are out of place. In other words, what each atherosclerosis *is* depends on where it is situated and how it relates to other practicalities – practices, instruments, people, complaints, measurements – that are "involved in enacting reality" (Mol, 2002, p. 54). Each atherosclerosis, however, has a place in the practice of the others; this layering of practice is why Mol insists that reality, even though multiple, still "hangs together" (55).[14]

Recent scholarship has continued to extend Mol's praxiographic methodology to new spaces (e.g., policy, pain medicine, college organization, disciplines), often with the intention of developing models for more inclusive science-policy decision making (Graham, 2015; Gruber, 2014; Herndl & Cutlip, 2013; Teston et al, 2014). For both Graham (2015) and Teston et al (2014), the way forward is through doing. Working from the context of health policy deliberations, Teston et al (2014) suggest that a true hybrid forum, an inclusive space where issues of science and science-related policy can be discussed and evaluated among various stakeholders across technical, social, political, ethical and economic dimensions, cannot be achieved when membership is based on certified expert knowledge:

> Indeed, such an epistemological orientation will unavoidably marginalize anyone outside the evidence-based medicine mainstream as member of the outside 'laity.' This source of perspectivalism is exactly what the ontological approach seeks to avoid. Rather, eligibility for party participation at forums like the Avastin hearing should be decided

[14] See Mol (2002) for a discussion of alignment, incorporation, coordination, and calibration, her strategies for how objects and realities hang together.

> upon participants' experiences based in practices. Such an eligibility requirement surfaces the legitimacy of experiences had by more than those who run randomized clinical trials. This means that we must shift our notion of expertise, or at least the ground upon which expertise is legitimated, away from an anecdote/data divide and toward ontological multiplicity" (166).

Unwilling to completely dismiss epistemology but still advancing the new materialist focus on practice and doing, Graham in *Politics of Pain Medicine* proposes what he calls a praxiography of representational practice:

> My analysis treats the stated epistemologies and metaphysics of the discussants as emergent epiphenomena that arise from their ontologies. That is, just as certain practices stage certain ontologies, the discursive instantiation of those ontologies (as beholden to 2500 years of epistemological/metaphysical inquiry) will necessarily be cast as perspectival and representationalist. That is, practices stage modes of being which, in turn, encourage the participants to talk about truth and knowledge in ways that are operationalized by the underlying ontology" (85).

Working across STS and RSTM, Graham's approach offers a middle ground between the object-oriented rejection of the perspectival and the postmodern neglect of the material. Graham does not deny language and its associated epistemological focus; instead he places it more modestly amidst materialist concerns.

Building on this scholarship, in this chapter I suggest that the theory of multiple ontologies can enrich conversations about expertise and inclusion in science-policy decision making, particularly in matters of concern. Specifically, I reread Collins and Evans' normative model of expertise through multiple ontologies.[15] Collins and Evans most likely will not agree with this. However, the blending of Mol with Collins and Evans, I argue, both productively resolves gaps in each other's work while leading to the creation of something new. What Mol brings to the table is a way forward that deconstructs the expert/lay binary without, as Latour and

[15] Collins and Evans' vast oeuvre on expertise includes various versions and revisions to their original model of expertise. I will provide a brief overview of the main versions in the following section, but my analysis will primarily focus on the three core expertises set out in the 2002 article (and further refined in later articles). These three have received the lion's share of the scholarly attention and are most relevant to the emergency CGR meeting.

others have shown of the postmodern, reconstructing it. Meanwhile, Collins and Evans provide the necessary normative model that Mol's descriptive praxiography lacks. Indeed, Collins and Evans' call for a third wave of science studies in which "humanities and science studies scholars to work 'upstream' of technology development" is aligned with Latour and other non-modern calls for the development of practical strategies for "helping manage the uncertainty of post-normal science and policy formation" (Herndl & Cutlip, 2013, p. 4). Rereading Collins and Evans' model through Mol's theory of multiple ontologies, I will explore what this approach, which I am calling an expertise of doing, might mean for the long-standing problem of expertise and inclusion in scientific, technical, and health policy disputes. Specifically, I will look at the controversy in L'Aquila, an undeniable matter of concern, and ruminate on what an expertise of doing might suggest about how to reconfigure such a decision-making dispute.

An Expertise of Doing

What much of the literature and many of the models for incorporating diverse perspectives in science-policy debates are concerned with – Collins and Evans included – is what Mol (2002) calls "a politics of who" (166). A politics of who focuses on, perhaps unsurprisingly, who questions, i.e. who is, or should be, in a position to decide? Concerned about the consequences of unlimited inclusion, Collins and Evans propose one way forward for answering the question of who should be at the decision-making table – experience and expertise. Recognizing that there is more to science and technology expertise than solely what certified experts can provide, Collins and Evans suggest that the who at the STEM policy table should include experience-based experts. They (2002) begin by developing a four-part classification of expertise as a starting point for assessing which fields of experience are legitimate or relevant: 1) no expertise, 2) interactional, 3) contributory, and 4) referred. "No expertise" is important to note

given Collins and Evans' interest in demarcating experts from non-experts. However, with the more exhaustive treatment of expertise in later articles, some of what might have originally be placed in the "no expertise" category by default would now be classified differently. Interactional expertise entails having enough expertise to "interact interestingly with participants" (254). For example, the scientists in Wynne's well-known study of the Cumbrian sheep farmers needed (but did not have) interactional expertise to work productively with and take in the farmers' expertise. If one has enough expertise "to contribute to the science of the field being analyzed," this is considered contributory expertise (254). Lastly, referred experts, or those who have "expertise at one remove," are those who are able to apply their expertise in one field to another (257). Referred expertise refers to experience brought from another field and indirectly applicable to the technical question at hand. Collins and Evans compare this category of expertise to the experience of having "referred pain in a leg as a result of a back injury" (257). I will expand in greater detail on these definitions momentarily.

In *Rethinking Expertise* (2007), Collins and Evans expand on this model by developing the Periodic Table of Expertises (PTE). The PTE is an attempt to classify all the kinds of expertises that might be brought to bear on a technical problem (See Figure 2). As part of the PTE expansion, Collins and Evans include several major additions. One key idea underpinning this expansion is tacit knowledge, which is socially or collectively held and gained by interaction with members of the particular community. This also begins to hint at the distinction Collins and Evans draw between analyzing expertise at an individual versus a collective level. As part of their continuing efforts to prove that expertise is not necessarily limited to rare, esoteric individuals, the PTE most prominently includes multiple additions to the original four-part taxonomy. Ubiquitous expertises (such as langauge fluency, how close to walk to someone on

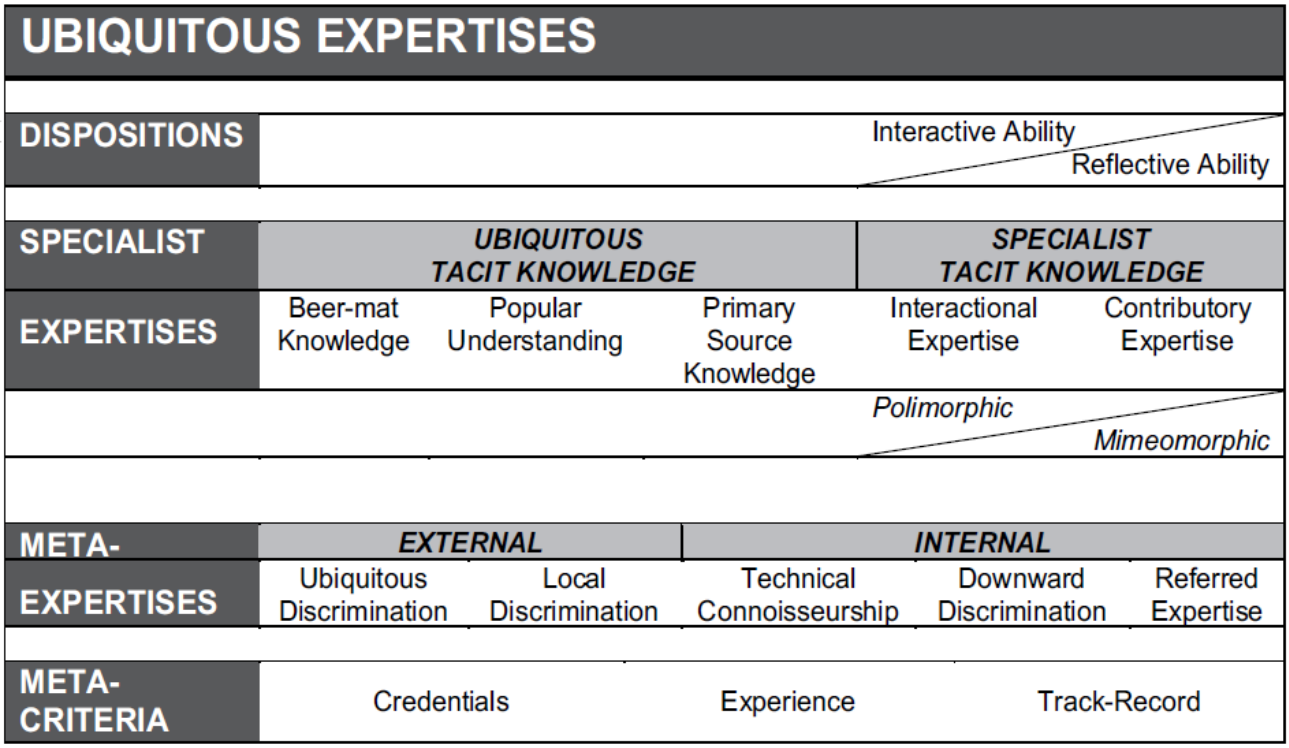


Figure 2: The Periodic Table of Expertises (Collins and Evans, 2007, p. 14).

the sidewalk, and moral understandings) are acquired by all members of human societies in the course of normal enculturation. Dispositions play a role in converting latent interactional expertise into realized interactional expertise. Specialist expertises are at the heart of the PTE, ranging from low (i.e., no contact with specialist community) to high levels of expertise (i.e., close interaction with specialist community). This indexing of expertise to the contributory expert is, I argue, problematic. Finally, the meta-expertises and meta-criteria are used for evaluating other experts or claims to expertise.

While Collins and Evans' emphasis on making room for diverse kinds of experts is valuable, the apparent focus on a politics of who can still be considered problematic. According to Mol, the trouble with a politics of who is: 1) it overemphasizes creating space for other voices without considering what those voices might say if they did get the space, which often configures the marginalized wills as "set, predetermined, and clear," 2) it isolates decision-making moments

from the practices that have been producing them, and 3) it pushes the "power of professionals back," claiming more choices for the publics while limiting professionals to an artificial divide between fact and value (169-171). Instead, Mol proposes a politics of what, which is concerned not with the differences between experts and non-experts, or in Mol's case, doctors and patients, but with the different enactments of the thing in question: "different enactments of disease entail different ontologies. They each do disease differently. But they also come with different ways of doing the good" (176). From this vantage, "not going primarily with a politics of who but stressing the necessity of a politics of what helps to open up the professional domain instead of pushing it back" (Mol, 2002, p. 184). Given their manifest desire to articulate a rationale for using the advice of scientists and technologists (instead of just pushing them back), Collins and Evans' work might be productively shifted by a focus on a politics of what, and therefore, a focus on practices and doing.

Though they do not frame it as such (and likely do not intend it), Collins and Evans' description of their normative model of expertise is laced with the ontological. Namely, their discussion, particularly of their twin key terms, experience and expertise, hints at the practices and doings that are the bread and butter of multiple ontologies, practices and doings that give rise to the very epistemologies and ways of knowing highlighted by Collins and Evans in their taxonomy of expertise. Opening their discussion of categories of expertise, Collins and Evans (2002) "start, then, with ourselves and our practices…," applying their model to sociologists for a familiar example (254). Distinguishing between the first and third waves of science studies, the authors note that "knowledge and truth are grounded in scientific procedures; expertise is most often grounded in experience" (250). Much like the earlier reference to Graham's case for a praxiography of representational practice, knowledge is, here, rooted in practice. For Collins and

Evans, the rationale for using the advice of scientists and technologists is also rooted in practice, "in virtue of the things they *do* as scientists and technologists" (emphasis mine, 236). It is their doings that warrant their inclusion in decision making. Arguing for scientists' place in the core technical decision-making group, Collins and Evans emphasize their value as people "who have actually *done* relevant experiments…the core-scientists' special position, apart from their possession of specialist equipment, arises from their long experience …" (260, emphasis mine). Indeed, as Collins and Evans note, the term experience-based expertise, in this situation, refers to specialist abilities (238).

Of course, Collins and Evans are not only concerned with the place of scientists. Revisiting Wynne's discussion of the Cumbrian sheep farmers, Collins and Evans note the contributory expertise that the farmers possess. This expertise comes not from credentials but from their experiences and practices as farmers: "Those who actually do it (who have contributory expertise) might have more relative merit as judges of scientific value than critics" (244). Again, in their differentiation between political and technical spheres of decision making, Collins and Evans argue that technical decision-making rights are meritocratic (262). In other words, inclusion is based on what has been *done*.

Similarly, I propose that the types of expertise put forth by Collins and Evans are better understood as distinct ontologies. As Collins and Evans rightly note, expertise is multiple. However, these expertises are not simply different perspectives but different ways of doing and practicing expertise. And it is from these practices that experts derive credibility, experience, and knowledge. In other words, what experts know is based in what they do (or don't do). A closer examination of Collins and Evans' descriptions of expertise shows invocations of experience and practices. Interestingly, very rarely do Collins and Evans comment on what knowledge each

class of experts should possess; rather, as I will show, they identify experts by what they can do or how those particular types of experts would behave or act.

Contributory Ontology

The contributory ontology is described as being able to contribute to the field. In other words, this way of doing expertise entails specific, skilled participation in the domain of their expertise. More than simply theorizing, contribution occurs through practices such as writing papers, presenting at conferences, running and reporting on experiments, and building new instruments. An expert staging this ontology is distinguished by his or her technical abilities and practices, his or her ability to do a particular kind of science. Collins and Evans' understanding of this expertise has remained relatively stable across their publications; they describe it as "the standard meaning of technical expertise" (2015, p. 105). Collins and Evans further claim that all contributory experts are also interactional experts (because they have mastered both the language and the practices of the domain), though potentially only latently depending on their reflective and interactive abilities as I will discuss below.

Interactional Ontology

The interactional ontology is first described as interacting interestingly with participants in the 2002 article, a treatment that Collins and Evans (2015) later call superficial. This definition is something they continue to elaborate on many times over in their various publications. Collins (2004) describes it in more detail as the ability to converse expertly about a practical skill or expertise without being able to practice it. It is "developed through linguistic interaction without full scale practical immersion in a culture" (Collins, Evans, Ribero, & Hall, 2006). In other words, learning a language in order to facilitate interaction. Examples include sociologists (such as Collins himself while doing fieldwork with gravitational wave physicists),

ethnographers, peer reviewers, high-level journalists, non-player sports coaches, and a specific case of AIDS treatment activists. These experts have no access to the material culture of a domain except as represented in discourse (Collins, Evans, & Gorman, 2007). While this particular ontology may initially appear to be the most heavily language-based, as noted by Collins and Evans (2002, 2007), a step back will show that this language and discourse is grounded in practice. Or rather, it is a practice, as even Collins and Evans recognize on occasion: "Indeed, wherever readers see the word 'language' they should understand something like 'linguistic practice'" (Collins & Evans, 2015; see also Collins, 2011; Collins & Evans, 2017). But even more so, in addition to knowing the linguistic practices of a domain of contributory expertise, an expert staging an interactive ontology is also engaging in various practices needed to occupy such a position and acquire that linguistic knowledge in the first place. Effective interactional expertise requires a deep familiarity and level of access, which requires its own kind of practices to achieve.

As mentioned above, Collins and Evans claim that interactional expertise can be latent or realized. The difference, they say, depends on one's interactive and reflective abilities, which includes a variety of skills and ways of being or interacting with others (human and non-human), including such practices as active listening, turn-taking, collaborating, delegating/directing, relationship-building, and conflict management. In other words, someone with contributory expertise could learn to become more articulate (a skill that is generalized across domain areas), thus enabling him or her to better express the content/domain knowledge s/he already possesses. This latent/realized distinction is important for Collins and Evans' model because of the language/practice divide that sets contributory expertise apart as well as their overall indexing of all expertises to contributory expertise. But, particularly under a practice-based model, this

distinction between latent and realized becomes irrelevant. The abilities that Collins and Evans describe, even if they are not specific to one contributory expertise domain, are integral to actually practicing an interactional ontology. There is no interactional expertise if one cannot actually interact interestingly. Thus, for my purposes moving forward, when I speak of interactional expertise, I am only referring to what Collins and Evans have called "realized."

Referred Ontology

The referred ontology is described as being able to indirectly apply contributory expertise from one domain to another. Later classified as a meta-expertise in the PTE, referred expertise involves judging between competing expertises and experts, an ability that is predicated on earlier experiences or work on projects of a similar kind but with different technical contents. Staged by the practices of transfer or coordination, Collins and Evans compare this way of doing expertise to the work of managers or leaders of large scientific projects, who will not possess contributory expertise in all of the fields of science they must coordinate.[16] Referred expertise does not require that an expert have specific knowledge or even the specific technical abilities of the various sciences they are overseeing; rather, this ontology values "*experience of* contributory expertise in some related science" (2002, p. 257). This puts them in the position to understand what is involved in making a contribution to the fields of the experts they are leading at one remove, so to speak. For example, they may know how much to discount technical arguments because they will have seen seemingly incontestable arguments turn out to be contestable (2007, p. 66). In this ontology, where the technical contents are not shared, it is most clear that what transfers (and thus what marks this ontology) is practice.

[16] See the appendix in Collins and Sanders (2007) for a non-science example of referred expertise – the case of the plumber.

It is worth noting that while I am excited about the possibilities of bringing multiple ontology theory to bear on questions of expertise, I also want to proceed cautiously. To apply "doing" as a flat, all-encompassing term could lead us back to the problem of extension (i.e., the flattening of expertise and the problem of too much democracy discussed earlier), only through a performative doorway. Are all patterns of doing ontological practices? And can any practice constitute expertise? After arguing for the existence of experience-based expertise, Collins and Evans (2002) recognize that "experience, however, cannot be the defining criterion of expertise. It may be necessary to have experience in order to have experience-based expertise, but it is not sufficient" (251). I would agree that not all experiences (or doings) can be used to claim expertise. This only further highlights the need for practical methods for evaluating claims to expertise, a need that Collins and Evans (2003) acknowledge is unmet by their original taxonomy, though they later attempt to provide some possibilities for doing so (Collins & Evans, 2007; Collins & Weinel, 2011). As I will discuss in the following sections as I apply an expertise of doing to the L'Aquila case, the performative orientation of multiple ontologies offers some possibilities for regulating what counts as practice-based expertise in science-policy deliberation.

Enacting Expertise and Earthquakes

Referring to communication about seismic activity, Thomas Jordan, director of the Southern California Earthquake Center at the University of Southern California in Los Angeles and chair of the International Commission on Earthquake Forecasting for Civil Protection (ICEF), which reviewed the L'Aquila events in a report released in 2011, said, "It has to be *done* right, and it was not in L'Aquila" (Hall, 2011, p. 267, emphasis mine). Jordan's comment, though perhaps not intentionally, highlights the doing or the practices involved in this controversy, rather than what was said. But who does (or should do) the doing? And what does

the doing depend on? According to Mol's theory of multiple ontologies, "events are made to happen by several people and lots of things" (25). In the case of L'Aquila, the 2009 earthquake is in fact different earthquakes because each stakeholder (i.e. Giuliani, scientists, government officials, the Aquilani) has different, site-specific ways of doing earthquakes. Language is a part of that, but it is not the only part. As Graham and Herndl point out, the revised "where" question includes the original "what" query, implying that "patterns of talk are informed by patterns of practice" (14). In other words, communication is shaped by practice. A more complete picture of the controversy in L'Aquila can be obtained by considering the practices that shape the discourse and the available expertises.

That said, as Collins and Evans so carefully emphasize, the valuable work of description and deconstruction are not enough. Scholars also need to work upstream, to use Collins and Evans' term. To this end, I suggest applying an expertise of doing model to L'Aquila, a decision-making scenario whose global controversy and noise suggests that it may have been done wrong. What might such an approach mean for issues of expertise? Does an expertise of doing add anything useful to the conversations encircling L'Aquila? What could such a model suggest about how to reconfigure long-standing problems of expertise and inclusion in scientific, technical, and health policy disputes? Novel problems may require input from different assemblages of technical and experiential domains. Without procedures for effectively assessing relevant and necessary expertises for a particular situation, debate and decision making will, more than likely, default to the traditional pantheon of experts, and novel data and modes of thinking may be overlooked at great cost. While it is not my intention to level a value judgment about *who* should have been included in the decision-making process surrounding the 2009 earthquake, I am confident in recommending the establishment of better—clear and

transparent—procedures for evaluating issues of expertise and inclusion. However, I differentiate this from pre-established inclusion criteria. The CGR and other similar organizations devoted to managing risk and informing the public may well benefit from pre-established inclusion *management* procedures, which, in turn, can provide guidance about who should or should not be included. Indeed, such revisions to the decision-making process seem to be both a necessary response to the human loss suffered at L'Aquila and a necessary step towards saving future lives.

While I acknowledge that an emphasis on an expertise of doing works particularly well in moments of criticism about past events, such a model can also be productive for future, as-of-yet-to-occur crises. As I will discuss shortly, an understanding of expertise as practice-based includes accounting for social practices, such as deliberation. In this sense, an expertise of doing functions less as an analytical heuristic for past crises and more as a guide for developing and/or revising inclusion management procedures that can be set in place in advance of potential crises.

An "Expertise of Doing" Applied

The L'Aquila earthquake and its ensuing controversy has played out in a wide range of discursive settings which have included a scientific commission, an indictment hearing, a trial, an appeals process, the popular press, the blogosphere, and the epistolary work of scientific organizations like the AAAS. A thorough accounting of the entire L'Aquila earthquake controversy would require far more space than is available in a single chapter. As such I will confine my analysis of expertise to the primary cluster of decision-making events surrounding the earthquake – the 31 March 2009 Emergency Meeting of the CGR and subsequent press conference.

As I described earlier in this chapter, Collins and Evans, even in their first iteration of a normative model of expertise, emphasize two spheres of decision making – the technical and

political. Being able to identify which kind of decision making is happening is important in their scheme because it dictates several facets about how the decision making occurs, including what expertises are relevant and who should be included. This aspect of their model is a well-meaning attempt to curtail the problem of extension; however, it is an ideal division. Many decision making situations, not least of all matters of concern, are not (and cannot be) so neatly divided into technical and political decision making. The emergency CGR meeting provides one such example of how the technical and political are often more muddled, a point I will demonstrate in more detail in the following chapter.

The primary exigencies for the emergency meeting of the CGR revolve around the activity of one local personality—Giampaolo Giuliani. Though Giuliani is not invited to or included in the meeting, his claims to contributory expertise are interrogated and responded to by those at the meeting. As stated earlier, this exigency is initially masked by technical questions about seismic activity. A self-proclaimed expert, Giuliani clearly sees himself as having contributory expertise. He is self-published on topics relating to earthquake prediction models and has been invited to speak formally to other geologists about his methods. For him, seismic activity is enacted through his four homemade radon detectors. In other words, when materiality and practices are foregrounded, the visibility of seismic activity is dependent on the radon detectors (and, the website that displays the real-time measurements, for that matter). In the weeks preceding 6 April 2009, the radon detectors measured increases in radon gas levels, which informed Giuliani's predictions. Here, the earthquake was enacted as increased levels of radon gas. While these methods are contested (and even rejected) by many in the geologic community, Giuliani is engaging in scientific practices and processes. Taking into consideration the strong skepticism of other seismologists about Giuliani's status as a contributory expert, it may be more

plausible that he demonstrates referred expertise. His ability to conduct radon measuring experiments seems to speak to the transfer of laboratory skills and other experience running experiments (though in the context of particle and astrophysics) in keeping with the definition of this type of ontology.

Approaching expertise more broadly, as practice-based, not only makes room for but also requires evaluation of claims to expertise such as Giuliani's. He clearly engages in a unique set of practices, which may or may not warrant his inclusion. Indeed, his very public predictions force the question of legitimacy. Removing certified knowledge as the basis for identifying necessary expertises (and thus potentially opening wide the doors to include any and all) has troubled many scholars, including Collins and Evans. Indeed, questions of who is right and wrong may seem to grow quite muddled in light of a practice-based approach to expertise.

However, this concern about unlimited inclusion (and the loss of the ability to accuse others of being flat wrong about technical matters) can be mediated by drawing on the dual facets of practice-based expertise. As Zoltan Majdik and William Keith (2011) argue, enacting expertise as practice involves both individual, material practices, (i.e., regular enactment of skills, knowledge, and/or behaviors) and social ones (i.e. deliberation, evaluation, validation, acceptance) (278). In other words, individual practices alone are not sufficient to endorse a claim to expertise or inclusion. Social agreement, and the ability to "articulate reasons for – thus operating under a requirement to socially validate and legitimize – an individual's enactment of expertise" are necessary (Majdik & Keith, 2011, p. 279).[17] Keith and Majdik (2011) further elaborate this point, proposing that expertise can be understood as expert argumentation, in the

[17] While Majdik and Keith's point is well-taken, the question remains, however, to whom should this be articulated?

"ability to make a case for a particular definition of problem or solution" (374). An expertise of doing, then, includes a discursive-material element that distinguishes between experts and others.

In her discussion of manufactured controversies, Ceccarelli (2011) provides further support for the importance of deliberation. She argues that outright dismissal of, say, climate change deniers, is doubly harmful to technical experts because it concedes the debate and confirms any charges of the close-mindedness of expert groups. A more promising strategy, she suggests, is to enact more deliberative practices – engage the opponent's claims but, after refuting the most critical charges, shift the deliberation 'from questions of fact, definition, and cause to the questions of value and policy that are the driving force behind the public debate' (217). Instead of competing for scientific expertise, participants become fellow citizens debating policy.

Deliberation has long been held to be a strengthening, valued feature of democratic practices, but little, if any, such deliberation over necessary expertises occurred in L'Aquila. The technocratic deployment of the CGR as a censoring and exclusionary tactic is a drastically different way of adjudicating Giuliani's implicit claims to expertise. Giuliani's case exemplifies the need for and importance of a linguistic layer for evaluation of the legitimacy of practices and determining which expertises are necessary.

While there is much debate surrounding the function Giuliani should be allowed to play, the most clear-cut example, perhaps, of contributory ontologies is the seismologists and geophysicists of the CGR. Given the technical questions about seismic activity and the feasibility of prediction practices at hand, it is unsurprising to find such traditional contributory expertises at the emergency meeting. Instead of fluctuating gas emissions, the scientists enact seismic activity as releases of energy, measured in magnitudes, and peak ground acceleration, measured

by local ground movement, as clusters, swarms, and temblors. Their ontologies make earthquakes visible through maps, charts, and graphs, which synthesize the data collected by various monitoring tools (e.g., creepmeters, tiltmeters, strainmeters, modeling software, satellite images, and seismometers). Seismic activity is a matter of measurements, statistics, and probability. The INGV, through their map of earthquake hazard, enacts earthquakes through color. The darker the color (i.e., blues, purples), the more doing of earthquakes. It was to these practices of mapping, charting, and graphing that the scientists at the CGR meeting pointed when discussing the potential existence of an earthquake. In fact, the first CGR speaker immediately presented a list of recorded magnitudes of recent L'Aquila shocks (Commission 2).

In addition to the geologists, the CGR also included three members with engineering backgrounds (seismic, civil, and hydraulic). Depending on the technical question at hand, the role of these men shift. On the one hand, as practicing or trained engineers, they can offer contributory expertise if the question is, for example, one of structural soundness or building safety in light of seismic activity. But they do not necessarily have the contributory expertise to answer questions about the nature of earthquakes or earthquake forecasting, the likes of which were a central focus of the emergency meeting. In such instances, they could, however, function as referred experts. While the degree of difference or separation may vary by case and subspecialty, the purposes and technical content of engineering are necessarily different from geology. Whereas scientists' work is often about discovering, engineers' emphasis is generally on designing or solving a specific problem. Engineers do not necessarily work to discover the mechanisms of a particular process, but they certainly work to discover how to account for or counter them. Indeed, because the work of engineering often requires one to integrate knowledge from many scientific disciplines, it is highly plausible that engineers could and do learn about

and interact interestingly with scientists such as geologists. Additionally, whereas geologists work within a geologic conception of time, engineers must account for and work within human time scales. But, like geologists, they deploy similar kinds of skills and practices in their work on projects of a similar kind. And, perhaps most important to being a referred expert, these CGR engineers have the experience of contributory expertise in subspecialties that are neighbor to the earth sciences.

These shared practices shaped what and how the scientists (and engineers) communicated about L'Aquila's seismic activity. The earthquake was enacted through practices generally purported to be objective ways of knowing – scientifically-tested methods of data collection, number-crunching statistics, measurement tools.[18] Sticking to their particular strain of contributory expertise, the scientists functioned as reporters of these observations and facts, making objective statements and passing the information on to the government officials. The noted uncertainty in their language may also be a reflection of the statistics and probabilities they use to know earthquakes. Shaped by their ontologies, the scientists were not particularly in a position to make clear-cut answers or predictions, much less policy decisions.

Removed from the contributory ontologies of the scientists, the members of the DPC involved in the L'Aquila controversy do earthquakes in a different way. Earthquakes, for the DPC, mean private meetings, telephone calls, and enacting pre-set risk communication

[18] With the rise of experimental science in the 17th century, scientists' authority and credibility was built on being unbiased, rational, and invisible, a practice that Donna Haraway (1997) calls being a modest witness. Science was done by mirroring reality, and scientists acted as "authorized ventriloquists for the object world" (Haraway 23). Through the 19th century, the dominant model of science's work was linear; science was to discover how nature worked and then hand it off to the civic arena. Following the science-related horrors of WWII (e.g., atomic bomb, eugenics), this division of labor, and its implied separation of fact from value, was further reinforced (Walsh 36-38). Though much STS and rhetoric of science scholarship has demonstrated that science and scientists are not objective, removed witnesses, this is still a practice the discipline strives for and values. Such a disciplinary practice would certainly have shaped, and potentially constricted, the ways in which the scientists of the L'Aquila Seven responded.

procedures; it also means holding public press conferences. Bertolaso, head of the DPC, described the earthquake to Stati, a regional official, as "a public relations event," a phrase that both capture the doing present (i.e. event) and the relational nature of the doing (Caporale, 2012). Here, earthquakes are enacted as announcements, official warnings, press releases, and "policy responses" (Commission, 2009, p. 4). They are also, for government officials, done as risk assessments. Earthquakes are particular kinds of calculations (economic, ethical, logistical, political, etc.), estimations, and probabilities. They are costs. Indeed, earthquakes done as emotional, financial, or political costs could explain why the DPC was so invested in reassuring or calming the public. What these practices indicate is that, when it comes to matters of policy or risk management, the DPC could be considered to have contributory expertise. But in a technical conversation about earthquake science, like in the emergency CGR meeting, they do not.

Whereas the scientists' particular contributory ontologies tend to relegate them to the technical matters, the DPC members are generally admitted to both technical and political arenas. The governmental officials, from both regional and national levels, are located in multiple spaces. They have access to the scientific practices and technical conversations, but they also are located in a public/political arena that enacts earthquakes differently. They move among the primary stakeholders, which indicates that they, to a certain degree, experience earthquakes in shared ways with the other stakeholders. But their movement is also a particular way of doing. The practice of bringing technical content about earthquakes into the context of public policy ultimately rests with the DPC. In theory, all of these positions and practices suggest that the DPC would be the most likely site for interactional ontologies. I say likely because the reconstruction of the events and the ongoing controversy is evidence that interactional expertise was demonstrated by no one. This is most surprising for two men, de Bernardinis and Dolce, who

were both CGR and DPC members and thus most familiar with both groups and best positioned to interact interestingly. But, the DPC epically fails to communicate the scientific message of uncertainty to the Aquilani. That they did not satisfactorily resolve issues at the procedural level (hence the trial) may be due to their positions and practices not just as risk assessors or policy makers but also as spokespeople. For example, at press conferences, media correspondents often seek yes/no answers, simplified information, and sound bites as a result of how they enact earthquakes, thus shaping the communication.

A Seat at the Table?

Across the various spaces and events surrounding the L'Aquila earthquake, the residents of L'Aquila are, by in large, absent. Sometimes invoked, they are generally off-stage and limited to being receivers of technical and policy decisions. Indeed, the decision-making forums deployed in this case do not particularly make room for them at the table. Likewise, Collins and Evans caution against unfiltered inclusion. While not opposed to including lay persons with expertise, they are quite clear in their stance that just because some lay persons might gain expertise does not mean that they can be broadly considered experts. In all of this discussion of expertise and doing, the question of the public's role remains. What, if any, expertise might the citizens of L'Aquila have?

As I said at the beginning of this chapter, it is not my intention to level a value judgment about who should be included. And I am still slightly cautious about doing so for fear of going down the well-worn rabbit hole of Mol's politics of who. But I am hoping that by considering more specifically who should or should not have been given a seat at the table, it will allow for a broader reflection on the nature of the case itself and the rationale underpinning different configurations of inclusion.

Many have suggested that Giuliani should have been included at the decision-making table – or at least listened to – because he was "right." True, Giuliani's prediction did come to pass, but he was, arguably, more lucky than he was right. Reliable earthquake prediction, especially at the level of precision that Giuliani was operating at, is widely acknowledged by the scientific community as not presently possible. Moreover, if a criterion for inclusion is rightness, it would seem to be more of a return to epistemic grounds and concerns, not ontological, practiced-based ones. If we look to see who is right and who is wrong, I worry that the doings that lead to that rightness or wrongness would be obscured. By describing the case's primary question as a binary -- "Is there going to be an earthquake or is there not?" – L'Aquila is framed as a matter of fact. And as a matter of fact, Giuliani may be allowed in but the people of L'Aquila are, necessarily, excluded and deemed to have no pertinent expertise.

But as I have argued in Chapter 1, the L'Aquila controversy should not be construed as a matter of fact but as a matter of concern. Interpreting L'Aquila as a matter of concern authorizes certain responses or ways of handling the situation that are missed when it is treated as a matter of fact. As I will show in the next chapter, the deliberation in L'Aquila is not necessarily about epistemic issues rather than values. In short, I will show that fact and value may not be neatly separated but can be in dynamic, often nested relationships within the flow of debate. I argue that the CGR's attempts to purify and treat the situation as a matter of fact, rather than as a matter of concern, resulted in the ensuing and lengthy post-quake conflict.

When earthquakes are matters of fact, the questions and answers are more clear-cut – is there or isn't there going to be an earthquake? Both the international press and the CGR chose to, at least initially, frame the case in such a manner. Additionally, a retrospective analysis such as the one I have conducted here allows for an answer to be given to this question, which

contributes to the case's potential to appear "facty." Because the event in question happened, right and wrong have been determined. But, this looking backwards hides the messiness and uncertainty that was present in the decision-making moment. If an expertise of doing were applied in a forward-facing situation (for example, at the time of the deliberations in L'Aquila), uncertainty would still be reigning. To be sure, the fault would eventually slip but when and to what degree would remain unknown. This kind of uncertainty is likely to remain as, unlike meteorology for example, seismology does not study events that repeat on a human scale against which to develop predictions of the future. Even more so, the geologic timescale ensures that the future is not particularly accessible. This is not to say that there is no benefit in retrospective analyses to help assess the decision making that occurred for better or for worse; rather, there seems to be a great need and value in identifying strategies and methods that will work in the kairotic moment. Particularly if the goal is to save lives, being able to assess issues of inclusion and expertise while in the depths of uncertainty, not just after the fact, seems to be key. The failure to do so in the case of L'Aquila emphasizes the challenge of determining relevant expertise in a timely manner in an ever-changing context.

L'Aquila is categorically different from other cases that deal in uncertainty, such as environmental policy. Just as there are different kinds of doings, value and uncertainty are not flat terms either. These may be additional elements to consider if trying to develop normative action or principles of rarefaction. When dealing with questions of inclusion, Collins and Evans (2002) similarly note the need to distinguishing between types of science as well as types of expertise. In their schema, seismology would be classified as a historical science, in which the scientific input is uncertain and unlikely to become more so any time soon. As the testimonies and statements of various geologic organizations attest, when it comes to questions of earthquake

forecasting and prediction, there is no foreseeable resolution or consensus on these matters in the near future. Seismologists study unique historical trends that are embedded in systems that are too complicated to model accurately and "may even be impossible to predict accurately because of the working of chaotic processes" (Collins & Evans, 2002, p. 268). For Collins and Evans, an environmental issue such as climate change is one step removed, classified as a reflexive historical science, where the potential for uncertainty is even greater because the long term outcomes are affected by humans.

Despite these differences, in the case of both earthquakes and climate change, the science is not certain and not likely to become certain soon. Consequently, Collins and Evans argue that in such instances political and social input should be given more importance in deliberation. So, if the L'Aquila case is approached as a matter of concern that deals with uncertain scientific input, an argument can be made for the inclusion (and more direct representation) of the Aquilani at the table. Here, too, Giuliani, as a member of the public sphere may have grounds for inclusion.

But the reasons to include the Aquilani might be more than that. In addition to being members of the public, the residents of L'Aquila also have an embodied expertise that is rooted in their doings and practices. As theories of embodiment stress, location, space, and materiality matter. In the context of expertise, this is clearly demonstrated in works such as Brian Wynne's (1989) now-canonical exploration of the Cumbrian sheep farmers or Beverly Sauer's (2002) analysis of risk, mine safety, and the embodied expertise of miners. Similarly, but with an ontological twist, Teston et al's (2014) study of the FDA's Avastin hearing suggests that inclusion "should be decided upon participants' experiences based in practices. Such an eligibility requirement surfaces the legitimacy of experiences had by more than those who run

randomized clinical trials" (166). In short, they recognize the lived experiences of patients (and other public voices).

Like the Avastin cancer patients, the residents of L'Aquila have an embodied experience of their "disease." The doing of the earthquake was very different for the people living in L'Aquila as compared to the scientists who were located in Rome. For the Aquilani, removed from the measurements and data of the scientists and the bureaucracy of the government officials, earthquakes are enacted in a physical way.[19] Though speaking broadly, Brian Wynne (1992) explains that "…public experiences of risk, risk communication or any other scientific information is never, and can never be, a purely intellectual process, about the reception of knowledge *per se*" (281). Earthquakes are tangible and felt – in the shaking, the damage, and the disruption of daily life. Certainly, of all the stakeholders in this controversy, the Aquilani physically experienced these (and past) seismic sequences, from early tremors to the final quake. When interviewed about the earthquake, L'Aquila local Pier Paolo Visione literally enacts it: "…shaking a table in a restaurant with a slow but vigorous motion that nearly topples a bottle of the local red Montepulciano wine," noting that his '"skin began to crawl"' (Hall, 2011, p. 267). Here, in the historic town, the earthquake was made known by "bells ringing and clocks striking, and…fresh chasms in the old yellow walls" (Hall, 2011, p. 267). For local resident Vincenzo Vittorini, it was "a gigantic noise. And then darkness" (Hall, 2011, p. 267). Moreover, the earthquake was staged through what it left behind – reconstruction, continued disruption, injury, and death.

[19] It is important to note that while the public experiences, to varying degrees, the different practices of the scientists and government officials, the scientists and government officials also share in some ways the practices of the public, for they are also citizens and residents. In the case of L'Aquila, this commonality is not as strong; the CGR scientists are mostly from Rome, the government officials vary. Nevertheless, here I am referring to the L'Aquila public and their site-specific practices.

These ways of doing earthquakes correlate with the concerns of the Aquilani. Considering the very physical aspect of enacting earthquakes for the residents, an enactment which directly impacted their lives and well-being, it is unsurprising that they would seek advice and answers to questions of action. If buildings are shaking and walls are cracking, whether one wants to discuss definitional questions or not, the very material aspect of this situation means that qualitative and procedural issues would have to be addressed. Indeed, these are the issues which the public cites as being mishandled in the legal case they bring against the CRG members, the only real venue in which they are granted active involvement.

The experience of seismic activity is personal, but it is also cultural, passed down, and refined through the generations. Given L'Aquila's specific location along Italy's fault lines, its residents, unsurprisingly, have a culture of doing earthquakes. Traditionally, the practice was to leave the house and spend the night outside sleeping in cars or staying up in the piazza. Now, more and more people stay inside and turn to watching the television and listening to authorities, a practice some people said resulted in increased deaths and should never have replaced older ways of doing (Hall, 2011). Acknowledging this passed down, lived experience of earthquakes, it could be argued that the Aquilani do, in fact, have some kind of expertise. Collins and Evans (2002) acknowledge that "local knowledge is a kind of expertise because local people can be said to have long experience of the local environment" (267). In other words, the residents of L'Aquila could be said to derive expertise from their site-specific practices and experiences.

As I have said earlier, I agree with Collins and Evans that not all experience can be used to claim an experience-based expertise. According to Collins and Evans (2002), for experience to be linked to a claim for expertise, it cannot be something that "anyone could master…immediately without practice," and it should not be on the fringe or discontinuous with

the core-set's expertise (251). Applying these conditions to the case, the Aquilani's experiences living with earthquakes and seismic risk fit both criteria while Giuliani becomes excluded by the fringe status of his methods. Maybe we shouldn't call what the residents of L'Aquila have and do expertise. But it is something to be recognized and, especially in the context of a matter of concern, would be valuable to have at the table. Compared to the expertises of the CGR and DPC, the L'Aquila residents have an expertise that was not otherwise included in these particular science-policy deliberations, an expertise that might have impacted both the deliberations and decisions surrounding the L'Aquila earthquake. Whether or not the L'Aquila public are accepted as having pertinent expertise, the issues that are raised by this scenario are not necessarily the adding of more seats to the table; rather, this scenario highlights the challenge of determining relevant expertise in a timely manner in an ever-changing science-policy context as well as how science-policy decision making should be *done.*

Who But Also How

Banal though it may seem, what this doing-based analysis of expertise makes abundantly clear is that people are complicated. They cannot simply be forced into categories. Particularly in science-policy decision-making scenarios in which the political, technical, social, and material concerns cannot be purified, stakeholders' ontologies will also blur. As Mol emphasizes, people move among sites of practice, thus enacting different ontologies. Take, for example, the case of Bernardo de Bernardinis, one of the L'Aquila Seven. If the matter at hand concerns the safety of bridges or dams in the context of seismic activity, then de Bernardinis, as a hydraulic engineer, may have contributory expertise. However, if the matter pertains to earthquake forecasting, he would have referred expertise. But, de Bernardinis, as a member of the DPC, could also be considered to have contributory expertise if the topic of discussion is one

of public policy or risk communication. Not only are people difficult to categorize, as de Bernardinis' case demonstrates, but there will also always be competing allegiances. When de Bernardinis speaks, one has to wonder about which role he is functioning in and how he can marry the sometimes competing interests and practices of the various groups he is member to. However, de Bernardinis is far from being the only example of this complexity across the members of the CGR. As this approach to doing expertise shows, a clear separation between experts and non-experts is replaced by a layering of practices and a range of functions.

As an idea or a model, the CGR is generally a good one. As one possible format for science-policy deliberation, it got a lot of the right kinds of people to the table. And, as the previous analysis shows, it also recruited a range of expertises. While good in theory, the CGR as a practice, evidenced by the L'Aquila controversy, seems to be malfunctioning. As the wiretap and conflicting meeting purposes suggest, the emergency meeting of the CGR was deployed as a method of technocratic exclusion. While this targeted exclusion would naturally raise concerns for many STS and RSTM scholars, it is particularly troubling when approaching the case as a matter of concern. Along with certified and experience-based experts, the inclusion of publics and their practices and concerns is especially necessary in these cases of scientific uncertainty for satisfying, successful decision making (Collins & Evans, 2002, p. 269). Additionally, such inclusion can also be crucial to protecting human lives and minimizing the impact of hazards (Sauer, 2002; Wynne, 1989). And yet, as the previous analysis shows, this inclusion was not necessarily the case for L'Aquila. The CGR as a practice is broken, but the patch is not simply revising who is included. Indeed, specifying exactly who should be included is not possible because each case and problem will be unique and thus will require specific deliberative practices to evaluate what expertises are necessary to resolve the problem at hand. Though their

general absence in the L'Aquila controversy is certainly concerning, the addition of lay voices is not necessarily the solution. Rather, the way forward seems to rest with how.

A more productive line of inquiry might be to examine how science-policy decision making is conducted rather than remaining focused only on who should be present. As Mol suggests, we need to "stop shifting the boundaries between patient and expert and look for new ways of governing the territory together" (171). Analyzing the technocratic deployment of the CGR from an expertise of doing places emphasis on what is happening; multiple ontologies allows for the mapping of the layered practices while a normative model allows for upstream intervention. Such mapping can show which practices or expertises are at play as well as what is absent. What is most notably lacking in the case of L'Aquila is interactional expertise. Generally associated with practices of mediation, Collins and Evans describe international expertise as interacting interestingly with participants. Possible examples of job positions that are likely to enact this expertise include managers of large corporations, social science researchers, journalists, and technical communicators. In other words, effective interactional expertise hinges on being truly familiar with the discourse, content, and practices of participants in order to facilitate communication and the task at hand.

In complex science-policy scenarios such as L'Aquila, which necessarily require unique configurations of multiple and varied expertises and stakeholders, interactive expertise is crucial. The fallout from the emergency CGR meeting implies that not only was some form of interactional expertise missing but it was desperately needed. What the case of L'Aquila suggests, both in the passing of information from CGR to DPC and from DPC to the Aquilani, is that science-policy decision making is not just about who is present and talking. There are a series of mediations that need to happen in order for reality to hang together across multiple sites

of practice, which indicates the very important function that interactional expertise plays. Based on their positions as straddlers of the technical and public, politicians or civil servants like the DPC members could be likely candidates for interactional expertise. But, as de Bernardinis's falsely reassuring message indicates, this is not necessarily the case. Interactional expertise may not directly correlate with job title, but it may also be that political objectives were an influencing factor. If, in cases of scientific uncertainty, the political and the social are warranted more inclusion, an expertise of doing suggests that there may be a need for a mediator whose explicit task would be the facilitation of communication across various ways of doing. Such a mediator might also be well positioned to facilitate the successful inclusion of previously excluded ontologies and stakeholders, like the Aquilani, in the deliberative process. And, in the specific case of the L'Aquila controversy, interactive expertise could have helped the CGR and DPC conduct a press conference that would have been more useful to the people. Even if the CGR could not predict with certainty that an earthquake was imminent, it would still have been important for the Aquilani to have a sense of the likelihood of the event. The DPC statements represented the risk as zero, which prevented the Aquilani from weighing the scientific picture against their own practices and values. In short, the DPC made the decision for them.

As any seismologist will readily assert, earthquakes can neither be stopped nor predicted. Minimizing their impact requires communication among all stakeholders, a practice that begins with a decision-making process that puts greater value on interactional expertise. As compared to the contributory experts of the CGR, someone with interactional expertise is, arguably, better positioned to and more practiced at facilitating communication. In the case of L'Aquila, this could have meant a more clear representation of 1) the technical content – the possible risks and assessment of the situation and 2) the qualitative and procedural concerns of

the public, who face the material consequences of any decision making. Neither decision making nor the lived conditions and experiences of the people impacted by those decisions are necessarily improved by unlimited inclusion. Without interactional ontologies, the decision-making table will remain incomplete.

Chapter 3: Uncertain Deliberation

Just as matters of concern necessitate a reconsideration of who participates in deliberation, they also require a reconsideration of deliberative practices and the rhetorical tools used to account for them. Having examined some of the practices, specifically those pertaining to expertise, that shaped the events in L'Aquila in the previous chapter, I will now turn my attention more directly to the practice of discourse. As I mentioned earlier, much of the conversation about L'Aquila has been focused on words and miscommunication. And so it is to words, namely key communication breakdowns in the deliberation prior to the 2009 earthquake, that I now turn.

In the weeks and days preceding the tragic events of 6 April 2009, the authorities needed to find a way to a) adjudicate the available evidence, b) to assess the appropriateness of including Giuliani's predictions as part of that collection of evidence, c) ensure that the public needs (in terms of recommendations for action) were addressed, and d) determine how to effectively distribute that information from governmental agencies to the public. The overflow that transforms this case from a matter of fact into a matter of concern lies at the intersection between public requests for information and the available evidence. Indeed, a truism of research in STP is that public requests for information in the face of uncertain situations will exceed the available scientific evidence. As Wynne (1992) explains, "public experiences of risk, risk communication or any other scientific information is never, and can never be, a purely intellectual process, about the reception of knowledge *per se*" (281). Similarly, Callon, Lascoume, and Barthe (2009) have noted that "laypersons…are infinitely more demanding than specialists when they come across a problem which resists them, especially when it is an existential problem. Especially when it involves illness or death that seems to strike at random" (78).

The local residents who were interviewed by the media persistently requested guidance from governmental authorities: “All we wanted was clearer information on risks in order to make our choices” (Hall, 2011, p. 266). Vincenzo Vittorini, one of the local residents who was a party to the lawsuit, said his issue was not with “science” but with “a lack of specific advice” (Hall, 2011, p. 266). Indeed, in the trial following the earthquake, both the CGR and the Department of Civil Protection (DPC) were faulted for not discussing “what specific advice should be given to residents about what to do in the event of a major quake” and “failing to remind residents of earthquake preparedness procedures” (Hall, 2011, pp. 267-268). The Aquilani’s complaints reference a perceived failure to provide advice, specifically advice on what action to take. Unfortunately, while the deep uncertainty in L’Aquila may have warranted a more open, inclusive approach “where groups can come together to discuss technical options involving the collective,” what the Aquilani got was the CGR – and a corrupted version of the CGR at that (Callon, Lascoume, & Barthe, 2009, p. 18).

As I have suggested in previous discussion about the case, the DPC deployed the CGR as a technocratic method of exclusion, shutting out both Giuliani and the public, at great cost not only to the Aquilani but also to the CGR scientists who appear to have been co-opted, perhaps unwittingly, into this exclusionary agenda. However, these scientists are not entirely without blame. As my analysis will show, they were clearly complicit in attempts to purify matters of fact from matters of concern. The scientists and the politicians at the meeting insisted on treating seismic activity solely as a technical object, attempting to purify both the matters under consideration and the possible interlocutors.

In this chapter, I draw upon one of the primary analytic tools deployed in rhetorical investigations of science-policy deliberation – stasis theory. Originally deployed in courtrooms

and legal settings as a way to categorize the issues under debate, stasis doctrine has long been used to describe how issues take shape. Traditional stasis theory application comes with the side effect that complex and messy stasis moments are disentangled and purified into separate questions. This fails to account for the complexity and dynamism of deliberation under and about uncertainty, which is a hallmark of matters of concern. As I will show, the events of L'Aquila strongly suggest the need for a revised approach to stasis – in both rhetorical theory and deliberative practice – because traditional stasis doctrine fails to account for matters of concern and may have significantly contributed to the chain of events that ultimately led to the conviction of the L'Aquila Seven. Therefore, in this chapter, I employ a "functional" approach that will analyze the dynamic flow of issues in situ (Graham, 2015). The following investigation of the emergency meeting of scientists, civil servants, and politicians uses this functional stasis analysis to identify the primary breakdown in deliberation that ultimately led to a message of calm and reassurance immediately prior to the devastating earthquake. The results provide insights into not only the events in L'Aquila but also broader issues of risk, uncertainty, fact, and value in science-policy deliberation. While I must limit myself to one analytic tool, this approach to stasis theory aims to serve as a model to reflect on implications for broader issues of accounting for uncertainty in deliberation.

Perspectives on Uncertainty

Scholarship in RSTM and STS demonstrates a consistent interest in methods for dealing with or managing uncertainty. Indeed, from a classical perspective, rhetoric is inextricably bound to the contingent (Crick, 2014). Some approaches advocate settling or reducing technical uncertainties first as the best way to provide useful information to decision makers (Pielke, Sarewitz & Dilling, 2010). Here, uncertainty is treated as a gap in knowledge that can and should

be reduced to zero (or as close as possible). Such approaches, however, have been thoroughly critiqued in light of contemporary risks that involve irreducible uncertainties that are difficult to measure, extend across personal, political, and technical boundaries, and cannot be settled or contained before making decisions (Beck, 1999, 2009; Crick, 2014; Keranen, 2013; Pilkey & Pilkey-Jarvis, 2009; Prelli, 2013; Scott, Segal, & Keranen, 2013; Wynn & Walsh, 2013). A key extension of this work has been the recognition of a range of uncertainties in order to better account for them. For example, in their study of how an interdisciplinary pain management group dealt with uncertainty, Graham and Herndl (2013) suggest that uncertainty has multiple ontologies and epistemologies. Likewise, Walsh and Walker (2016) draw upon the work of Goodnight to offer a spheres model for tracing coherent accounts of multiple uncertainties as they travel from one context to another.

In response to calls for alternative approaches for making decisions within the context of persistent uncertainty, rhetoricians have argued that our field is uniquely positioned for this challenge. A rhetorical perspective and practice – with its concern for judgment and action – can support decision making in the contexts of uncertainty and risk, where certainty and prediction cannot be assured. By and large, rhetorical scholars have offered deliberative approaches, which support an understanding of context, the articulation of common interests, and coordinated action with stakeholders and decision makers throughout the process. Deliberation is the process of dialogue and decision making about uncertain matters, with the goal of coming to a broadly supported decision that will benefit the stakeholders in the future. As part of a deliberative approach, rhetoricians have argued for the necessity of developing scientific prudence. This ability to deliberate about particular, contingent matters while relying on practical experience and virtue, they argue, can help guide deliberation (Danisch, 2010; Grabill, 2007; Herndl &

Cutlip, 2013; Herndl & Graham, 2015; Keranen, 2008; Sauer, 2003; Scott, 2006; Simmons, 2007). However, these deliberative approaches also introduce problems of inclusion and power, as discussed in previous chapters (Ceccarelli, 2011; Collins & Evans, 2002; DeVasto, 2016; Latour 2004, 2009).

Recognizing the challenge of selecting relevant stakeholders but still favoring a deliberative approach, Callon, Lascoumes, and Barthe (2009) support distinguishing between situations of risk and situations of uncertainty. I will provide a more detailed explanation of this distinction momentarily, but, in short, they argue that uncertainty should be handled with a more open (though still somewhat constrained) approach. They contrast this with cases of risk, in which they advocate for a more technocratic approach. For instance, deliberation and decision-making about uncertain issues like climate change should be handled with greater deliberation – and would warrant greater inclusion – while issues such as vaccinations would warrant something more technocratic.

This distinction between risk and uncertainty is useful up to a point. But risk versus uncertainty as an easy line of demarcation fails. This is, in part, because of the increasing implementation of Bayesian modeling for addressing serious science-policy questions, the forecasting of earthquakes and associated potential hazards being one among many.[20] In actual

[20] There are two main opposing schools of statistical reasoning – the incumbent frequentist and the up-and-coming Bayesian. Until recently, the classical or frequentist approach has been the standard for scientific research. As the name suggests, frequentist methods attempt to predict the probability of a future event given the frequency with which it has occurred in the past. Reflecting its origins in games of chance, frequentist statistics are often associated with examples of determining the probabilities of tossing a certain roll of the dice or drawing certain cards. But in Bayesian statistics, probability is extended to cover degrees of certainty about statements. So, while frequentists would say that their calculations are based on objective data, Bayesian approaches incorporate "subjective" information (i.e. expert judgment) in a way that, arguably, provides more complete information to the decision maker. They also allow us to "consider probabilities for events that have never happened before, i.e., events for which there is no historical data and for which data can't be collected" (Wilson, 2001, p. 8). Like the frequentist with the deck of cards, the Bayesian approach would use the existing data about the makeup of the deck of cards but would also consider if there was additional information (usually the opinion of experts) that could be factored into the bet maker's decision. In this case, a Bayesian might consult someone who typically plays

practice, the two – risk and uncertainty – are rarely separate. If we, for example, imagine risk in something like its pure form, we can conceive of a situation in which there is no judgment involved, no qualitative, non-calculative basis for decision-making. And of course this is hardly ever the case.

Matters of concern, like the L'Aquila controversy, make this abundantly clear. For not only is there "not a monolithic form of uncertainty operating…but an array of uncertainties" as Walsh and Walker (2016) helpfully point out, but there is also a complex and dynamic interplay between risk and uncertainty. Certainly, we need to attend more closely to what happens to uncertainty as it circulates in these hybrid spaces – especially the blending and transformation of uncertainty into risk and the consequences of doing so. As I will show in my analysis, when the technical, political, and public overlap, there is a tension between the need to reduce complexity and uncertainty (and thus limit the possibilities of deliberation) and the need to embrace them. In the remainder of this chapter, I turn to exploring the effects of this slurry of tension, uncertainty, and risk on deliberation and communication as well as how rhetorical methods might be adapted in order to better trace uncertainty (and its interplay with risk) in the often-hybridized discourses of risk communication.

Stases for Matters of Concern

In elucidating matters of concern, Latour provides a reinterpretation of Heidegger's *Ding* [thing]. Both Latour and Heidegger trace the etymology of a thing to *Althing*—the Old Icelandic word for parliament. For Latour (2004) and Heidegger, things, as opposed to objects, do not

cards with this dealer. She may have additional information, like the dealer has a reputation for being a bit shady. By working with the expert to quantify what the term "a bit" means in terms of probabilities, the Bayesian comes up with additional data to factor into the calculations. By incorporating subjective information into the calculations, Bayesian statistics occupies a gray area between subjectivity and objectivity, between risk and uncertainty.

stand apart; rather, they are at the center of gatherings that, like hybrid forums, may bridge technical and political questions into a seamless whole:

> Martin Heidegger, as every philosopher knows, has meditated many times on the ancient etymology of the word thing. We are now all aware that in all the European languages, including Russian, there is a strong connection between the words for thing and a quasi-judiciary assembly. Icelanders boast of having the oldest Parliament, which they call Althing, and you can still visit in many Scandinavian countries assembly places that are designated by the word Ding or Thing. Now, is this not extraordinary that the banal term we use for designating what is out there, unquestionably, a thing, what lies out of any dispute, out of language, is also the oldest word we all have used to designate the oldest of the sites in which our ancestors did their dealing and tried to settle their disputes? A thing is, in one sense, an object out there and, in another sense, an *issue* very much in there, at any rate, a gathering. To use the term I introduced earlier now more precisely, the same word thing designates matters of fact and matters of concern. (pp. 232-233)

Latour's use of the term *issue* is especially interesting given the common focus of rhetoricians on stasis as a primary analytic construct for investigating science-policy deliberation (Ceccarelli, 2011; Fahnestock & Secor, 1988; Graham & Herndl, 2011; Prelli, 2005; Walsh, 2009). And this focus, of course, makes a certain amount of sense, for the resolution of stases is central to the adjudication of issues. Indeed, I am excited by this potential for productive resonance in investigating the deliberative practices in hybrid forums as they tackle matters of concern. But, in making this move from matters of concern to stasis theory, I must confront a significant methodological issue for rhetorical studies, namely, the tendency of traditional stasis analysis to replicate the fact-value divide that is rejected by matters of concern.

Rhetoric, rhetorically-informed technical communication and STS have long recognized the false dichotomy between facts and values. Indeed, the social constructivist and rhetoric-as-epistemic traditions, which are built on the rejection of this dichotomy, still inform much of rhetoric and technical communication today. In spite of these theoretical and epistemological commitments, I worry that stasis – both as a theory and methodology – remains indebted to a

more modernist epistemology. Indeed, rhetorical scholarship on stasis theory, especially in cases of science-policy controversy, is traditionally marked by a recurrent focus on purification and procedure. That is, the taxonomic methodological approach to stasis theory comes with the side effect that complex and messy stasis moments are disentangled and carefully delineated into separate questions. And certainly this sort of careful analytic approach to science controversy can be helpful in identifying tacit questions within a discourse and determining how those questions contribute to the resolution or lack of resolution of overarching questions. However, the traditional taxonomic approach often slides into procedural recommendations, which suggests that stasis questions can and should be addressed in the order prescribed by classical theorists (e.g., fact then definition then value then action).

For example, Fahnestock and Secor (1988) suggest that stasis debate can and should proceed from simpler to more complex, each level building on the answer to the question of the previous level: "The full *stases*, from fact to proposal, constitute the backbone or outline…introduc[ing] a topic by defining it and commenting on its extent, go[ing] on to consider causes and consequences, then evaluat[ing] the phenomenon, and finally turn[ing] to the future by predicting or recommending certain actions" (429). Fahnestock and Secor (1988) classified these moves or questions into lower (i.e., fact, definition) and higher stases (i.e., value, action), creating a kind of internal hierarchy (440). Similarly, Walsh (2009) explains that resolving one level of stasis propels the discussion into debating the next. Due to their linked, hierarchical nature, stases exert what she calls "an irresistible upward pull on the discourse" (42).

Walsh's (2009) hierarchization and use of directional metaphor "upward" helps codify the procedural recommendations of stasis doctrine. Even when the goal is not to prescribe a hierarchy or procedure, rhetorical recommendations regarding traditional stasis theory sometimes

inadvertently reinforce the division between the technical and the public sphere. For example, Ceccarelli (2011) offers stasis doctrine as one possible mode in which rhetoricians can intervene in manufactured scientific controversies (e.g., if an oil company were to provide concocted evidence to create doubts about anthropogenic climate change). Ceccarelli argues, convincingly, that scientists' efforts to discredit such manufactured controversies at the conjectural level of stasis have been fraught with failure. Instead, she suggests that

> a more promising strategy would be to engage the debate, but after refuting the most damning charges, shift the focus of discussion away from the conjectural *stasis*, recognizing that manufactured scientific controversy is really "a political controversy over values masquerading as a scientific dispute." Addressing the real issue of which values should be prioritized in society, or what standards of proof should be applied by a public body weighing the stakes of action and inaction, or what specific policies would be best in the given circumstances, forces the debate to turn on matters that are more appropriately managed in the public forum, rather than merely replaying a long and complicated technical debate before a nontechnical audience. (212)

While Ceccarelli's approach may constitute a promising rhetorical strategy to meet the desired ends, it still serves to bracket off the public sphere from matters of fact. It still purifies different stasis questions while assigning them to separate discursive domains. As such, I worry that this traditional rendering of stasis theory may be inadequate to address questions of technical democracy that rise to the level of matters of concern.

Indeed, I am not the first to recognize that the traditional compartmentalization of stasis questions is inadequate to address such cases. For example, Blythe, Grabill, and Riley's (2008) study of one community's debate over the desirability of a dredging project highlights the resistance of matters of concern to traditional taxonomic stasis analysis:

> Even if people agree fully on a definition, *reaching agreed upon stases is difficult because people often switch unexpectedly from one type of stasis to another* [emphasis added]. An exchange that occurred at a citizens' meeting on February 4, 2004, revealed this difficulty. During a meeting of the CEC, Barbara told the group about her recent phone conversation with a chemical engineer who had

> been hired by TOSC to review the Corps's dredging plans. During that conversation, the engineer argued that it did not matter whether the federal government characterized the dredging as an environmental or a navigational project. That is, he claimed that arguments over definition missed the most important issue: A navigational dredging project still had to meet environmental standards. When Barbara shared the engineer's opinion at the meeting, Henry, another member, said that the environmental versus navigational issue was a red herring. The real issue, he said, was whether the project should meet [certain legal] standards …. He shifted from a question of definition to one of conflicting laws (Hermogenes's 10th stasis). (290-291)

Why should such a shift in *stasis* be unexpected? Perhaps only because traditional stasis theory in rhetoric and policy discourse tacitly recommends purified, sequential stasis questions. I would argue, however, that both this work of purification and the procedural mandates that follow fail to account for cases such as the L'Aquila earthquake controversy. Further, I argue that if such works of purification are folded into science-policy deliberation, then the discussants risk treating matters of concern as matters of fact. Rhetoricians, then, must tackle these questions directly and develop novel approaches to stasis theory that can better accommodate the complexity and dynamism of debate in matters of concern. To that end, I employ a "functional" approach to stasis analysis as identified and described by Graham's (2015) *The Politics of Pain Medicine.* A functional approach, as I will describe in more detail, is a method for analyzing the dynamic flow of stasis questions in situ, focusing more on the interaction between stases and the resolution of static questions into usable topoi than on the specific nature of the particular stasis issue.

Functional Stasis Analysis

Originally deployed in courtrooms and legal settings as a way to taxonomize the issues under debate, stasis doctrine has been presented in varying ways since the Classical period in order to describe how issues take shape. More recent work in RSTM has doubled down on the taxonomic approach to offer more complex and nuanced approaches to stasis taxonomies that

account for evidentiary and methodological debate in technical spheres. Prelli (2005), for example, added four additional stases to the traditional taxonomy – evidential, interpretive, evaluative, and methodological. These "superior" stases coordinate with the traditional, or "subordinate," stases to create a 16-cell matrix of compound stases (e.g. conjectural–evidential or qualitative–methodological). Graham and Herndl (2011) further expanded Prelli's schema by adding a practical stasis, thus creating a 20 compound stasis taxonomy.

While Prelli's (2005) stasis taxonomy provides a good starting point for thinking about deliberation in hybrid forums, I aim to push beyond the primarily taxonomic approach. Although I use many of the excellent insights that Prelli's schema provides, that analysis will be subordinate to what I believe offers a more fruitful approach – Graham's (2015) "functional *stasis* analysis." Graham describes how he derived this approach by

> taking a cue from neuroimaging scientists. Neurologists differentiate between structural and functional imaging studies. Structural imaging seeks to describe the anatomy of the brain. It identifies prominent neuroanatomical features and locates them relative to other features. It is concerned with a cartography of the brain—where does one structure begin and another end? In contrast, functional imaging studies work to describe physiology. How do blood and oxygen flow through various brain features as they process information and stimuli? Structural imaging is three-dimensional; functional imaging is four-dimensional—gathering data over time. I would argue that the typical taxonomic approach to *stasis* theory is structural—it isolates individual stases from the flow of argument. In contrast, functional *stasis* analysis seeks to capture the dynamic and often nested relationship among stases within the flow of debate. (92)

In keeping with this functional approach, my analysis focuses primarily on three identified static moves that describe the evolving in situ relationships between stases and between stases and topoi. That is, again following Graham (2015), I explore three "physiological" functions that are evident in the L'Aquila discourse: nesting, resolution, and buttressing (93). *Nesting* describes a particular relationship between stases that occurs when positing one stasis question forces a second prior stasis question to be raised. The latter stasis is said to be nested in the former.

Resolution occurs when the argumentative processes of stasis debate come to a close – that is, when an answer is provided. Rhetorically, I understand these static resolutions to be the establishment of new topoi – new common places – for future discussion or praxis. Finally, *buttressing* refers to the interaction between nested topic resolutions and stases. That is, when stases nest, the resolution of the host stasis is dependent on the resolution of the stasis nested within it. The newly established topos of the nested stasis buttresses the soon-to-be established topos of the host stasis.

This functional or physiological approach is essential because it offers an opportunity to better capture the complicated relationships between the stases used in arguments. The traditional use of stases presumes a direct supporting relationship between different static levels. And this makes sense, given the productive orientation of classical rhetorical theory. If the goal is to construct a compelling oration, then thinking hierarchically about how supporting arguments ultimately lead to the desired outcome is appropriate. However, when stasis theory is used analytically and used to study ephemeral rhetorical events with multiple discussants and competing lines of inquiry, the stases observed may not be deployed hierarchically and may indeed support multiple, conflicting outcomes. Similarly, lines of argument offered at one point during an event may not even get folded into the broader discourse, providing stases that ultimately support nothing at all.

In keeping with Graham's (2015) functional approach and its origin in neuroimaging, my analysis of the CGR meeting details the physiological events in the debate. Ultimately, therefore, this analysis is a kind of *activation study*, a mode of neuroimaging investigation that maps temporal data onto the brain's structure. These data show which structures of the brain are activated in what order as the brain works its way through events. So, for example, in activation

studies of reading Shakespeare, researchers might be able to distinguish between the specific neurophysiological structures used while reading tragedy, while reading comedy, or while simply turning the page. Linguistic- and emotion-processing units will be engaged during the cognitive acts of reading and may engage differently in coordinating with those units that control movement during the physical act of page turning. In extending Graham's functional metaphor to my analysis, I begin by offering an overarching and structural view of the CGR debate. However, in the following sections, I will also identify activations by time. This phase-by-phase analysis will center on which stases, resolutions, and buttresses are active at different phases in the discourse. Table 1 provides a consolidated presentation of the stases activated in the CGR debate.

Stasis	Generic Form	Operationalized for L'Aquila
Practical–Qualitative	What action is most appropriate following this discussion?	How can we reassure the people?
Evaluative–Conjectural	Is claim X scientifically significant?	Is it likely there will be another earthquake soon?
Evidential–Conjectural	Is there scientific evidence for claim X?	What is the available data?
Evidential–Definitive	What does the available evidence mean?	Does the available data mean there will be an earthquake?
Translative	Does X have the proper authority to contribute to this issue?	Do we include Giuliani's data?
Ethotic–Translative	Does individual X have the credibility to serve as an authority?	Can we ignore people who do not behave as we wish?
Practical–Translative	Who ought to bring action?	Who is authorized to make which contributions?
Methodological–Conjectural	Is procedure X a viable scientific procedure in this case?	Is radon gas emission detection an acceptable method?

Table 1: Stases present in CGR debate with their generic forms and operationalization for L'Aquila

CGR Purification

What originated as a concerning increase in seismic activity in October 2008 developed into an ongoing issue of public concern surrounding the prediction of potentially catastrophic earthquakes. This still-unfolding, 9-year and counting controversy has played out in a wide range of discursive settings, including a scientific commission, an indictment hearing, a trial, an unfolding appeal process, the popular press, the blogosphere, and the epistolary work of scientific organizations such as the AAAS. Thus, I confine my analysis to the CGR meeting. In keeping with the tenets of functional stasis analysis, I have provided a map of the nesting stases, resolutions, and buttressing identified in the CGR meeting (see Figure 3).

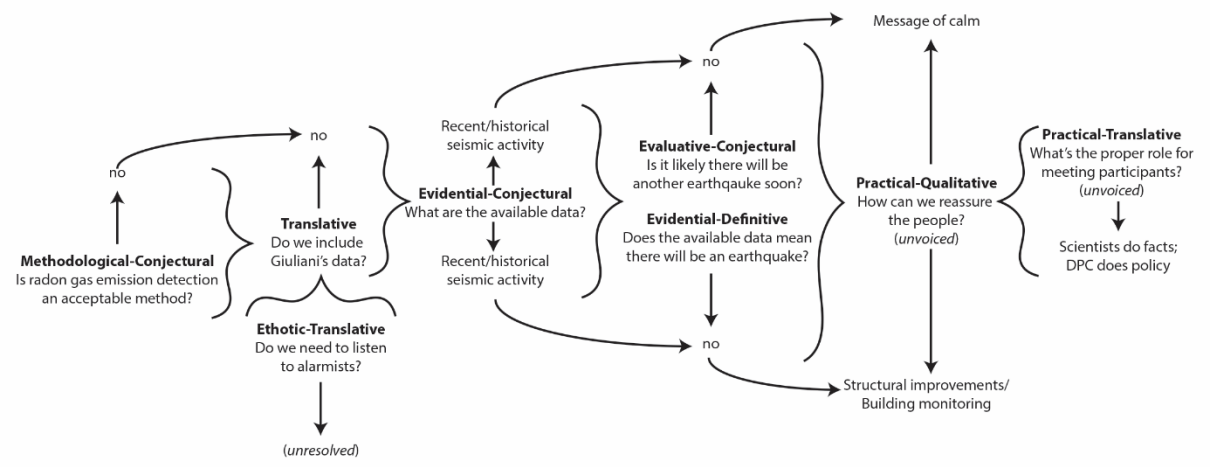


Figure 3: Structural mapping of the Commissione Grandi Rischi (CGR) discussion

The map provided in Figure 3 is ultimately informed by an awareness of the back-channel discussions that contributed to the call to meet in the first place. In the wake of Giuliani's predictions and the attention he garnered, the Aquilani demanded answers. As previously mentioned, Bertolaso and Stati's recorded telephone conversation seems to indicate that rather than provide these answers, the DPC's primary goal was to allay the Aquilani's fears by silencing Giuliani. But the CGR meeting was not primarily framed as an effort to discredit Giuliani. Although the director of the DPC made one oblique reference to Giuliani at the outset

of the meeting (see Commission, 2009, p. 2), the CGR was largely presented with a modified question: Is an earthquake likely to happen soon? This question, which was ostensibly asked as a reasonable response to public demands, would ultimately lead to the rejection of Giuliani that the DPC sought all along.

The articulation of this question represents, temporally speaking, the first nesting in our functional stasis map. DPC officials needed to determine what question they could put to the CGR that would serve their primary goal of calming the Aquilani in a PR-friendly manner. The immediate question – How do we reassure the public (in a PR-friendly way)? – is an example of the practical-qualitative stasis, following Graham and Herndl's (2011) elaboration of Prelli's taxonomy. This question has to do with a course of action (practical), but that course of action must be established in dialogue with qualitative concerns (perceptions and community values). That is, DPC officials could not simply start the meeting by discrediting Giuliani and asking the CGR for confirmation. So instead, the question they asked the CGR was of a different stasis, one that was nested inside the first question and resolution. The premeeting question, How do we reassure the public (in a PR-friendly manner)?, was answered with the proposed course of action – by assessing the likelihood of an impending earthquake – which immediately forces the question, What is that likelihood?

According to Prelli's taxonomy, the DPC's question to the CGR is an evaluative–conjectural question: What is the likelihood of an earthquake? In other words, the DPC officials wanted a risk assessment, which would allow them to discredit Giuliani's predictions and reassure the Aquilani. Despite the historical rhetorical distinction between facts and probabilities, I understand a risk assessment to be a conjectural question. In his canonical 1921 book, *Risk, Uncertainty, and Profit*, American economist Frank H. Knight demarcates risk from uncertainty:

> Uncertainty must be taken in a sense radically distinct from the familiar notion of Risk, from which it has never been properly separated.... The essential fact is that 'risk' means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomena depending on which of the two is really present and operating.... It will appear that a measurable uncertainty, or 'risk' proper, as we shall use the term, is so far different from an unmeasurable one that it is not in effect an uncertainty at all (19-20).

For Knight, risk applies to situations where the outcome of a given situation is unknown but the odds can be accurately measured. Situations in which we cannot know all the information needed to set accurate odds from the start are deemed uncertain. In the context of science, risk would then correspond to situations in which we have a sufficiency of observed instances such that we can plot a probability distribution (e.g., the chance of a person who smokes contracting lung cancer) while uncertainty would characterize those situations in which we do not (e.g., the prediction of natural hazards). Building on Knightian uncertainty, STS and STP scholarship has gone to great effort in recent years to distinguish between questions of risk and questions of uncertainty in science-policy deliberations. For example, Callon, Lascoume, and Barthes (2009) elaborate on this distinction:

> The term “risk” designates a well-defined danger associated with a perfectly describable event or series of events. We do not know if this event or series of events will in fact take place, but we know that it may take place. In some cases, statistical instruments applied to series of systemic observations performed in the past make it possible to calculate the event’s probable occurrence, which will then be described as objective probability…. In actual fact, science often proves to be incapable of establishing the list of possible worlds and describing each of them exactly. This amounts to saying that we cannot anticipate the consequences of the decisions that are likely to be made; we do not have a sufficiently precise knowledge of the conceivable options, the description of the constitution of possible worlds comes up against resistant cores of ignorance, and the behaviors and interactions of the entities making them up remain enigmatic. The conditions required for it to be relevant to talk of risk are not met. We know that we do not know, but that is almost all we know; there is no better definition of uncertainty. (19-21)

In short, risk is a quantifiable probability. It is statistically derived numbers grounded in established scientific methodologies. Uncertainty is when "more than one outcome is consistent with our expectations" (Pielke, 2007, p. 55). This slight detour through the risk–uncertainty distinction foreshadows the interpretive conflict between the DPC and the CGR.

The Emergency Meeting of the CGR

My analysis of the meeting minutes suggests that the conversation between the CGR and the DPC proceeded in four phases: data delivery, discussion scaffolding, translative fleshing out, and practical fleshing out.

Phase 1: Data Delivery

The CGR, like many other science-policy collaborations, sought to assemble the available evidence in order to assess it. The meeting began with the activation of the evidential–conjectural question: What is the available data? As Walsh (2009) notes, stasis questions such as evidential–conjectural ones are most often posed to scientists because they focus more heavily on "the facts," as was true of the L'Aquila meeting. Indeed, the bulk of the meeting focused on the scientists presenting "*che cosa sta accadendo dal punto di vista scientific* [what is happening from the scientific point of view]," which entailed relaying seismic recordings, historical data, and visualizations (Commission, 2009, p. 2). For the first third of the meeting, the discourse moved back and forth between activating the evidential-conjectural *stasis* (What is the available data?) and its resolution – recent and historical seismic data.

These datasets presented seismic activity as an object of scientific inquiry and subsequently shaped what and how the scientists communicated about L'Aquila's seismic activity – as a matter of fact. As discussed in Chapter 2, the seismicity was enacted through practices generally viewed as objective: scientifically tested methods of data collection, number-

crunching statistics, and measurement tools. In these repeating moments of evidential–conjectural resolution, the scientists' sentences often started with phrases such as *we observe*, *we are seeing*, or *in reality*, emphasizing an objectivity that was, at times, almost disinterested, and a certain factualness (Commission, 2009, pp. 2-4). The scientists, therefore, functioned as reporters of observations and facts, using such objective "is" claims to pass them on to policy makers.

Following this initial presentation of scientific data, the first statement about the meaning of the data occurred. As Figure 4 shows, the evidential–conjectural stasis resolution was activated, then, to buttress the evidential-definitional topos. According to the scientists and based on current understandings in seismology, the data did not unequivocally mean that there would be an earthquake. In fact, the likelihood of an earthquake could neither be confirmed nor denied.

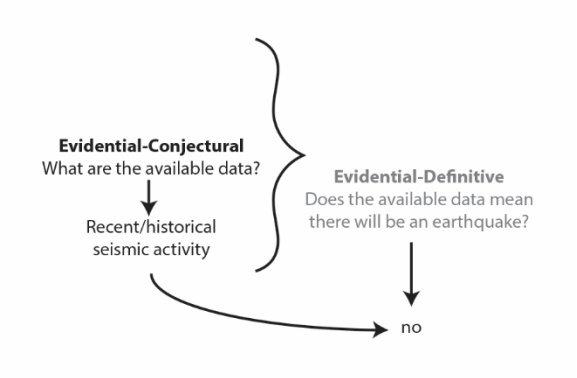


Figure 4: Data delivery

Phase 2: Discussion Scaffolding

Prompted by the belated entrance of several local officials, seismologist Franco Barberi interrupted the presentation of recent and historical seismic data in order to restate what he understood to be the meeting's goals: a) to make an objective evaluation of the seismic activity and b) to discuss and provide recommendations regarding Giuliani's warnings (Commission, 2009). These statements formally activated the evidential-definitive *stasis* (Does the available

data mean there will be an earthquake?) and the translative stasis (Do we include Giuliani's data?) Barberi's understanding of the goals of the meeting are not quite aligned with those presented by the DPC earlier. Not grounded in scientific methodologies or risk–uncertainty distinctions, the DPC understood (and needed) the question that they posed to the CGR to be one of risk (i.e., Is it likely there will be an earthquake soon?) if they were to successfully discredit Giuliani and reassure the Aquilani. The CGR, unable to answer that question, as seismology is unable to predict earthquakes, redeployed the DPC question as an activation of the evidential–definitional question, What does the evidence mean? or in this case, Does the available evidence mean there will be an earthquake? This talking past each other is represented in the functional stasis map by their collocation (see Figure 3).

Members of the CGR then proceeded to resolve this evidential-definitive question. A pattern ensues: The scientists alternated between resolution statements – no, the evidence does not necessarily indicate an earthquake – and buttressing references to recent and historical seismic data. For example, Boschi stated, "*Improbabile che ci sia a breve una scossa come quella del 1703, pur se non si puo' escludere in maniera assoluta.* [It is improbable that there would be a tremor like the one in 1703 in the near future, though the possibility cannot be entirely excluded]" (Commission, 2009, p. 2). Later, Barberi responded: "*Concordo con Selvaggi che sono molto piu' frequenti le sequenze sismiche che le forti scosse. Ovviamente non possiamo dire che ci sara' o non ci sara' una forte scossa*. [I agree with Selvaggi that there are more frequently seismic sequences than large quakes. Obviously we cannot say whether there will be or there will not be a large quake.]" (Commission, 2009, p. 4)

The scientists' language was repeatedly marked with modals, adverbials, and verb tenses typically used to indicate uncertainty: "*con un grado, però, di incertezza* [with a degree,

however, of uncertainty]," "*non si può escludere in maniera assoluta* [it cannot be excluded absolutely]," "*come sia estremamente difficile fare previsione* [it would be extremely difficult to make temporal predictions]," and "*Gli sciami tendono ad avere la stessa magnitude ed è molto improbabile che nello stesso sciame la magnitudo cresca*. [The clusters tend to have the same magnitude and it is very improbable that within the same cluster the magnitude would increase]" (Commission, 2009, pp. 2-4). With only one exception, every scientific speaking turn was marked with at least one indicator of uncertainty. Such rhetorical moves to emphasize uncertainty reflect the uncertainty inherent in the field of seismology at this time; while the scientists can and did present data, they were uncertain about its meaning. Earthquake prediction is uniformly rejected in the scientific community. However, there are competing accounts of appropriate methodologies for earthquake forecasting, presented variously under the language of risk or the language of uncertainty. Whether earthquake forecasts truly constitute risk or uncertainty is a fraught question and must remain the subject of another discussion. However, as the CGR treats both prediction and forecasting as uncertainty, my analysis of the flow of *stases* and resolutions relies on that account.

The noted uncertainty in the scientists' language may also be a reflection of the statistics and probabilities they used to understand seismic activity. Their ways of enactment did not directly set them up to make clear-cut answers or predictions, much less policy decisions. Thus, the scientists' responses focused exclusively on the stases activated by an earthquake as a matter of fact. Such rhetorical moves also demonstrate an attempt to remain in the stases that are seemingly objective, to "safeguard their ethos from attack" (Walker & Walsh, 2012, pp. 10-11).

Buttressed by this cyclical activation of the evidential-definitional and evidential-conjectural topoi, some of the scientists did venture into other more action-oriented stases but

only in reference to matters outside of their direct expertise. Supported by their firm conviction that the data do not say whether or not an earthquake will occur, the CGR members encouraged investment in prevention strategies (i.e., quake-resistant buildings). This was the CGR's resolution to the unvoiced, unactivated practical-qualitative question, How can we reassure the people?

But, as Figure 5 shows, nested inside this question is a concern about roles, a practical–translative issue. Resisting entering the stases of value and action concerning scientific matters, the scientists, in effect, attempted to hand off their information to the government officials who would, as one scientist said, "define the action" (Commission, 2009, p. 4). This role distinction between scientists and civil servants is one that CGR members were quick to address. And, as if to reemphasize their role as scientists who present facts, they promptly returned the conversation once again to the inability of scientists to say that the data predict an earthquake, buttressed by additional statements about recent and historical seismic data.

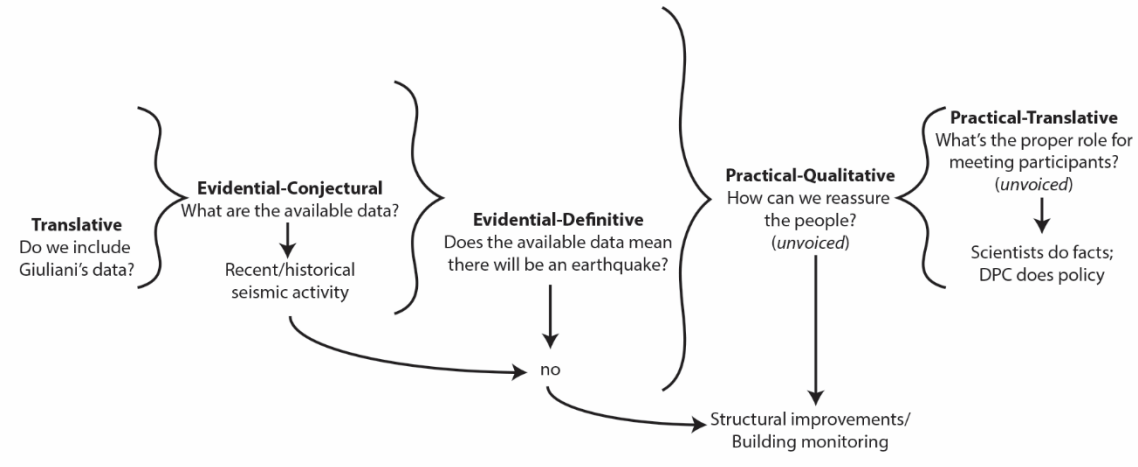


Figure 5: Discussion scaffolding

Phase 3: Translative Fleshing Out

During their presentation, CGR scientists displayed no inclination to consider Giuliani's evidence. Of course, neglecting to consider this evidence did not constitute refuting it and, as

such, did not serve the DPC's tacit goal of silencing Giuliani. As a result, DPC official Daniela Stati explicitly introduced the issue, marking a third phase of the meeting: "*Quello che vorremmo sapere è se dobbiamo dare retta a chi va in giro a creare allarmismo* [What we would like to know is whether we have to listen to those who go around town creating alarm]?" (Commission, 2009, p. 4). As an activation of the ethotic-translative *stasis*, this question is a matter of expertise. Is Giuliani qualified to speak on these matters, and should he be allowed to participate? In short, the answer was no; however, unwilling to be pulled into overtly political questions, the CGR scientists retreated to the relatively safer territory of matters of fact, invoking a methodological-conjectural discussion.

Here I understand translative as a more general *stasis*. Even though its instantiation in the CGR is indexed specifically to Giuliani, the question raised is more about what types of people are eligible to serve as experts in this discussion. And, so the most significant follow-up is found in the activation of the nested methodological-conjectural question. That is, for the scientists, at least, the appropriateness of including Giuliani is predicated on the appropriateness of his scientific process. At the same time, the CGR also opens up as a possible line of inquiry, the suggestion that Giuliani's personal credibility might remove him from eligibility as an authority. This is activated in the nested ethotic-translative *stasis*. To be sure, the translative and the ethotic-translative are closely related in their activation in the CGR. However, the ethotic-translative remains unresolved. The line of inquiry is never fully pursued, perhaps due to politeness, available time, or simply the activation of the methodological-conjectural *stasis* resolving the translative *stasis* in a more PR-friendly manner.

One of the most obvious stopping points in the course of the CGR discussion regarding earthquake prediction is Giuliani's radon gas data and methodology. This issue is not simply

conjectural; the meeting minutes show that none of the CGR members disputed the presence of the radon gas or questioned the measurements that indicated their levels had risen. Those measurements, the evidence of increased levels, stood. The question at hand was about the validity of radon gas theories and methodology for earthquake prediction and if this data should be included as part of the presented data. Prelli's (2005) schema perfectly accounts for this sort of question: The methodological-conjectural stasis is activated and presents itself quite simply and directly, "Is procedure X a viable scientific procedure in this case?" (p. 305).

With more certainty than they displayed elsewhere, the CGR scientists emphasized the consensus of the seismological community that there were simply no available approaches for predicting earthquakes:

> *Ci sarebbe anche qualcuno che farebbe alcune previsioni con un apparecchio che misura le emissioni di gas. Potrebbe essere interessante in futuro, ma oggi sicuramente non lo e'. Non c'e' nessuno strumento che possa avvisarci che ci sara' un terremoto.* [There might also be someone who could make some predictions with a device that measures gas emissions. This could be interesting in the future, but today there definitely is not any such thing. There is not a single instrument that can tell us that there will be an earthquake.] (Commission, 2009, p. 4)

And these scientists dismissed radon measurement, neither scientifically proven nor accepted by the larger scientific community, as a viable, valid scientific process for predicting earthquakes:

> *Non vale la pena che la CGR discuta di questo, ne ha gia' discusso a lungo in altre occasioni. ... Questa sequenza sismica non preannuncia niente ma sicuramente focalizza di nuovo l'attenzione su una zona sismogenetica in cui prima o poi un grosso terremoto ci sara'. .. l'unica difesa, oggi, e' quella di incentivare le attivita' di prevenzione (rafforzare gli edifici) e pianificazione.* [It is not worthwhile for the CGR to discuss this [i.e. whether gas emissions, or anything, can predict earthquakes]. We have already discussed it at length at other occasions. ... This sequence of seismic events does not predict anything, but it certainly focuses attention once again on an area of seismic activity where sooner or later there will be a big earthquake. ... The only defense we have today is to incentivize reinforcing buildings.] (Commission, 2009, p. 4)

In one fell swoop, this rejection of the notion that increased radon levels could predict earthquakes buttressed the resolution to both exclude Giuliani from the debate and discard the

radon-measurement data. Because Giuliani did not adhere to the methodological consensus, he was excluded from the body of practicing scientists and from entering the discussion, thereby sidestepping any questions about the meaning of his radon evidence. After discrediting Giuliani's methods and excluding his participation as an expert, the CGR could return to the question of what the facts were from a "scientific perspective" and what they meant. As if for emphasis, this phase of the meeting concluded with a reactivation of the evidential-definitive resolution that the available data could not predict an earthquake (see Figure 6).

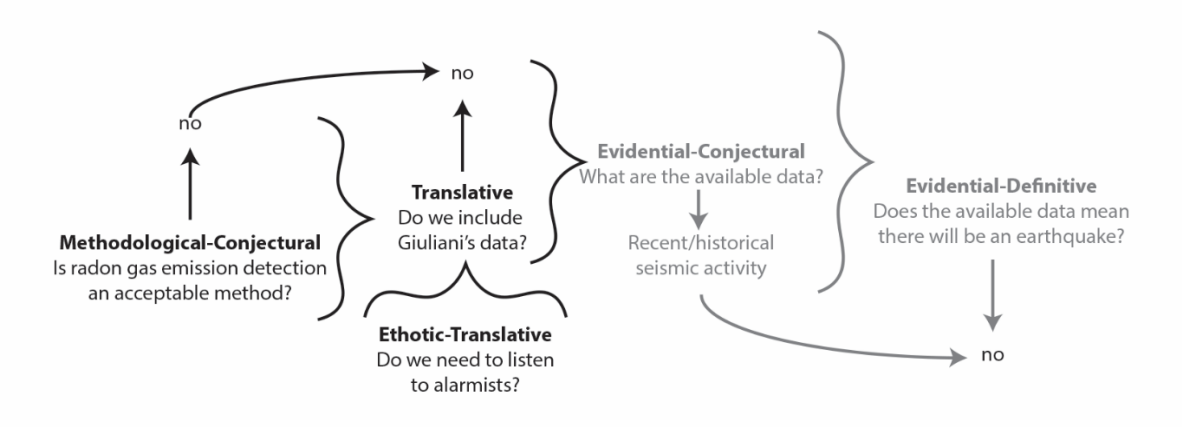


Figure 6: Translative fleshing out

The Giuliani factor at the CGR meeting raises obvious but serious questions within the continuing scholarship on expertise and inclusion in science-policy debate (as discussed in the previous chapter). The ethics of inclusion in this case arguably differ depending on the wave of STS or STP in which one participates. Under the postmodern model of universal inclusion (see Collins & Evans, 2002), Giuliani absolutely deserved to be an active participant in the process. Discrediting him should never have been a goal. Indeed, his inclusion may also have been warranted under the more normative models of technical decision making. Although Giuliani is not a published scientist, his lengthy experience as a lab technician might have granted him what Collins and Evans (2002) call "referred expertise" and thus validated his inclusion in the ongoing

decision-making process. While in hindsight, it is easy to note that Giuliani's recognition of increased radon gas levels did indeed correspond with a serious earthquake, the official scientific position is that this correlation could be accidental. If so, then the Italian authorities might well have been ethically correct in charging him with inciting a public panic and excluding him from the conversation. But at the least, it seems problematic that the participants at the CGR went into the meeting intending "to immediately shut up any imbecile." Certainly, the CGR failed to constitute itself as anything like the hybrid forum that Callon et al (2009) imagined.

Phase 4: Practical Fleshing Out

In the fourth phase, evidence of the CGR meeting really breaking down emerged. I do not mean breaking down in the sense that people stormed out of the room or that there was some interruption in discourse. While the meeting proceeded without visible interruption or concern, the breakdown I refer to was demonstrated by acts of talking past each other, rather than to each other. For example, the DPC presented the CGR with a question, but the CGR answered a different question. As a result, each group of discussants activated different stases, which authorized different resolutions. It is not clear from the meeting transcripts or any follow-up material if anyone was ever aware of this static misalignment.

Buttressed by previous emphases on the impossibility of earthquake prediction, two CGR members attempted to provide a resolution (from outside the field of seismology) to the activated practical-qualitative stasis. They support preventative measures, such as structural improvements and monitoring, as the only defense presently available. Following these comments, the meeting concluded with Stati saying, "*Grazi per queste vostre affermazioni, che mi permettono di andare a rassicurare la popolazione attraverso i media che incontreremo in conferenza stampa* [Thank you for your affirmations, which allow me to go reassure the public through the media that we

will have a press conference]" (Commission, 2009, p. 4). Stati's closing statement demonstrates an abrupt switch to an alternative resolution of the practical–qualitative stasis, buttressed by the evaluative–conjectural resolution.

I attribute this transformation of the CGR's message of uncertainty to the DPC's message of reassurance to an interpretive conflict caused by the false equivalence of the evidential–definitive and evaluative-conjectural stases that were being adjudicated (see Figure 7). The DPC took the scientists' uncertainty and hesitancy about predicting an earthquake as a signal of unlikelihood (conjectural). This interpretation suggests that when dealing with matters of concern, which overflow traditional stasis taxonomies, the scientists' "objective" statements cannot necessarily be divided from value, as much as they may try to do so. According to Walsh (2009), even if scientists attempt to restrict their discourse to the "objective" stases, these statements of fact carry the power of implication that encourages listeners to "hear scientists making implicit value and policy claims" (p. 42). For example, towards the end of the meeting, Barberi stated, "This sequence of seismic events doesn't predict anything" (Commission, 2009, p. 4). It does not take much effort to sense the value- and policy-level implications nested in such a statement. That is, if the swarms do not announce anything, then they are not a bad sign; an earthquake is unlikely, therefore action is not necessary at this time. Certainly, additional factors such as political currents or economic impact play a role in assessing these objective statements in the decision-making process, but the Giuliani factor cannot be denied. Although the meeting was not officially framed as an effort to discredit Giuliani, the desire to silence him seems to have colored the DPC's interpretation of the scientists' message of technical uncertainty.

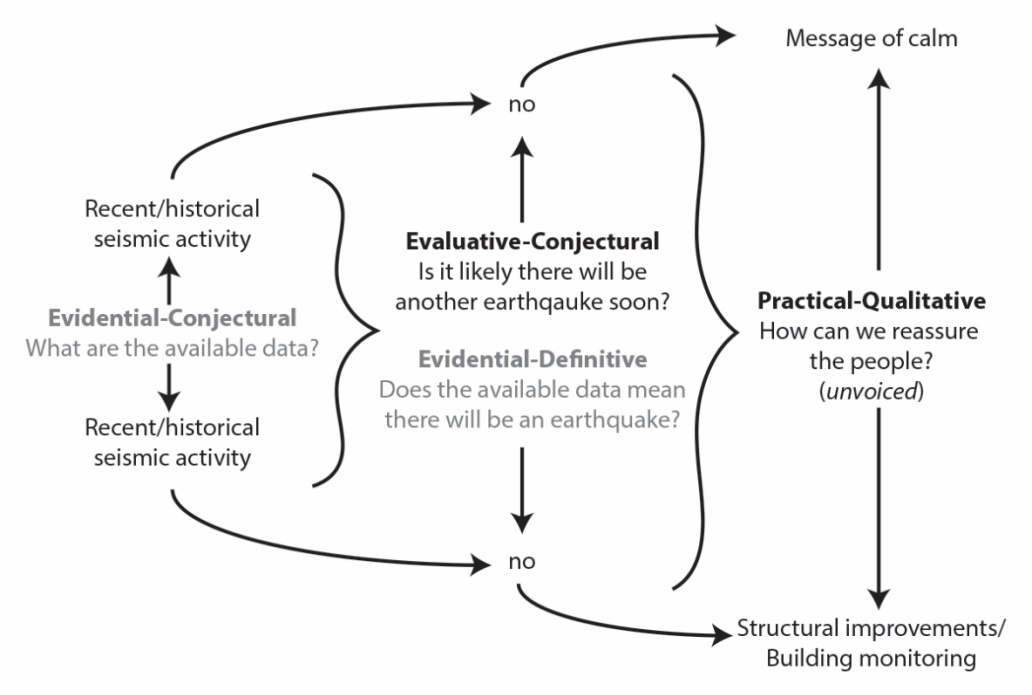


Figure 7: Practical fleshing out

After the CGR Meeting

In accomplishing the identified DPC goals, the CGR emergency meeting was a success. It discredited Giuliani, and given the DPC's interpretation of the CGR's statement of uncertainty as a statement of unlikelihood, it addressed the DPC's initial question – How can we reassure the Aquilani? Subsequently, the DPC held a press conference. Given their desire to calm the public, the government officials did not simply convey the facts. They reassured the people, reporting that the conditions were normal and "there [was] no real danger" (Woodman, 2013, p. 56). As I describe in Chapter 1 with more detail, this is when De Bernardinis' infamous "glass of wine" comment is aired in an attempt to reassure the populace and reclaim the DPC's authority. As the events surrounding the 2009 earthquake show, these assessments and reassurances were ultimately based on a misunderstanding of uncertainty as low risk and did not reflect the events that took place. This miscommunication is what the Aquilani take issue with during the trial.

As boundaries become increasingly blurred and hybrids and imbroglios appear more frequently, situations like the L'Aquila controversy could become more common. Such controversies, though, are useful because they draw attention to these incoherencies that otherwise might remain matters of fact, destabilizing existing practices and fostering reflection (and maybe changes). Studies of controversy traditionally look for closure. Reporters, scientists, bloggers, scholars, and more have been quick to point to the lessons learned from L'Aquila about risk communication, ethics, and relationships between scientists, politicians, and publics; many fear that scientists will see this controversy as a lesson in clamming up. But the L'Aquila controversy, like so many hybrid fora, resists closure and easy conclusions. Although I am not able to fully address here the ongoing policy questions involved in this case of the L'Aquila Seven, my analysis, however, does suggest potential revisions to rhetorical theory. Specifically, traditional approaches to stasis theory might be inadequate to account for technical controversies in hybrid forums.

Ultimately, I argue that the conflict here between the deliberative practices of the CGR and the DPC and the expectations of the people of L'Aquila highlights the sort of conflict that occurs when matters of concern are construed solely as matters of fact – when uncertainty is handled as risk. By handling the situation as a matter of fact and not recognizing the overflow into matters of concern, the CGR failed to tell the Aquilani what they wanted to know or include them (and Giuliani) in any meaningful ways. As this functional stasis analysis shows, the key stakeholders in the L'Aquila controversy were communicating (or had expectations for communicating) on different stasis levels. Thus, the "incomplete, imprecise, and contradictory information" that the prosecution charged the L'Aquila Seven with referred to information at a

procedural level rather than a factual one. Such miscommunication points to the hybridity of the situation, and such miscommunication, regardless of fault, can clearly be costly.

If, instead, the DPC and the CGR had chosen to approach the possibility of a L'Aquila earthquake as a thing—as a matter of concern, they might then have chosen to constitute a true hybrid forum. Hybrid fora take up issues from different domains, overriding the traditional purification of fact and value, and reconfigure the division between technical and public spheres. Such a move toward hybridity of inclusion and decision-making authority might have given discussants the opportunity to open up the issue to a wider array of stases and thus better accommodate people's demands. Such a move might have also made it possible to include, or at least consider including, Giuliani and address the appropriateness of his predictions in an open, inclusive space rather than allow certain stakeholders' desires to silence him twist the conversation. Of course, the deep uncertainty of living with earthquakes is difficult to deal with. But the technical experts' insistence that earthquakes are matters of fact, thereby bracketing off public concerns, likely paved the way for the Aquilani to be more "demanding," as Callon et al (2009) note, in retroactively finding fault.

Finally, I am concerned with the long-term ramifications of public efforts to find fault. While the scientific community's boundary work and insistence on modeling earthquakes as matters of fact certainly contributed to the stasis conflict I identified, the resulting public outcry and subsequent indictment of the L'Aquila Seven might only serve to reinforce these boundaries. As the epistolary advocacy of the AAAS, AGU, GSA, and IAVCEI referenced in Chapter 1 indicate, the scientific community has taken both notice of and exception to the current Italian legal proceedings. These letters show evidence of the authoring scientists retreating from public engagement and reinforcing the modeling of earthquakes solely as matters of fact grounded in

scientific consensus and accepted methodologies. They declare quite clearly that "to expect more of science at this time is unreasonable" (Leshner, 2010). I worry that the efforts to prosecute the L'Aquila Seven will further encourage scientists to remove themselves from the political dimensions of technical decision making to avoid exposing themselves to risks of incarceration – which, of course, is exactly the opposite of what is needed in situations of deep uncertainty. Subsequently, the Italian prosecutorial efforts surrounding the L'Aquila Seven will likely have international reverberations that further inhibit the formation of hybrid fora – a matter of concern for all technical democracy.

Chapter 4: Agency Visualized

Whether predicting natural hazard events or measuring social impacts from human-made hazards, the handling of risk and uncertainty in modern societies involves an unprecedented level of complexity. The challenges of navigating issues such as an abundance of data and sources, uncertainty, complicated mathematical models, and technical language have driven the development of new risk communication strategies – notably visual techniques. Within the world of risk communication, this move to visualize risk is an increasingly popular strategy for facilitating interaction between experts and publics. Risk visualization is the strategic use of images to either augment the quality of or independently engage in risk communication along the entire risk management cycle (e.g., identifying, evaluating, planning for, or monitoring risk). Risk visualizations can generally make use of any visual technique and come in a wide variety of forms, include drawings, photographs, movies, diagrams, and maps.

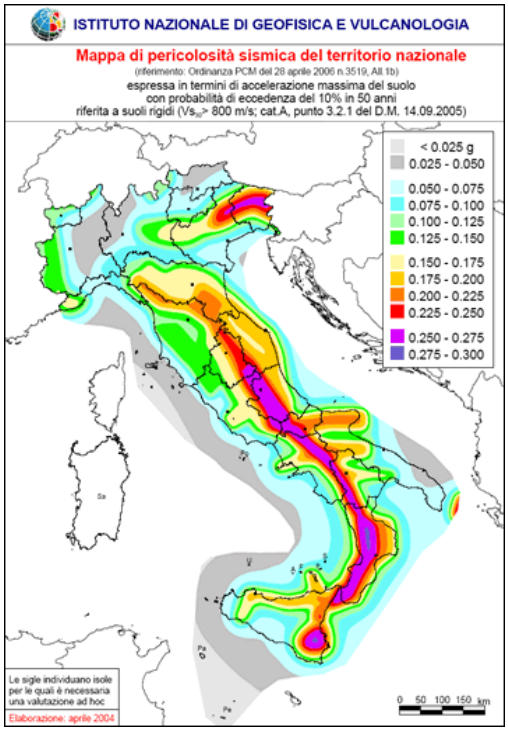


Figure 8: National seismic hazard map of Italy

Evidence of the growing presence and importance of risk visualization can be seen in the case of L'Aquila. "The only useful thing that can protect us from earthquakes is the seismic hazard map of a country," said seismologist Giulio Selvaggi in a spontaneous statement during the final hearing of the L'Aquila Seven (Processoaquila, 2014). Enzo Boschi, former President of the INGV and another member of the L'Aquila Seven, echoes a similar sentiment in a letter published in *Science* about the L'Aquila controversy. He concludes, "In publishing an official map, seismologists have done all they currently can to protect society from earthquakes" (Boschi, 2013). The map referenced by these scientists can be seen in Figure 8.

Agencies and organizations tasked with matters of risk are also increasingly advocating for visual risk communication. The Red Cross, for example, promotes the use of visual strategies in one of its guidebooks: "Even for highly literate people, pictures speak louder than words. People often remember visual messages, such as photos, graphics, animation or video, more clearly than text. When people see visual proof of the effectiveness of disaster reduction measures…they are much more convinced than when they hear or read about it" (International Federation of Red Cross, 2011, p. 59). Similarly, the Federal Emergency Management Agency's (FEMA) guidance about risk communication strategies and public outreach claims that "the use of graphical and visual tools, such as color maps, can often be more effective in communicating hazard data than tables filled with text and numbers…people understand and remember visual data much better than textual data" (25).

All of the above examples attribute great agency to risk visualizations, both in terms of contributing to risk prevention and engaging publics. To be sure, visuals have powerfully mediated how the world is perceived, and they have material consequences for catalyzing future actions and realities. In prioritizing the role that objects play in rhetorical events, Graham (2009)

argues for the importance of "trac[ing] how multiple rhetorical events working in concert form an agentive chain of events that continues to propagate further discursive and practical effects" (399). The fundamental insight behind Graham's work is that objects (e.g., technologies, materials, nature) perform along with the human in rhetorical events and have the ability to legitimize certain interpretations. As such, visuals are undeniably important vectors for risk communication between experts and non-experts. Visuals, and the ethics of their design and use, should be taken seriously. But what agencies do these visuals actually stage? And how do they stage them? Do they, as Selvaggi suggests with seismic hazard maps, actually protect us and/or enable users to minimize danger? This is an issue that is, as of yet, unexplored in the rhetoric of science and made all the more salient because of both the power we culturally invest in visuals and the increasing pressure on experts to incorporate visuals into their public outreach.

As described earlier, matters of concern require the consideration of "a complete set of new actors," actors that are both human and non-human (Latour, 2008, p. 39). Whereas the previous chapters emphasized human actors, in this chapter, I will consider the non-human and its role in how rhetorical agency is perceived, distributed, and fostered. Recent interest in agency scholarship over the role of objects and technologies and the distribution of agency across networks is well suited for exploring a variety of associations between the human and non-human actors present in matters of concern. Continuing this work, I draw upon models of agency that entwine individual agency and ideological forces (Herndl & Licona, 2007; Miller, 2007; Winsor, 2007) and network theory (Cooper, 2011; Graham, 2009; Gries, 2015) to explore the rhetorical, agentive nature of seismic risk visuals, such as those referenced in the L'Aquila controversy. In response to the call to develop novel approaches that can better accommodate the complexity and dynamism (and complete sets of new actors) of matters of concern, I offer

agentive modeling, a mixed methods data visualization approach for networked modeling of agency. I apply this method to a collection of technical and public-facing risk visualizations from the websites of key seismic risk organizations. In what follows, I engage in a short review of the relevant literature before I describe my research methods and interpret the results of the analysis.

The Pictorial Turn

In the mid-1990s, W.J.T. Mitchell identified the emerging cross-disciplinary trend of attending to visuality as the "pictorial turn." This turn marked a growing understanding both that visual culture is highly complicated and that applying traditional textual approaches to study visuals was not sufficient for understanding their complexity. Prior to this turn, rhetorical research on visuals was limited because of the field's long-standing emphasis on oral and written communication. Because of this disciplinary emphasis, a great effort in rhetorical scholarship has been made to demonstrate the argumentative, persuasive potential of visuals (Birdsell & Groarke, 1996; Dyehouse, 2011; Finnegan, 2001; Fountain, 2014; Hill & Helmers, 2004; Smith et al, 2005; LaWare, 1998; Richards, 2015; Rosner, 2001; Prelli, 2006; Propen, 2007; Walsh, 2015; Wysocki, 2005). In other words, visuals do not simply display or show information; they are rhetorical and "perform persuasive work" (Wysocki, 2004, p. 124). As this body of scholarship emphasizes, understanding the rhetorical nature of visuals is central to grasping their possibilities and challenges, to taking them seriously.

In both technical and scholarly spheres, growing attention is being paid to the role of visuals in risk communication. Particularly within the contexts of health and medicine, scholars are actively evaluating the effect of visuals and specific visualization strategies and technologies on public and political perceptions of risk (Bostrom, Anselin, & Farris, 2008; Brander, Drozdzewksi, & Dominey, 2014; Landau et al, 2009; Dobos, 2016; Ventura et al, 2015, Roth,

2012; Severtson & Burt, 2012; Hess et al, 2011; Walsh, 2014) as well as the potential of visuals and specific visualization strategies and technologies to foster public engagement with risk (Richards, 2015; Stephens, De Lorme, & Hagen, 2015). This research shows, among other things, that visuals can be effective tools for public outreach, helping to communicate complex information and mediate between different communities. But these are not the only roles visuals can play. As Gries (2015) points out, visual things are capable of co-producing all kinds of action, including persuading people to take action (69). While work such as DeLuca (1999) and Dobrin & Morey (2009) provide well-rounded theories of visual activism, this aspect is not well addressed in the study of technical graphics like seismic hazard maps. Existing work on visual activism often focuses on media such as photography, which has different affordances than technical graphics. Photography, for example, plays with properties like light, texture, depth, perspective, and color to capture a moment, subject, or process at a single point in time. Technical graphics, on the other hand, are well suited for making trends, distributions, cycles, and relationships (particularly across time) more evident. They are also useful for making comparisons, representing large quantities of data, and providing overviews or steps of complex processes. That technical graphics have distinct conventions and functions has been recognized by a robust body of scholarship dedicated to their study (See, for example, Tufte, 1990, 2001; Brasseur, 2003; Kostelnick & Hassett, 2003; Kostelnick, 2008).

One of the goals of risk communication (including the visuals enrolled in it) is to generate danger-preventing action from the users. It is not enough to just see and know hazard o risk in situations where people's lives are at stake. The first step in understanding how risk visuals may induce action is to explore how they configure the potential for action in the first place. What agencies do these risk visuals actually stage, and how do they stage them? Given the

cultural power we attribute to visuals and their increasing prevalence in risk communication efforts, how exactly the potential for action is configured has important ramifications.

As scholars interested in visual rhetoric, especially, strive to show that visual things matter and actively shape our world, questions about available analytical resources and methodologies have arisen. Some have looked outside rhetoric, drawing from fields such as psychology, aesthetics, philosophy, literary criticism, and media studies. For example, Kress and Van Leeuwen's *Reading Images* (2006) offers semiotics as a method for studying visual argumentation. Likewise, Gross and Harmon (2013) use semiotics and Gestalt theory to develop a systematic, analytical framework for understanding how the visual and verbal work together to communicate meaning. Others have looked within rhetoric for visual methods, returning to classical rhetorical traditions (Dyehouse, 2011; Kimball, 2006; Prelli, 2006; Reeves, 2011; Buehl, 2016). Rhetoricians of science and technical communicators have developed a number of analytical heuristics to study the effects of science-related visualizations, both in book-length treatments (Fahnestock, 1999; Fountain, 2014; Gross, Harmon, & Reidy, 2002; Prelli, 2006), and a number of recent scholarly articles (Graham, 2009; Reeves 2011; Teston, 2012; Walsh, 2014).

In their reflection on the direction of visual rhetorical scholarship in RSTM, Prelli and Condit (2013) emphasize the need to be open to analytical tools, especially in this "preliminary phase" of study (1). And, there is a vibrant, growing methodological toolbox, as the previously referenced work suggests. But this toolbox is primarily focused on studying the effcts of visuals, and, as Gries (2015) points out, "we are left…with little empirical evidence to demonstrate how that [effecting] actually happens" (58). As Hariman and Lucaites (2007) and Gries (2015) model for us, visual rhetoric scholars can do a better job of making visible *how* visuals act.

Agentive Modeling

In order to explore the rhetorical, agentive nature of seismic risk visuals, I assembled a dataset of technical and public-facing visuals from the websites of key organizations concerned with seismic risk. I began with the two organizations involved in the L'Aquila case, the National Institute of Geophysics and Volcanology (INGV) and the DPC. The INGV is a world-renowned scientific organization dedicated to monitoring and maintaining Italy's network of geophysical sensors. They also provide early warnings, forecasts, and educational outreach. The INGV supports the DPC in its national, regional, and local efforts to "spread the culture of civil protection," which includes projects and activities for prevention of, monitoring of, and intervention or response to natural disasters ("Civil Protection Department"). For additional data collection, I went to the American counterparts of these two Italian organizations – the United States Geological Society (USGS) and FEMA.

Many of the visuals from these four websites are more technical in nature and designed for expert audiences, but I also wanted to include artifacts that aimed to be more public-facing in my analysis. So, I included the DPC's (2007) *The Civil Protection Handbook for Families* and the USGS' (2007) handbook for the San Francisco area, *Putting Down Roots in Earthquake Country*, to the dataset. These are the most current editions of this kind of document from both organizations.

For each site, I navigated to the pages related to seismic risk and earthquakes. I collected a large initial dataset by downloading or screen capturing the visuals I found. My goal in this first stage was to amass as many visuals as possible before beginning to sift and conduct a close analysis, a process Gries calls "data hoarding." As Gries (2015) notes, amassing a large dataset can better aid researchers in identifying patterns and trends in the data (111).

After collecting 91 visuals from the websites and handbooks, I began sorting through the data. Duplicate copies of a visual were noted and removed. Similarly, images that were relatively synonymous were also pared back, with one representative visual kept in the dataset. For example, the USGS creates ShakeMaps for any significant earthquake. While each visual is unique to the seismic event, they are all basically the same kind of visual, so only one representative ShakeMap was included. Other exclusion criteria included real-time data displays and visuals that were interactive and dynamic. As part of this selection process, I developed four genres that I used for further sorting and refinement: technical data displays, maps, photographs, and infographics. The initial dataset of 91 visuals was narrowed to a purposive sample of 21 for schema development and initial analysis.

Schema Development

A provisional coding schema was developed based on a random sample of N visuals stratified across all four genres. I then applied the provisional coding schema to an initial sample of four visuals, one from each category. I repeated this process one time, revising the provisional coding schema before completing a series of schema and rater calibration activities with a second rater. These activities included both group coding exercises and individual coding with subsequent discussion. Following the initial calibration sessions, coding notes and periodic conferencing throughout the coding process allowed for continual calibration and discussion, clarification, and refinement of the provisional schema. Although some revisions were more cosmetic in nature (e.g., numbering systems), others involved altering the actual codes included in the schema. In some instances, the initial categories were insufficiently granular. For example, the actant code, “land/soil” was broken down into a general “land” category as well as different types of soil. Multiple visuals included soil classifications, which had impacts on the varying

soils' level of influence. And in other cases, the initial codes were too granular. For example, "tectonic plates" and "earthquakes" were condensed into the code, "seismic activity." Periodically, new actants arose in the dataset, and the code was expanded to include them. See Table 2 for the final coding schema.

The coding process adhered to the following guidelines. For each visual, we identified who or what was acting and on whom or what, their levels of influence (ranging from minimal impact to potentially unstoppable), and the kind of action staged (that is, programmatic, or preventing danger, death, or destruction; anti-programmatic, or increasing danger, death, or destruction; or neither). While primarily referring to the visual itself to make coding decisions, we also drew upon supporting text (e.g., labels, titles, captions, etc.).[21] Any instances of repeated or multiple interactions were coded. Visuals were coded with an emphasis on what was actually represented or what was intended by the designers (particularly in the case of technical visuals) as opposed to possible implications or how it might be received. For example, a visual that showed post-earthquake destruction might feature multiple, destroyed buildings and rubble but be devoid of people. While these ruined buildings would certainly have an effect on people moving forward (and it is, perhaps, natural as a human viewer to draw this connection), this interaction would not have been captured as part of the coding process because there was no direct or indirect staging of people.

The two raters independently coded the dataset over several days. At the completion of coding, interrater reliability was assessed using Krippendorff's Alpha, an interrater reliability

[21] As Dobrin and Morey (2009) point out, "While we might try to understand images alone, that is, without attaching to them an external language…to do so would be problematic and might also be unethical. Images rarely occur without any connection to text, and practical experience tells us that within our culture of communication, one must understand both media to make sense of the constant images that clamor for attention" (10).

Actant	
Seismic activity	Shaking levels, magnitudes, seismograph inscriptions, cracks in walls, etc.
People	Direct or indirect representations (e.g., city dots, an abundance of community markers)
Household objects	Tables, chairs, books, stairs, etc.
Infrastructure	Buildings, roads, plumbing, power supplies
Debris	Rubble, waste, remains, rough fragments of stone, brick, concrete, etc.,; objects that have been transformed substantially by seismic activity
Car	
Information	Knowledge about seismic activity, safety actions, etc.
Seismic hazards	Tsunami, landslide, liquefaction
Seismograph	The actual machine or its inscriptions
Historic faults	Faults with evidence of displacement in the last 200 years via recorded earthquake, displaced survey lines, or creep slippage
Holocene faults	Faults with displacement in the last 11,700 years without historic record
Bedrock	
Gravel/sand	
Soft muds	
Emergency responders	People specifically engaged in responding to post-disaster situations in official capacities
Heavy machinery	Bulldozers, cranes, etc.
Hardware	Safety latches, anchors, etc.
Land	2D and 3D representations of land (e.g., mountain, land mass)
Animals	
Level of Influence	
Limited	Minimal impact, often limited options for activity
Moderate	Some impact, but neither all-powerful nor passive
Substantial	Significant impact, potentially unstoppable, many options for activity
Kind of Action	
Programmatic	Activity that prevents danger, death, or destruction
Anti-programmatic	Activity that increases or imposes danger, death, or destruction
Neutral	Activity that contributes to neither program or anti-program

Table 2: Final coding schema

metric capable of handling many possible designs and data types (Freelon, 2010; Hayes & Krippendorff, 2007). Although guidelines for reliability vary, values above .80 on Krippendorff's α are generally understood to represent substantial agreement.

Code	*α*	*n*
Actants	.977	798
Level of Influence	.946	15492
Kind of Action	.927	15492

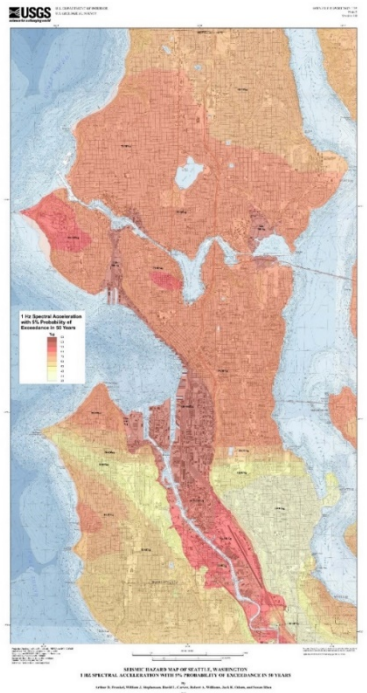
Table 3: Interrater reliability by code using Krippendorff's alpha

As seen in Table 3, the alpha values for each coding category indicate substantial levels of agreement. The relative infrequency of the application of some codes coupled with clear coding definitions (for example, the seismograph actant code) accounts for several of the particularly high levels of agreement. The total number of coding decisions (*n*) made is also included.

Artifact Analysis

To analyze the selected visual artifacts, I developed a data visualization approach for networked modeling of agency. Data visualization, or what many refer to as information visualization, is a productive step in making sense of a dataset because it "enables rapid interpretation of high quantities of information; enhances perception of trends, patterns, analogies, and threads; leads to new revelations about data and the way it is collected; facilitates understanding; and leads to hypothesis formation" (Gries, 2015, p. 127). Visualization can be more than an end product for delivering final results and findings; it can also be an integral part of the research process (Gries, 2015; White, 2010).

For each visual artifact, the coding schema was applied as described above to identify actants and the relationships among them. In the case of Figure 9, I identified seismic activity (as represented by the shaking levels), people, land, and infrastructure. For each identified actant, I



Source	Target	Level of Influence	Kind of Action
Seismic activity	Land	Limited	Anti
Seismic activity	Land	Moderate	Anti
Seismic activity	Land	Substantial	Anti
Seismic activity	People	Limited	Anti
Seismic activity	People	Moderate	Anti
Seismic activity	People	Substantial	Anti
Seismic activity	Infrastructure	Limited	Anti
Seismic activity	Infrastructure	Moderate	Anti
Seismic activity	Infrastructure	Substantial	Anti
People	Seismic activity	Limited	Programmatic

0: An urban seismic hazard map of Seattle, WA (left) with accompanying codes (right). This map, made by the USGS in 2007, shows the probability of ground shaking exceeding a certain threshold in a set number of years.

assessed if it was shown as acting on anything else (or if it was being acted upon) and in what ways. This information was then entered into Gephi 0.9.1, an open-source network analysis and visualization software used in various disciplines.

To facilitate the analysis and visual interpretation, I selected the Force Atlas layout algorithm. According to Mathieu Jacomy, one of the developers of Gephi and author of the Force Atlas layout algorithm, this particular algorithm's strength lies in its ability to allow the user to study the detailed properties of scale-free networks with the fewest biases possible. Force Atlas belongs to a class of networks known as force-directed algorithms. This algorithm uses the properties of the network to produce a layout that is aesthetically pleasing, flexible, and intuitive

while offering insights about the relationships between connections. It provides a high degree of accuracy for smaller datasets as well as fairly large ones and is particularly suited for networks in which every node is connected to relatively few nodes (Khokhar, 2015).

In Force Atlas, the placement of each node depends on the others. This process is heavily dictated by the connections, or edges, between nodes, which, like springs, attract their nodes. Nodes that have many shared edges are clustered, assuming that shared edges indicate similarity or closer relationship, and unrelated or distantly related nodes are repelled further apart. So, the position of a node cannot be interpreted on its own; it has to be compared to the others. Another concept that is made use of in force-directed algorithms is that of hubs and authorities. In a directed network, hubs are nodes with a high number of outgoing edges, and authorities are nodes with a high number of incoming edges. Force Atlas clusters the authorities towards the center of the graph, while the hubs get placed towards the periphery.

Force Atlas has several settings that can be used to impact the final layout, providing the user with new perspectives on the data and/or to solve a specific problem. Most of these settings affect the network's shape. For example, the "gravity" setting attracts nodes to the center of the network, preventing nodes that are far away from the center from drifting away. The stronger the gravity, the more attracted distant nodes are to the center. Another key setting is repulsion strength, which is the force repelling two nodes.

The visualization of any network involves design choices. In order to better answer my research questions, my final step was to make adjustments to the visualization settings and

appearance of the network**,** which I will go into in more detail shortly. Figure 10 is the final, exported network graph of Figure 9.[22]

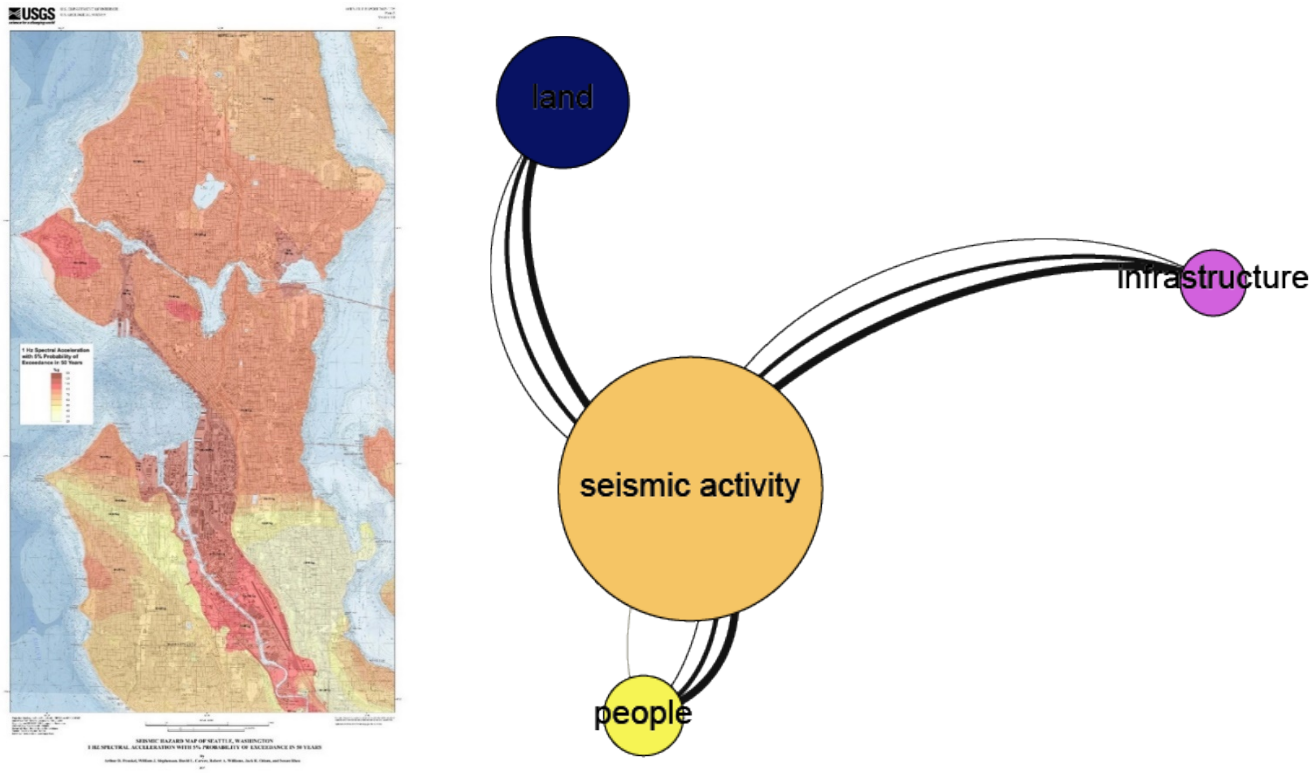


Figure 10: Network graph of agency (right) for the USGS (2007) urban seismic hazard map of Seattle, WA.

How to Read Gephi

In order to understand these network graphs, there are a few primary features to be aware of. Actants are represented by colored circles, or nodes. As seen in Figure 10, I identified four actants: infrastructure, land, seismic activity, and people. Each actant has been assigned a unique color to assist in cross-visualization analyses. The connections between the nodes are edges. An edge is drawn when one actant acts on another. So, these edges are directional.

[22] One visualization feature that Gephi does not currently support is multiple edges between the same actants. The program retains the data, but the visual output looks like there is only a single connection. To compensate for this, I used Adobe Illustrator to draw in the multiple edges as needed.

Several key pieces of information are encoded within the edges. The direction of the relationships between nodes is indicated by the curves of the edges, which can be read by following them in a clockwise direction. For example, in Figure 10, seismic activity is acting on infrastructure, land, and people, but only people are acting on seismic activity. The thickness, or weight, of each edge indicates the level of influence the source node has in relationship to the target node. Limited influence is 1, or the thinnest line; moderate, 3; substantial, 5. In Figure 10, each one of these weights is present in the edges connecting seismic activity and infrastructure. In other words, in the original hazard map of Seattle (Figure 9), seismic activity is shown to have substantial, moderate, and limited impact on infrastructure. Accounting for the level of influence helps me to account for agency's relational-ness. The color of the edges indicates whether the relationship contributes to the program of action – risk prevention – or an anti-program. Gray edges, like the one from people to seismic activity, indicate contribution to the program. The hazard map of Seattle suggests that while people are not particularly agential in the face of seismic activity, they can minimize their risk by avoiding areas of high hazard and/or relocating to areas of lower hazard. Black edges indicate anti-program actions, or actions that increase or impose risks, such as the effect of seismic activity on infrastructure. Tan edges indicate an action that contributes to neither. Finally, edge labels are used in special circumstances to indicate actions that are other than "transforms" or "acts on." See, for example, Figure 11. People were not transforming or acting on information. They were acquiring or enrolling it.

The design of the nodes also contains information about the original visual. For example, the larger a node, the more powerful it is. The smallest are the most passive. A node's size is

determined by its total out-going action. A quick assessment of Figure 10 readily shows that seismic activity is the dominant actant in this network while people, land, and infrastructure are relatively passive. Knowing the overall agentiveness, as staged by the artifact, is important to understanding what agencies are being staged and in what ways. While I recognize that connectedness is also a kind of power (see scholarship on actor-network theory, for example), that sort of power is visualized by layout position and edges. As mentioned earlier, each actant has been assigned a unique color to assist in analysis across the dataset. The only time a node does not have its unique color is when one actant enrolls another in order to act together. These assemblages are indicated by the shared node color, as shown in Figure 11. In this case, people

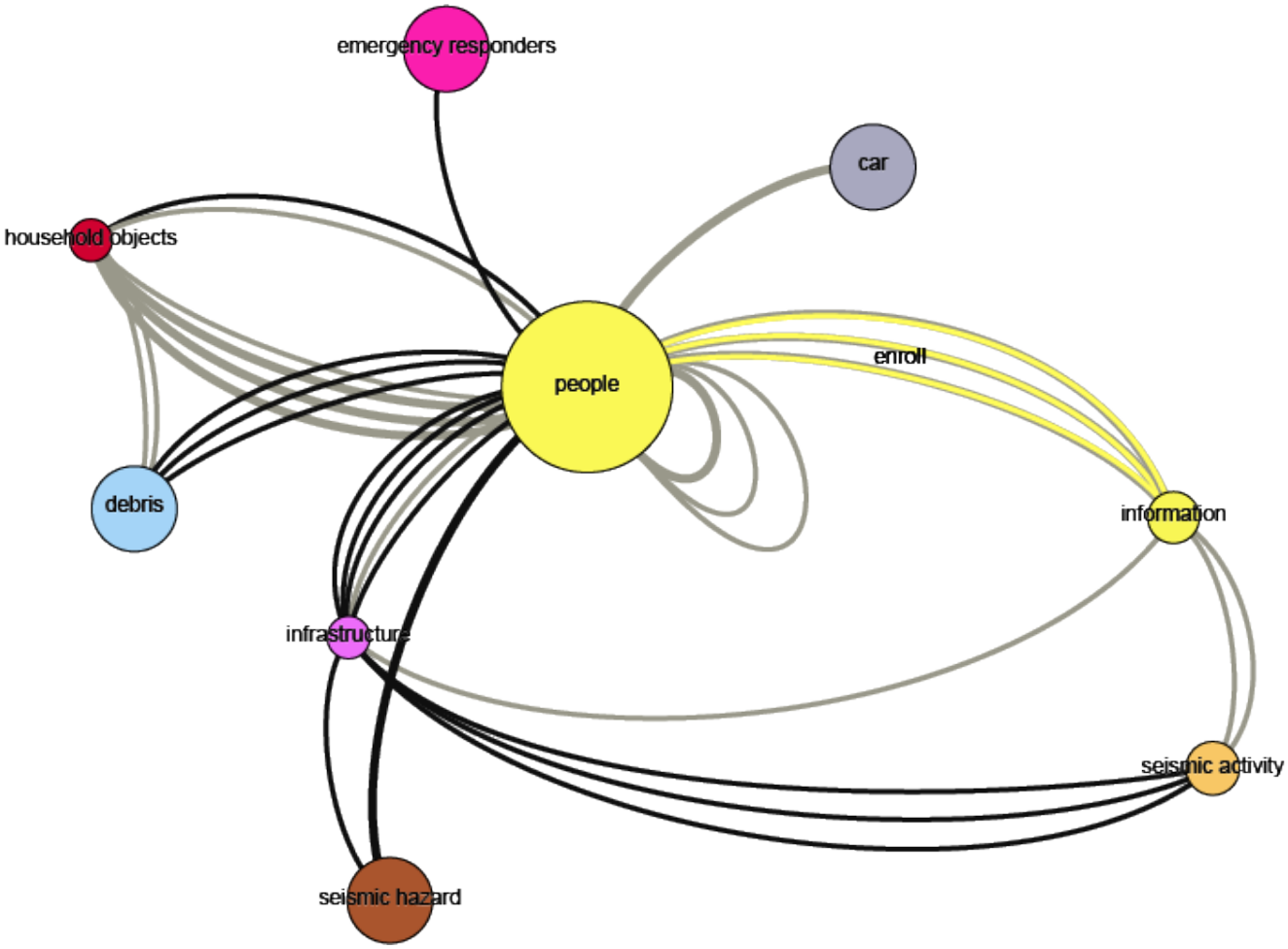


Figure 11: Network visualization from an infographic in the earthquake section of the DPC's (2007) The Civil Protection Handbook for Families

are enrolling information in order to increase their level of influence and ability to act on seismic activity. To further clarify the relationship, the core of the connecting edge shares the color of the nodes in the assemblage. The edges of the edge still retain the gray, black, or tan color scheme, as specified above.

Results

The final dataset consists of 21 network visualizations. Using these network visualizations, I quantitatively and qualitatively analyzed how agency was staged in my corpus of visual artifacts pertaining to seismic risk communication. As mentioned earlier, the visuals were well distributed across four genres: maps (6), photographs (6), technical data displays (5), and infographics (4). A total of 84 actants were identified across the dataset. The most common actants were seismic activity (20 instances), people (12), infrastructure (12), and land (8). 15 other unique actants were present, each appearing between one to four times across the dataset. Almost half of the networks (48%) were simple ones, involving only one to three actants. A third had four to five actants, while four were more complex, containing six or more actants. Overwhelmingly, the action in most (76%) of the visualizations was anti-programmatic (i.e. actions that do not contribute to danger prevention) with 15 networks consisting entirely of anti-program action and one being primarily anti-program. In only one network visualization was all the action contributing to the program; three other networks were mostly pro-program of action. One network visualization showed a balance of action between anti-program and program.

In keeping with this chapter's particular interest with agency in situations of uncertainty, I analyzed both the location and edge counts of the top three actants, both of which can be considered as proxy agency measures. The location of each node was classified as either "central" or "fringe." Incoming and outgoing weighted edges were counted and then divided to

create a ratio that could indicate the overall flow of the action. Five categories emerged from the dataset: passive, moderately passive, balanced, moderately active, and active. Passive nodes had zero outgoing edges, resulting in an undefined ratio. For example, people in Figure 12 are passive. Alternatively, an actant was considered active if it had zero incoming edges, resulting in a ratio of zero, such as the seismic activity node in Figure 12. Among the top three actants, these two categories were overwhelmingly common across the dataset (80%). There were also nine nodes that had both incoming and outgoing edges. An actant was considered moderately active if its ratio of incoming to outgoing edges was between 0.2 and 0.8. For example, the people node in Figure 11 had a total of 33 incoming edges; it also had 41 outgoing edges, giving it a ratio of 0.8. Alternatively, an actant was considered moderately passive if its ratio of incoming to outgoing edges was higher than 2. For example, the people node in Figure 10 had a total in-degree of nine

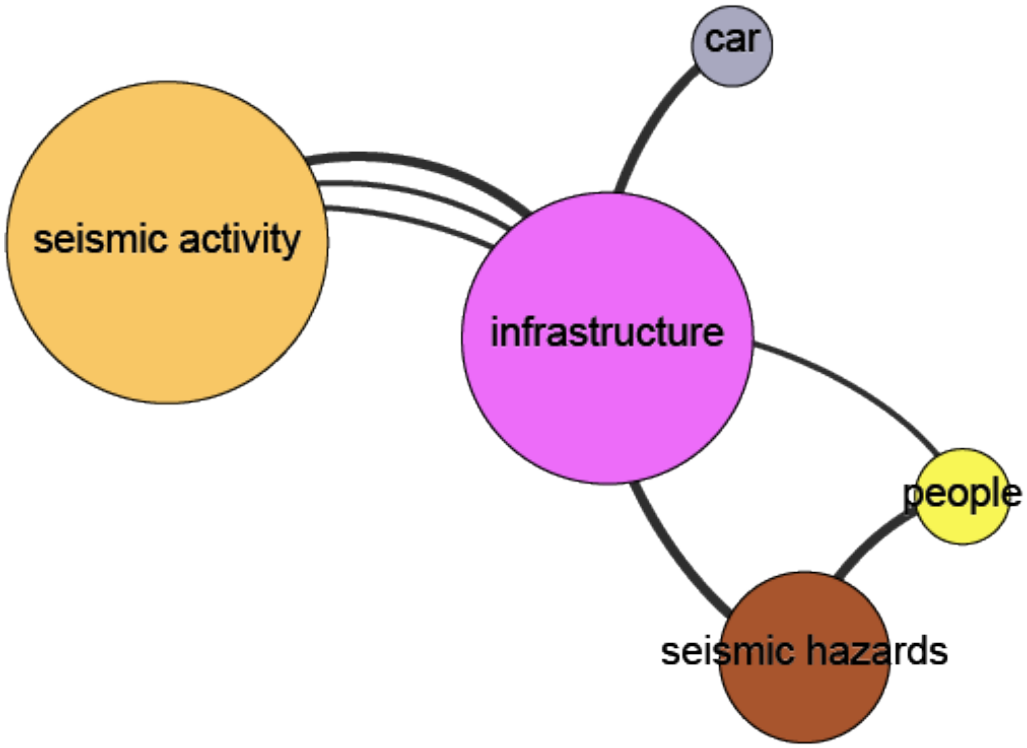


Figure 12: Network visualization of a photo collage emphasizing the multiple ways earthquakes cause damage. This visual comes from the USGS' Putting Down Roots in Earthquake Country.

and a total out-degree of one, giving it a ratio of nine. A balanced actant, the only example of which is infrastructure in Figure 11, had comparable numbers of in and out degrees, resulting in a ratio of one.

Across the dataset, seismic activity is, perhaps unsurprisingly, an active player. 81% of the time it appears, seismic activity has a fully active role. More often (14 times) acting from a central position in the network, seismic activity is also still very active (6 times) from the periphery. In other words, whether seismic activity is in close (or multiple) relationships (and thus densely articulated in the network) with other actants or not, it is consistently displayed as agential. Seismic activity is never staged in a passive or moderately passive position.

In comparison, people are shown to be passive 67% of the time. And they are twice as likely to be on the fringe of the network as they are to be centrally located. People are active, central agents only once and moderately active, central agents thrice. In other words, people *can* be strong, central actants. They can also be targeted victims, powerless and acted upon by many. But mostly, they're just peripheral. In a few cases, they can even impact themselves, for better and worse.

Similarly, infrastructure is most commonly shown as wholly passive (83%). It is twice as likely to occupy a fringe position in the network but also appears centrally. Unlike either seismic activity or people, infrastructure has the most variation in representation. Rather than being repeatedly staged in the same ways in these visuals, infrastructure has the greatest flexibility as an actant; it occupies the greatest diversity of positions across the passive-active and central-fringe ranges. It is also the only major actant that has an instance of being balanced.

Rhetorical Insights

These results suggest several key narratives about agency and how it is constructed by these visuals. In the face of seismic uncertainty, the primary message about the agential-ness of people is one of passivity.[23] One of the most common types of visuals in the dataset – and one of the more publicly displayed – is the hazard map. Widely accepted in geology and used by society to make major decisions, these maps predict the effects of future earthquakes of different magnitudes by assuming how likely certain areas are to have earthquakes. They show the distribution of earthquake shaking levels that have a certain probability of occurring in a specific area (USGS, 2015). Predicted hazard levels are typically represented by color with warm colors indicating the highest areas of hazard (i.e. greatest shaking). While seismologists like Selvaggi have touted the hazard map as "the only useful thing" for protecting people from seismic activity, these maps do very little to configure people as agentive.

Take, for example, Figure 8, the national Italian seismic hazard map produced by the INGV. The majority of the visual consists of a political map of Italy at a national scale with a small key and some brief descriptive text. In this visual, Italy is covered in vivid, eye-catching swaths of color, denoting the level of seismic hazard. This complete coverage of the level of hazard may be a useful strategy to help people understand that even in a situation of high uncertainty, danger is ever-present. However, this same strategy does little to configure people as agentive. In other words, if everywhere is dangerous, if everywhere seismic activity can act on people, what can people do? The only course of action seemingly suggested by the map is for people to move to areas of lower hazard. This action seems both overly simple in the face of a complex situation and unlikely given economic, social, and political concerns. In addition, users

[23] While their focus is on maps and mapping, Haraway (2007), Barton & Barton (2004), and Kress & Van Leeuwen (2006) all argue that the synoptic is totalizing. This is in line with my findings, although my dataset extends beyond maps.

of the map are likely to be further rendered passive by the technical nature of the map. While the intensity of the color scale quickly conveys a sense of increasing hazard to even the untrained eye, exactly what each color represents, in terms of the physical, lived experience of seismic activity, and what someone should do in response to living in that level of hazard, is unclear. So, users are alerted to the potential danger but left with no course of action. While this could be, in part, attributed to the purpose of the map, it is also a function of its intended audience. Indeed, very little on the map besides the color and political boundaries might be meaningful to a non-expert, further configuring a public viewer as passive and further troubling the suggestion on the part of the L'Aquila scientists to promote such maps as protective tools for people. These implications of these findings are all the more concerning given how common seismic hazard maps are in seismic risk communication and education efforts.

The foregrounding of the omnipotent nature of seismic activity is but one way that the "passive people narrative" is conveyed. Some visuals, such as Figure 13, also emphasize the range of other potential actants that could negatively impact the health and safety of people. In the case of an earthquake, people are also surrounded by and at the mercy of everyday actants, such as cars, electrical systems, and infrastructure. And in Figure 13, the page is literally surrounded by dangerous actants. These actants, which are typically allied with humans, can be mobilized by seismic activity to become just as destructive as an earthquake's shaking. While being informed and aware of other potential hazards is undeniably important, the message here is

so overwhelmingly anti-programmatic that, like the hazard map, people are placed in a passive role. Everything is acting on people, including more dispersed, blackboxed systems like plumbing and electrical power, all of which could easily induce resignation rather than resilience.

Further contributing to the potential for people to be seen as unable to act is the use of high presentational realism. Scholars are conflicted about the effectiveness of using of realism to help viewers better understand uncertain, risky situations (Kostelnick, 2013, Richards, 2015). While a high level of realism may be advantageous to convey elevated levels of danger or engage people's emotions, it may also, as Kostelnick et al (2013) point out, evoke fear or panic for users. The high level of realism displayed in Figure 13 (especially within the context of a wholly anti-programmatic message) could have a numbing/paralyzing effect on the viewer,

Figure 13: Photo collage from the USGS' Putting Down Roots in Earthquake Country

which is counterproductive for effective risk communication. The dramatic nature, for example, of the image of the fires in San Francisco's Marina District after the 1989 Loma Prieta earthquake (top left image of Figure 13) impresses upon the viewer the seriousness of this particular hazard but also its incredible scale and scope. In the face of multiple city buildings engulfed in flame, the options for action seem slim and insignificant.

Another key strategy in the dataset that seems to configure people in a passive role is repetition. Repetition is especially common in visuals that have a simple (1-3 actants) network, and it has the effect of reinforcing a particular power dynamic. This effect, while more or less apparent in the various visuals, becomes startlingly clear on the network visualizations. Overwhelmingly, the dynamic that is repeated is anti-programmatic. For example, Figure 14 is a graph generated by the USGS' citizen science program, Did You Feel It?, which collects information from people who felt an earthquake and creates visuals that show what people experienced and the extent of damage. In this technical data display, the two actants – seismic activity and people – are repeatedly interacting in the same way. Seismic activity, at substantial, moderate, and limited levels, acts on people. At least seventeen times (more if counting all reported data and not just the bins), people's passivity in relation to seismic activity is

emphasized. Confirming their limited agential role, people in this scenario are constrained to reporting the impact of seismic activity on themselves.

The primary message delivered by these visuals about the role of people may be one of

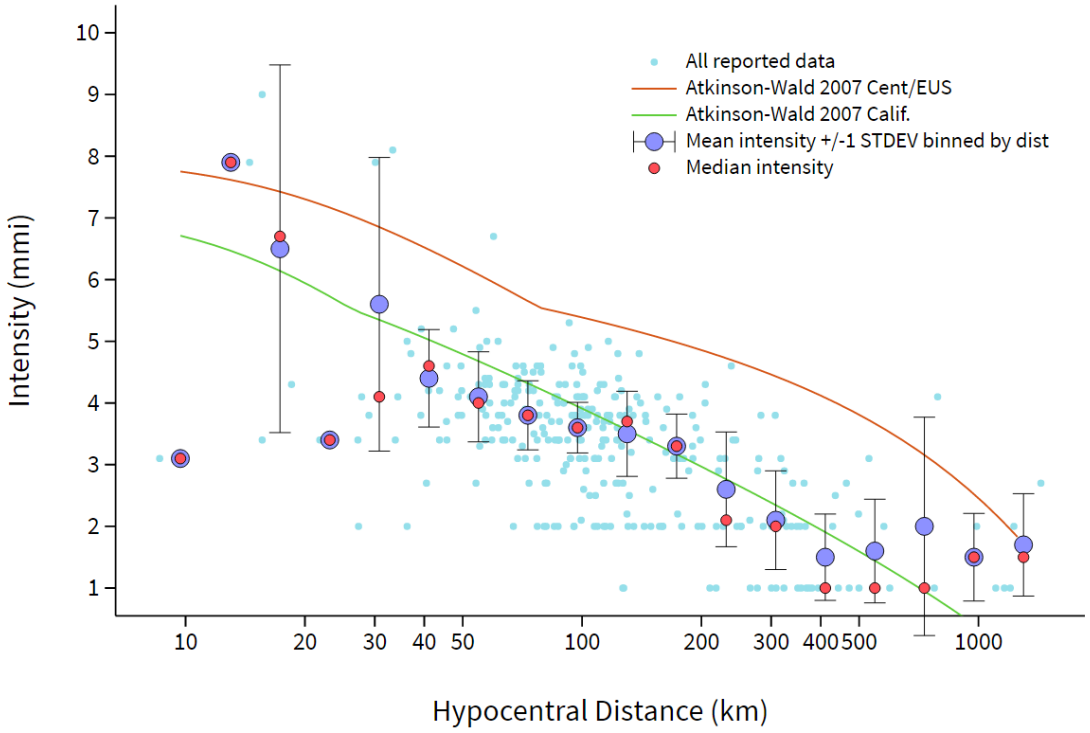


Figure 14: Sample graph created by the USGS' "Did You Feel It?" program

passivity, but it is not the only message. Sometimes, people are configured as being more active and having some kind of power to impact how they come through an earthquake. As mentioned in the results, people are central, powerful actants three times in the dataset. And when this is the case, they are consistently linked with non-human actants, such as information or anti-seismic hardware, suggesting that the enrollment of other actants is key to configuring people as active. Figure 15, an infographic created by FEMA to inform viewers about the hazards in their homes

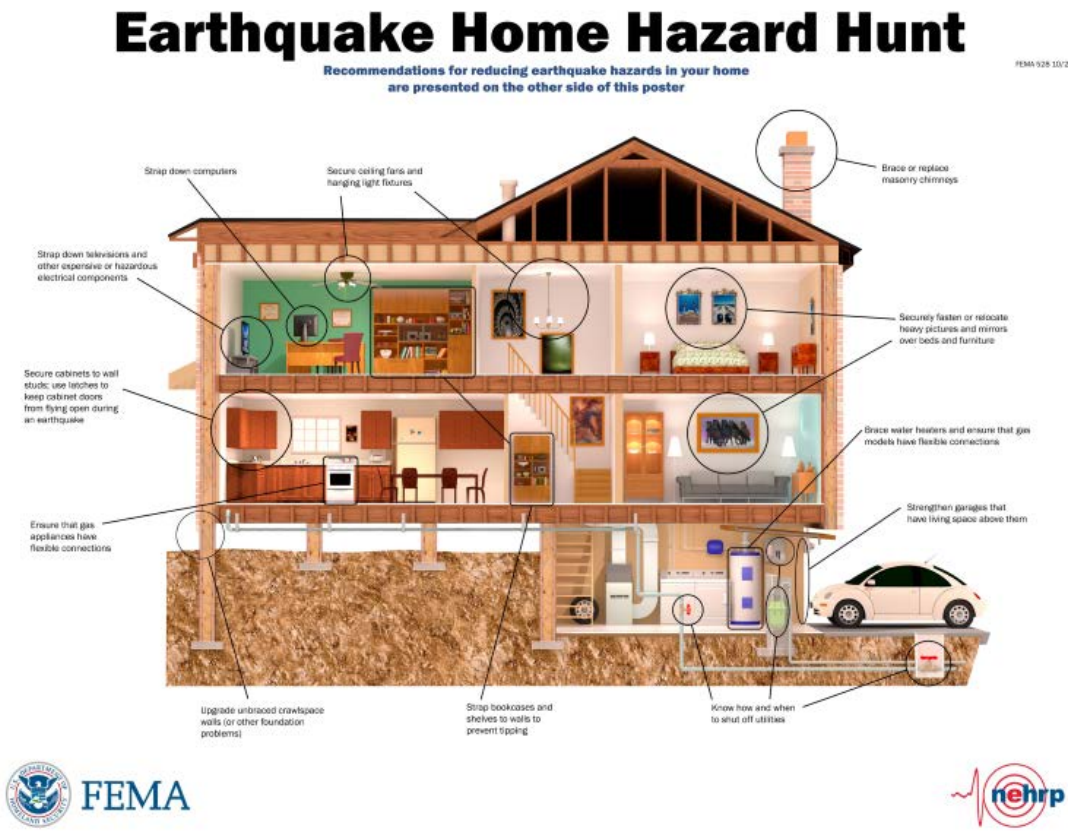


Figure 15: Infographic from FEMA

during an earthquake, proposes several assemblages as a strategy for helping people to lower their seismic risk before an earthquake occurs. For example, the viewer is advised to "know how and when to shut off utilities," suggesting that when people enroll information, they are better able to act in a manner that will increase their safety/resistance to seismic activity. Similarly, the infographic also advises people to enroll hardware as a means of becoming more powerful and active: "Use latches to keep cabinet doors from flying open during an earthquake." These specific suggestions for assemblages appear alongside other directives for home action, some of which imply enrolling non-human actants. A total of 12 different actions people can take to secure their homes are presented. In every part of the house, something can be done, and, by and large, the actions are quite manageable, like relocating large wall hangings over beds or securing computers to desks. There is no dramatic quality to the infographic. The illustration of the home

is realistic and orderly; the font is neutral; the language is similarly neutral, simple but directive. While the visual does assume a certain level of handiness and access to resources, people are undoubtedly configured as active and empowered, rather than passive.

Of course, human agency has its limits. All the preventative measures people are capable of taking cannot stop an earthquake from happening. So, another important part of configuring people as agential even in the face of uncertainty and loss of control, is considering how they respond to the event as well as how to prepare for it. Figure 16 provides one example of this. This photographic header is the beginning of the section on earthquakes in the DPC's *Handbook for Families*. One of the few visuals in the dataset to include actual people at all, these photographs emphasize people's position as central and active. The photographs capture a sense of energy and movement as they portray people engaging in various post-earthquake activities. Gender is not always identifiable, but, when it is, it is men who are doing the acting. Compared to other natural hazard sections in the handbook, this is the only one that features people in response as opposed to photographs documenting the hazard or its effect. Like Figure 13, the high presentational realism afforded by photography is at play here. But unlike Figure 13, the high level of realism and the dramatic action captured in Figure 16 is inspiring, as if modeling what is possible, rather than overwhelming. While they clearly have no control over the

Figure 16: Photographic header from DPC's The Civil Protection Handbook for Families

earthquake happening, the visual shows that people can control how they respond. And, according to the visual, the appropriate response is resilience. To be sure, the response portrayed here is idealized. Some elements of post-earthquake response are masked, like how long it can take to get from emergency response of photograph one to the reconstruction of photograph two. As they act on infrastructure, debris, heavy machinery, and other people, it's important to note that each photograph features a group of people. In other words, people are resilient in the face of seismic activity when they work together. Similar to the human/non-human assemblages of Figure 15, people can also enroll each other, or at least other men, in order to be agential.

Investing in Infrastructure

Given the stakes of communicating about seismic activity, it can be easy to focus on the human. But, I'd like to turn for a minute to infrastructure, which like people, was more often being acted upon. It is only shown as a powerful agent in two visuals – the majority of its action being anti-programmatic. That is, if it acted at all, infrastructure was staged as risky far more than helpful. This, of course, makes sense given that infrastructure is designed to be more or less invisible. As Johnson and Johnson (2016) point out, "When infrastructure is working, the resources it provides seem natural. For instance, access to water, electricity, or air travel is taken for granted until access to the water supply, the power grid, or airplanes is compromised. Functioning infrastructure is only transparent as long as it's functional." So, while infrastructure may be far more active than it appears, it is like to only appear active in situations, like a natural disaster, when it's no longer facilitating a relatively predictable experience.

But infrastructure in these visuals is a fairly central, connected actant, often with reciprocal relationships. For example, Figure 11 or Figure 12, which is the network graph for Figure 13. Interventionally, this seems to suggest possibilities for reducing seismic risk. As

Johnson and Johnson (2016) suggest, "infrastructure is rhetorical in that it attunes[24] audiences participating in the activities it supports." Particularly as a more connected actant in the networks, infrastructure is well positioned to contribute strongly to either programmatic or anti-programmatic activity. In other words, if infrastructure could be altered to be more active (that is, more resistant) in the face of seismic activity, it could affect other actants in the network and better support danger prevention or mitigation. The L'Aquila Seven noted this before and after the 2009 earthquake when discussing what measures could or should be taken in the historic town. The fact that is a common theme in post-disaster situations, when the failure of infrastructure becomes jarringly apparent, suggests that changing infrastructure is perhaps more difficult in practice to accomplish. As Johnson and Johnson (2016) point out, infrastructure is often held in place by a powerful network of actants itself, such as economic incentives. However, as they also point out, infrastructure are "at their most flexible during moments of strain when rules and protocols are more open for interpretation," which suggests a certain element of *kairos* is necessarily involved in making the kinds of changes I am suggesting. We may never be able to predict or impact seismic activity, but we can ally ourselves with our non-human neighbors.

Possibilities and Interventions

Taken together, this work supports a mixed methods data visualization approach as a useful way to examine what agencies are staged (and how) in risk visuals. It is important to keep in mind several things when considering the above analysis. First, this analysis takes the initial step of identifying potential agential configurations in visuals used in seismic risk communication. This step lays the groundwork for later examining the effects of these sorts of

[24] Johnson and Johnson (2016) draw upon Rickert's notion of attunement here. Rhetoric can "reattune or otherwise transform how others inhabit the world to an extent that calls for some action" (Rickert, 2013, p. 162).

visuals, but no data has been collected about how the public is responding to these documents and no analysis of their effectiveness has been conducted. Second, even though I have identified various rhetorical strategies in what often seem to be objective, transparent images, this does not necessarily imply intentionality. There is a long-standing critique within rhetoric and composition for presenting communication as something that an author, illustrator, or composer can be fully in control and conscious of. Indeed, the impact and possibilities of visuals is, in part, "due to the fact that [they] contain a surplus of value that cannot be fully controlled" (Schneider and Nocke, 2007, p. 17). Visuals are not immutable mobiles. They get reappropriated, repurposed, and ignored. They may even get "mangled," to use Andrew Pickering's image for the unpredictable transformations that are worked upon whatever gets fed into the old-fashioned device of the same name.

That being said, certain patterns about human agency in situations of seismic hazard did emerge in these visuals and may well have material consequences in terms of danger prevention and engaging publics. Some of these trends, like the overwhelming portrayal of people as agentiveless, are concerning, particularly because of the power we culturally invest in visuals and the increasing move to include visuals when communicating about complex and uncertain situations like seismic hazards. "You gonna die" visuals, such as the Italian hazard map (Figure 8), are not very helpful in the larger sense of learning how to protect oneself in the face of seismic activity. Being aware of the powerful, non-human actants that interact with us, as in Figure 13, is an important step but, similarly, not very helpful if it is the only one. These kinds of visuals, however, are what made up the majority of the dataset, which suggests that these anti-programmatic, passive relationships may well be the main messages being sent to viewers, which can set expectations for how people should act. This was true even of the visuals from more

public-facing documents, many of which were focused on scaring people or getting them to realize the incredible potential danger of seismic activity. The consequences of unsuccessful risk communication can result in injuries or even fatalities during or after a crisis. When citizens are not appropriately informed about what to do before, during, or after an earthquake, they are more vulnerable to accidents that could be avoided with proper information accessible.

I do not, however, want to be too quick to dismiss visuals that display anti-programmatic action as invaluable. While I am skeptical that making people feel small and powerless is the most effective way to help them become powerful, I wonder if this might be a strategy for catalyzing action. In our digital age, people have access to more information (and issues) than ever before. So, maybe a necessary step to engaging people in risk prevention is to first capture their attention and persuade them to take the issue seriously. As rhetoricians, we need to find ways of mapping *kairoi* as they arise to seismic risks – mapping the stress of morning commutes to the risk of infrastructure breakdown in the event of an earthquake; or mapping budget battles over infrastructure to disasters like Mexico City. Geologic time, the invisibility of seismic activity, and human misunderstanding of probability compounds the issue. As certain as these events are to occur over the long term, for any given place and time, earthquakes are low probability events. Those low odds of risk in the shorter term, the time frame humans pay attention to the most, are often dismissed. Instead, people pay more attention to, and worry more about, what is most salient. But a risk, like seismic activity, can become salient by showing up on our radar screen or by developing emotional connections or meaningful experiences with it.

I also wonder if visuals that are more anti-programmatic could contribute to decreasing (at least our sense of) uncertainty. They may make people feel more secure and in control because they can be used to establish, at least, an aesthetic of intelligence. In other words, we

may not know much, but let's focus on what we do know. As opposed to sticking our collective heads in the sand, these visuals can be read as evidence of the (often scientific) work being done to better understand seismic activity. Did You Feel It? graphs, like Figure 14, create, at the least, an illusion of doing something, of knowledge-building, even if they don't really position people as particularly powerful. Perhaps something useful (deliberative or not) is happening here, even if the visual itself is totalizing. Again, while I am skeptical that making people feel powerless is the most effective way to save lives, reducing the uncertainty of the situation to a more manageable level might also be important for catalyzing action.[25]

But ultimately, interventionally, we need visuals that configure people as agentive, that help them to enroll in the program of action. An important part of doing that is first understanding how power is being shaped in and by these visuals and through what means. As this analysis has demonstrated, visuals in seismic risk communication most often configure people as passive in the face of seismic activity, though there are exceptions. These visuals make use of strategies like color, repetition, tone, realism, genre, and content to configure the relationships among actants and their potential for action. Understanding these visuals as rhetorical can help to dismantle the tendency to treat visuals as certain, as truth.

However, this rhetorical nature is often masked by the perceived certainty of visuals. Indeed, one of the reasons why visuals are powerful and persuasive is because people think they are factual representations. Scholars such as Dragga and Voss (2001), Finnegan (2001), Kessler (2017), Walsh (2014), and Wysocki (2004, 2005) have challenged assumptions about the epistemic status of visuals, showing that they are crafted and designed. Joseph Dumit (2004)

[25] That being said, it is worth noting that organizations such as FEMA have said that effective earthquake education "fosters uncertainty, causing people to wonder about their environment and to question their safety in it." (FEMA, 2013.)

shows in his study of PET scan brain images that objects that make knowledge visible, as images do, are often treated as visual truth. Recognizing the tendency towards visual truth is important for considering how a particular visual might be received and interpreted.

Arguably, this tendency becomes even more significant when considering scientific visuals that will travel outside technical spheres, given the strong objective qualities associated with scientific practices. Visuals crafted by experts are often offered as a scientific salve for collective anxieties in situations of risk or uncertainty, "implying that the knowledge embodied in these visualizations might mitigate the risks of natural disaster, although they had no such ability" (Weisenfeld, 2012, p. 9). Critiquing the fetishism of the map, Donna Haraway (2007) states that they "would seem to be a reliable foundation, free of troping, guaranteed by the purity of number and quantification, outside of yearning and stuttering" (135). Visuals, such as the hazard maps the L'Aquila scientists offer above, may seem to make things seem clear and under control, but "that kind of clarity and that kind of referentiality are god-tricks" (Haraway, 2007, p. 135).

Challenging this perception may ultimately bolster expert-public communication and relationships by helping to curb what historian of science Naomi Oreskes noted as a more general societal expectation of "god-like omniscience and certainty in matters of earthquakes," an expectation that I surmise may be reinforced by the growing presence of visuals in risk communication (36). Additionally, if users and designers can recognize the rhetorical nature of these visuals, they can think critically about the choices being made and their potential ramifications.[26]

[26] Fostering public agency in situations of risk and uncertainty may also require looking at how publics resist and reinvent more technical risk visuals in order to create different forms of knowledge and different agentive trajectories. These "cartographies of struggle," as Donna Haraway (1997) has called them, are a response to the tendency of technical visuals to interpolate publics as subjects of expert knowledge and power.

In recognizing this rhetorical-ness, a door is opened for considering what other choices might be made instead, how they might be designed differently, which is its own kind of agentiveness in the face of seismic hazard: "What kinds of new arguments are possible (for example) if writers of academic pages take more responsibility in choosing the visual presentations of their arguments? What sorts of relationships can a writer establish with readers through different visual presentations?" (Wysocki, 2004, p. 125). Though Wysocki is addressing academic writers in particular, her question (and challenge) can apply just as well to technical experts seeking to communicate with non-experts. The visuals in this study that most often configured people as having some power to act a) were infographics that b) had more complex networks of agential relationships that included both pro- and anti-programmatic action. It may be that infographics have certain affordances, such as being a more familiar genre or better able to handle complexity, that make them well-suited for seismic risk communication. This is not to say that all seismic, visual risk communication should be done via infographic. Rather, that this genre may point to communication strategies that are worth identifying and incorporating in a more intentional way.

Configuring people as agentive, in this dataset, also entailed representing a complex network of agential relationships that included both pro- and anti-programmatic action. Despite tendencies to "simplify" technical situations, to "cut to the chase," or even the desire to tidy up a messy and uncertain matter of concern, this finding suggests a need for retaining a certain level of complexity. Visuals themselves are often perceived as a strategy for simplification. But that does not mean they need to be simple. For example, Figure 11 reveals a visual (see Figure 17 for a selection from the original visual) that contains more intricate relationships between a range of actants and a balance of both pro- and anti- programmatic action. While not the greatest act of

Figure 17: Sample from infographic from the DPC's The Civil Protection Handbook for Families

visual rhetoric, the infographic in Figure 17 retains a certain level of complexity. There is a give and take, a mutual shaping and intra-acting among a variety of components (Barad, 2007, p. 235). There are multiple pathways and strategies for action. By representing a more complex program of action, seismic risk visuals can avoid the extremes of "falsely optimistic" and "doomed," which creates greater opportunities for engagement and for multiple pathways and strategies for action. To return briefly to L'Aquila, if visuals such as seismic hazard maps are indeed "the only useful thing" for protecting people from seismic activity as Italian seismologist Giulio Selvaggi suggests (and fellow L'Aquila Seven member Enzo Boschi supports), it is

critical that these visuals provide a framework for the right kinds of action. The results of this chapter's analysis suggest one way forward.

Conclusion: Picking up the Pieces

The North Anatolian Fault extends for nearly a thousand miles across the northern edge of Turkey; in geologic circles, it's regarded as a sister fault to the San Andreas in Southern California. They are the same length and located at plate boundaries that slide past each other horizontally; they also slip at an equivalent long-term rate and have "creeping" middle sections. Both have major cities along their lengths. For all their sisterliness, the two faults have key differences. Most importantly, the North Anatolian is isolated from other faults, and it ruptures progressively in segments, like falling dominos. The San Andreas, which lies close to other major faults, is less defined. On a map, it appears to be one long, sweeping curve. In truth, it is less a single line than a broad, complex zone of parallel cracks, ranging in width from a few hundred feet to almost a mile, which exert influence on one another and keep the entire area in a state of constant tension.

Many dissertations might be more like the North Anatolian, advancing in a relatively linear progression, their chapters falling in succession like dominos. But this dissertation is more akin to the web of schisms that make up the San Andreas. There is a latticework of exigencies and variables that influence one another, often in ways that are difficult to untangle. So, if this work feels messy, that's because it is. There is no "single, golden thread that winds its way through the whole" (Galison, 1997, p. 844). Instead, it advances piecewise. But in so doing, there is a lamination of material. As my case suggests, matters of concern in general and earthquakes specifically are difficult to write and talk about, especially in a linear fashion. This dissertation has not escaped that fact. This is also why we need new approaches.

This project makes a case for developing scholarly approaches that better account for the complex and fraught nature of matters of concern in order to more clearly understand and

address these particularly sticky material-discursive situations and the difficulties inherent in communicating about them. Such developments can contribute to bolstering expert-public communication and relationships and to saving future lives. “Better accounting” for matters of concern is necessarily multifaceted. One such facet includes integrating three key concepts in rhetorical studies on public-expert interaction – expertise, uncertainty, and agency. As I have shown, treating these concepts in isolation only gets rhetorical theory so far in its attempts to address matters of concern. I have attempted to begin the work of integrating these concepts in the rhetorical approaches I offer here.

Each of the chapters of this dissertation offers possible ways forward. In Chapter 2, I offered an expertise of doing, which I apply to the L’Aquila controversy in order to show how practices shape what is known by various stakeholders and what is done. I argue that a practice-based orientation can enrich conversations about expertise and inclusion in matters of concern, reconfiguring how we might act in such situations as well as who could or should act. In Chapter 3, I applied a functional stasis analysis to the pivotal emergency meeting preceding the L’Aquila earthquake in order to better account for deliberative practices in uncertain science-policy controversies. I show how limiting deliberation to only credentialed experts in situations of deep uncertainty (i.e., handling the situation as a matter of fact) can lead to costly miscommunication and conflict between the deliberative practices and the expectations of the public. In Chapter 4, I explored the rhetorical, agentive nature of seismic risk visuals through agentive modeling in order to help make visible how these visuals act. Especially given the cultural power we attribute to images in general, these seismic risk visuals condition possibilities for response and action, with the most common narrative being one of passivity in the face of uncertain seismic activity.

In advancing these new approaches, these chapters also work more implicitly to entangle expertise, uncertainty, and agency. I do not mean to suggest that all three concepts are taken up in equal measure in all chapters or that that was the goal. Rather, my aim was to open new avenues of inquiry by beginning the process of entanglement. On that point, I find Heisenberg's Uncertainty Principle helpful to remember. This principle describes the relationship between the position and movement of subatomic particles, and the impossibility of simultaneously determining both. First proposed in 1927 by physicist Werner Heisenberg, it theorizes that the more precisely the position is determined, the less precisely the momentum is known in this instant, and vice versa. While this principle is not immediately relevant to earthquakes or rhetoric, it could easily apply to almost any area of inquiry. It speaks to the challenge of focusing on everything at once, which is an inherent challenge in matters of concern. This tension – between isolating and analyzing pieces of matters of concern and dealing with them together – is one that must continue to be negotiated. While such a feat may someday be possible, at this time, I must necessarily limit myself to more modest entanglements. Shuttling between different positions (isolation and various degrees of entanglement).

While it may not be possible to focus on everything at once, the situation is such that expertise, uncertainty, and agency *are* entwined and do influence each other. As Barad and others have pointed out, entities (e.g., things, words, objects, subjects) are constituted through their *mutual* entanglement with other entities. For example, uncertainty matters and is given meaning because of its relationship with agency. As we see in the days before the L'Aquila earthquake, uncertainty has agency; it can propel action and engagement. Its presence in a decision-making situation raises questions about who has expertise and how to determine what expertise is needed let alone how to act and who or what is authorized to do so. While agency is

often linked to having recognized expertise, it can also be extended to the previously marginalized by rethinking how expertise is defined. Indeed, it makes little sense to think about such an issue if one is not considering the relationship between expertise and agency. However, claiming expertise does not necessary confer agency, as Giuliani's example demonstrates. Alternatively, as scholars advance new understandings of agency, like Pickering's mangle or Barad's intra-action, these have impact on how we conceptualize expertise and how we understand uncertainty. Like decision-making, visuals are yet another ideal artifact for unifying agency, expertise, and uncertainty because they can be used to visualize uncertainty, construct expertise, and condition possibilities for response or action as well as act themselves – all of which could be happening concurrently. As Mol (2002) states, in practice such concepts are not treated in isolation, and "it makes no sense to delegate them to separate layers of reality. They are all relevant and have to be somehow reckoned with together" (155). While Mol is referencing the different practices and specialties involved in medical care, her argument transfers quite nicely here if we think of concepts like expertise, agency, and uncertainty as different areas of inquiry involved in attending to matters of concern. Like pathology or radiology, these concepts encompass different knowledge and practices, offering distinct points of leverage and methods of intervention.

Ultimately, the issues and questions raised here are left open. But surely, the first step is to consistently recognize that there are many entanglements in every action and situation. As Mol (2002) notes, open endings need not imply immobilization. Rather they indicate that there is work to be done. In the following discussion, I will suggest how this work can be extended and applied in other sites and, more generally, what this work might contribute to a more robust

theory of rhetoric and interventional practices. In so doing, I hope to foster additional work on risk communication, science-policy decision making, and visual rhetorics.

Ways Forward

One of the primary future directions for work that extends this dissertation is continued thinking about what "better accounting" for matters of concern entails. Part of this work, I argue, will be to continue to address the pervasive dualistic thinking that has long been recognized as one of the most challenging theoretical problems in Western philosophy. Scholars such as Graham (2015), Gronnvoll (2013), Pickering (2010), and Barad (2007) have drawn attention to the ways in which the postmodern project, despite providing alternatives and solutions to Cartesian binaries, has not transcended but reinscribed dualisms by privileging subjects over objects, humans over nonhumans, language over matter, culture over nature, and so on. As these scholars contend and as L'Aquila has shown, the upholding of binaries can be both unproductive and damaging. But truly dismantling them – in theory, method, and reality – is no simple matter. My work here aims to reinforce a shift to excavating vestiges of dualistic thinking from rhetorical theory and tools so that scholars can deeply engage with matters of concern, making rhetoric more robust in the process. In some cases, this will take the form of adapting existing rhetorical tools (i.e., functional stasis analysis) and in others it may require more novel innovation.

In particular, better accounting for matters of concern also entails continuing to explore the material alongside the discursive. Rhetoricians have successfully demonstrated that risk is socially constructed and that risk communication is a "difficult rhetorical enterprise that requires many different actors" (Danisch 174). But to render risk as a matter of discourse ignores the

physical, material reality of it.[27] One way this dissertation could be extended would be to more directly address the brute reality of seismicity. At times, I have mentioned and briefly discussed the material force of earthquakes, but these discussions have merely skimmed the surface of what a more thorough engagement with new materialism might produce. For example, how might earthquakes help us better understand matter's dynamic and sometimes resistant capacities (and thus enrich our thinking about agency)? What might be the rhetorical agency of an earthquake? More direct attention to vibrant materiality in matters of concern may require some methodological revisions. For example, one tool often used to help account for nonhuman actors is the network metaphor of ANT. While useful in many ways, it is limited in its ability to grasp situations that cannot be conceptualized as linear connection of nodes.

Materially, this dissertation's work could also be extended to attend more deeply to lived experience. As Fountain (2014) affirms, "We perceive, think, move, and feel through our whole bodily interactions and corporeal entanglements with the world around us…we are an assemblage made of bodies, objects, documents, discourses, and displays" (49). If this is the case, then there is an increasing need to understand peoples' embodied experiences if we are to better account for matters of concern. In the context of seismic activity, this is particularly relevant given the bodily experience of seismicity and seismology's extended efforts to erase bodies. But these embodied experiences are recurring for those living in seismically active areas. Following Sauer's (2003) work on mine safety, rhetoricians might work to capture the lived experience of those residing in seismically active areas in order to improve safety through more

[27] This is not to say that language and culture do not influence or engage with matter or that materiality should be privileged over language. As Coole and Frost (2010) argue, "society is simultaneously materially real and socially constructed…the challenge here is to give materiality its due while recognizing its plural dimensions and its complex, contingent modes of appearing" (27). Rhetoricians must continue to navigate the tension between language and materiality, to find ways to be with both. See Graham (2015), Mol (2002), Barad (2007), Bennett (2010).

effective documentation and engagement mechanisms. Alternatively, if we know that individuals are motivated by local concerns, personal experiences, and values, then what kinds of risk communication can tap into such motivations?

In the L'Aquila controversy, the voices of those who lived through the 2009 earthquake have been some of the least heard and, Pietrucci (2016) argues, most misrepresented. Foregrounding the lived experiences of the Aquilani, especially those involved in the trial, would provide an opportunity to improve our understanding of the controversial case but also produce a richer representation of the local experience of public communication of risk in L'Aquila prior to the earthquake. It would provide a chance to explore different rhetorical possibilities or opportunities that arise in specific contexts as well as the interrelatedness of public discourse, embodied experiences, nonhuman persuasion, and the ways spaces and places affect civic engagement.

Finally, in continuing to develop theory and interventions to better account for these messy material-discursive situations, rhetoricians must persist in asking "how to responsibly explore entanglements" (Barad, 2007, p. 74). How should we go about conducting this work? What do these cases require? For whom or what? How does that change by context? As the trials in the L'Aquila case suggest, part of better accounting for matters of concern takes on an ethical bent. Where does responsibility rest? Accountability becomes muddied as humans meddle more vigorously in natural processes (and in the case of earthquakes, contribute to human-induced seismicity) but also as nonhumans are increasingly recognized as actants. Who or what should be taken as the subjects and objects of ethical, legal, or political action? How will long-standing rhetorical concepts like epideictic rhetoric, with its emphasis on praise and blame, be impacted by evolving understandings of expertise, agency, and uncertainty?

Another path not taken here is examining the insights L'Aquila could provide on the role of science in decision making and policy. The L'Aquila case brings into sharp relief many of the issues under discussion in this area of research – what is the proper role of the expert in these contexts? If certainty is unattainable, how can scientists better act? How do we integrate expert knowledge with democratic processes that value public decision making? How can and do publics assert their own decision-making roles? The addition of the trial and manslaughter charges heightens the stakes. (See Walsh (2013) for extended discussion and her review of various models, including reinforcing the is/ought divide, the progressive model, the education model, and the "more seats for non-experts" model).

Beyond L'Aquila

This case study of L'Aquila is, in many ways, a forensic analysis of failure. As such, the lines of inquiry established here could be productively extended by juxtaposing it with less circumscribed cases. One artifact of the case I've chosen is that the science of risk and the emphasis on (and hunger for) seismic prediction emphasizes specific technical and quantifiably criteria and patterns of reasoning that dominate public imagination. But what about wicked problems that defy such patterns and have no clear decision even in retrospect? How might issues of expertise, uncertainty, and agency look different in cases of environmental policy and risk, sustainability, or community development, for which an answer, such as it might be, might be 20 years in coming? Even more so than L'Aquila, such cases highlight clashes in values as well as epistemic issues.

The communication failures exemplified in the case of L'Aquila might also be productively juxtaposed with examples of success. As Walker (2014) points out, there is an overwhelming tendency in rhetorical studies to focus on how communications fail or might have

been done better. This dissertation is no exception. But, Walker (2014) asserts, "rhetorical engagements in public science communication can benefit from providing examples of success" (4). The primary benefit he suggests is inspiring scientific audiences that they too can have successful communications, which might in turn aid rhetoricians' attempts at engagement. Particularly in light of the potentially chilling message the L'Aquila trial sends to scientific experts, circulating examples of success is critical, not just for providing inspiration but also for developing best practices.[28]

Visual Extensions

The work I have begun here with seismic risk visuals could be productively continued in several ways. As I mentioned in the previous chapter, my analysis of the dataset is not calibrated with viewer/user reactions. Conducting reception studies would provide insight about how exactly these visuals are contributing to, as Wysocki describes it, the "thick work [of] shaping how we see space and time and ourselves" (Fleckenstein, Hum, & Calendrillo, 2007, p. 83). Given the results of Chapter 4, a focus on infographics and social media might be particularly fruitful in order to better understand how to motivate risk-reducing actions and sustainable behaviors. Additionally, looking to successful risk visuals like hurricane probability maps may also provide insight. Simply visualizing complex scientific information to a public audience (e.g., mapping hazard levels) is insufficient because it lacks engaging, human components (Dragga & Voss, 2001). This information could then be used by rhetoricians to develop or refine communication and engagement efforts.

[28] Such work is also in line with recent publications in science policy literature, which suggests that science policy scholars who see to improve decision making in the context of deep scientific uncertainty should "look [for] empirical examples that work in certain situations and provide them not as recommendations but as options in a range of alternatives" that can be utilized in developing science policy, adapt as needed, or attempted and possibly disregarded (Logar, 2011, p. 264).

To be clear, my goal is not necessarily to help non-experts read risk visuals more like scientists. That is a technocratic outcome, and it requires a whole set of cultural affordances that can neither be administered to viewers like a vaccine nor fixed with the bandage of a color scale change on the USGS side. But if we can move past this kind of deficit model thinking, we can begin to advocate for and design hazard assessments and visuals that are more meaningful and real to non-experts, that better account for the whole story of "hazard."[29]

Additionally, future scholarship that directly engages methodologies for non-iconic visuals seems particularly important as the field moves toward interventional goals. Much of the visual rhetorical scholarship I have drawn upon (e.g., Gries, 2015), while incredibly insightful and helpful in my thinking, focuses on iconic images.[30] But none of the images in my dataset are iconic. How might some of the insights from new materialist-visual work such as Gries' be modified for studying non-iconic images or visuals that have developed in response to repeat situations? As Bazerman and Miller describe in their discussion of genres, "If a community or communities encounters the same class of crisis over and over again – such as natural disaster or foreign invasion – they predictably develop standard responses to it" (Walsh, 2013, p. 35-36). Though Bazerman and Miller do not specify, these responses could arguably include visual ones. Surely, visuals that develop in response to recurring situations (visuals that are perhaps more mundane and widespread) can mediate and live rhetorical lives just as iconic ones do, rhetorical

[29] As L'Aquila (among other cases) shows, some of the impacts of natural hazards, which are brutal for some inhabitants (particularly marginalized ones) are not shared by technocratic organizations like the USGS or the DPC (e.g., power staying cut-off to low income housing for much longer than high-income in the heat of summer, or groceries making it to Beverly Hills but not Compton for weeks). Primary concerns of these organizations, like lost real estate and damage to national security and public infrastructures are important but not the whole story.
[30] Iconic a la Hariman and Lucaites (2007): "images appearing in print, electronic, or digital media that are widely recognized and remembered, are understood to be representations of historically significant events, activate strong emotional identification or response, and are reproduced across a range of media, genres, or topics" (27).

lives that are equally if not more important to understand because of their accessibility and presence.

Not By Theory Alone

Communication about matters of concern remains a particularly difficult challenge. But I see this challenge as a window of opportunity for research and action – a *kairotic* moment. As Crowley and Hawhee (2004) describe in their work on *kairos*, for ancient rhetoricians like Isocrates, "the urgency and currency of a situation demands action" (40). Critical engagement, in other words, is not just the current trend; it is part of the rhetorical tradition. This early call to involvement and intervention is echoed in contemporary rhetorical work. Ceccarelli (2013), for example, calls rhetoricians to more overtly address how they engage in public scholarship in order to more effectively transform scholarly findings into action in non-academic fora. She is joined in this call to turn rhetorical theory, concepts, and findings into practical strategies and tools by a number of contemporary scholars (Druschke, 2014; Goodwin, 2014; Herndl & Cutlip, 2013; Parks, 2014; Walker, 2014). I am invigorated by this ancient and contemporary resolve that our task as rhetoricians is multifaceted. We must both criticize and construct; we must be willing to identify the problem and work to recommend solutions. In light of the L'Aquila controversy, with its palpable material consequences, it seems clear that these kinds of situations cannot be left to theoretical work alone.

Therefore, an additional purpose of this chapter is to begin to transform the insights from this dissertation into a few practical suggestions for those engaged in communication and deliberation about seismic risk (with the intention of scaffolding civic agency and designing spaces of interaction). These suggestions are five-fold: 1) disrupt the promise of closure; 2) meet

people where they are; 3) recognize that visuals do real, rhetorical work; 4) make use of "peace time"; and 5) reconcile expertise and citizenship.

1. **Disrupt the promise of closure**. In matters of earthquakes, much of society seems to expect god-like omniscience and certainty. Accordingly, much of the discourse focuses on prediction – will or won't there be an earthquake? But that question as well as the question of what to do is unlikely to be resolved with facts. Experts need to resist answering "yes or no" questions because seismology cannot provide those kinds of answers. As seen in L'Aquila, making reassuring or trivial statements, both of which tend to provide closure and certainty, can be incredibly problematic. Instead, experts should acknowledge scientific uncertainties while still speaking to what is known. Information should be publically available, with uncertainties clearly expressed, during periods of normal seismicity as well as during seismic crises. People expect experts to be certain, but when they are not, it can cause people to pay more attention and think more deeply about what is going on. Additionally, by not making unfulfillable promises of closure, experts can work to build trust with public audiences.
2. **Meet people where they are – communicatively**. Experts (e.g., politicians, civil servants, and scientists) need to do a better job of meeting non-expert stakeholders where they are. Too often, experts speak strictly on technical terms and, in the case of L'Aquila, adopt a paternalistic approach to communication. Instead, experts should consider what sorts of motivations, decisions, and needs non-expert stakeholders have; they should listen to and inquire about the concerns, questions, and positions held by non-experts. Organizations like the DPC or the USGS might be primarily concerned with the cost of lost real estate and infrastructure, but a sole emphasis on those concerns may only be

partially effective. Particularly in the case of seismic risk, disaster is universal but it is also particular and embodied (Coen, 2013; Weisenfeld, 2012). So, more than the issue of making scientific findings more accessible (i.e., content delivery), experts need to understand local hazard conditions, locally available resources, and local experience when thinking about how to best communicate about seismic risk with non-experts.

3. **Recognize that visuals do real, rhetorical work.** Understanding the rhetorical nature of visuals is central to grasping their possibilities and challenges, to taking them seriously. Visuals crafted by experts are often offered as a scientific salve for collective anxieties in situations of risk or uncertainty, "implying that the knowledge embodied in these visualizations might mitigate the risks of natural disaster, although they had no such ability" (Weisenfeld, 2012, p. 9). As the previous chapter shows (along with other scholars), visuals do real work; they are not secondary or add-ons. There are choices to be made when creating a visual, and those choices (as represented in and by the visual) will have impact. Contrasting this perspective against more traditional approaches to visuals prompts the question: "What kinds of new arguments are possible (for example) if writers of academic pages take more responsibility in choosing the visual presentations of their arguments? What sorts of relationships can a writer establish with readers through different visual presentations?" (Wysocki, 2004, p. 3). Though Wysocki is addressing academic writers in particular, her question (and challenge) can apply just as well to technical experts seeking to communicate with non-experts. By understanding the rhetorical nature of visuals and taking an active role in their design, experts can begin to lay the groundwork for designing and deploying usefully persuasive graphics.

4. **Make use of "peace time."** In many communities, seismicity is a recurring event. And while any seismic situation is necessarily unique and must be treated as such, experts can draw upon the typical responses, needs, and motivations that affect stressed stakeholders to develop possible responses. Crafted without the pressures of a seismic crisis on hand, these typified responses can be adapted to a particular context as needed and circulated rapidly. One example is responses to earthquake prediction claims. Imagine if in L'Aquila, rather than a knee-jerk reaction to silence Giuliani, the DPC had deployed some version of a proactively designed response, one in which scientific, governmental, and communication experts had collaborated. The 'prediction effect' brought on by Giuliani might have been diffused. With less pressure for immediate responses and action, communities can work to provide publics with open sources of information at regular intervals, not just during seismic crises.

   The interludes between increases in seismic activity are also opportunities to engage in more holistic approaches to planning and reducing risks across environmental, social, economic, and political landscapes. "Peace time" provides an opportunity to build a shared understanding of risks, consequences, and options. Adaptions, like constructing new infrastructure, reorganizing vulnerable systems, or retrofitting existing infrastructure, take time to plan, design, agree upon, fund, and implement. But a shared understanding among key stakeholders can help to streamline a community's efforts to become more earthquake-resilient. One way to do this is by holding events or workshops that bring together stakeholders with different perspectives to facilitate conversation and co-produce strategies and/or policy. To help catalyze robust dialogue around difficult topics, event facilitators can identify key boundary objects (e.g., maps, simulations, decision-

making software, concepts) to guide and focus discussion. (See, for example, Wilson & Herndl, 2007).

5. **Reconcile expertise and citizenship**. A commonly voiced challenge for science-policy decision making is to recognize that publics can have expertise. This dissertation certainly echoes that point. But it is also important for science-policy decision making that experts be recognized as citizens. In their attempts to remain objective and protect their *ethos,* scientific experts often compartmentalize their identities (Walsh, 2009). But, at the end of the day, scientists are people who are connected to local communities. As such, they, as fellow citizens, have a certain level of accountability to that community both in their scientific work and in their clear communication about their work. As members of the L'Aquila Seven have pointed out during the trials, they did not directly contribute to the false information or reassuring messages distributed to the Aquilani. But neither did speak up to correct it. So, in this case there is a reversal – instead of protecting their credibility by being detached, scientists could have protected it by being involved. I do not mean to suggest that scientific experts should always have their citizen hat on. The roles we all play necessarily shift depending on the rhetorical situation. But we do need to make room for expertise and citizenship to co-exist – because in reality, they do, but also because we need them to if we are to ethically address matters of concern. And while I am primarily thinking about scientists here, this point applies to political and governmental experts, too. Political officials also have a responsibility to communicate risks to their fellow citizens, though in their case, without sacrificing the science to politically palatable messages. Political and technical discourses can be understood as

more than just managing public issues; they can also be fundamental acts of what Asen (2004) has called citizenship engagement.

Final Reflections

The questions and the issues raised over the course of this project have lead me into complicated theoretical terrain. The case and examples I have examined in this project offer insights in a number of areas of study, as I have previously suggested. In this concluding chapter, I have attempted to provide readers with academic fodder and move our discipline a little further toward drawing practical conclusions from our complex theories. I am confident that the approaches advocated for in this dissertation lay the groundwork for more directly interventional work. Such a movement to engagement is not only possible but an important part of the rhetorical tradition. And as L'Aquila (and subsequent central Italian earthquakes in 2016) shows, even nations on the forefront of seismic research, with comparatively sophisticated disaster preparedness, need to realize that much more work remains to be done. These are pressing opportunities for rhetoricians interested in science-policy deliberation. In the end, I hope this project motivates rhetoricians of science to continue theoretical and applied work on MOCs.

Reporters, scientists, bloggers, scholars and more have been quick to point to the lessons learned from L'Aquila. They cite lessons about risk communication, about ethics, about relationships between science and politics, between science and the public; many fear that scientists will take a lesson in "clamming up." But L'Aquila, like any matter of concern, resists closure and easy conclusions. Perhaps its greatest lesson is one we have yet to learn - how to live with uncertainty. Uncertainty, which we've always lived with, is magnified immediately before and after major earthquakes. But it recedes after a time, like the memory in this country of the San Francisco earthquake of 1906. While the L'Aquila controversy is still fresh in our minds, my

hope is that this dissertation can catalyze changes in our understanding and actions towards disaster. L'Aquila is but one of many reminders that we exist in a geologic time and in a world where catastrophic events beyond our predicting may occur, that we exist precariously on the surface of this volatile planet. Seismology may not be able to provide us with the answers we desire. But that doesn't mean we should not "seek…worthwhile ways of living with the real" (Mol, 2002, p. 158).

References

Alexander, D. E. (2010, December 30). *An evaluation of the recovery strategy after 6 April 2009 earthquake in L'Aquila*. Retrieved from Disaster Planning and Emergency Management: http://emergency-planning.blogspot.com/2010/12/evaluation-of-recovery-strategy-after-6.html

---. (2010). The L'Aquila Earthquake of 6 April 2009 and Italian Government Policy on Disaster Response. *Journal of Natural Resources Policy Research*, 325-342.

---. (2014). Communicating Earthquake Risk to the Public: The Trial of the "L'Aquila Seven." *Natural Hazards*, 72, 1159-1173.

Althusser, L. (1971). *Lenin and Philosophy and Other Essays.* (B. Brewer, Trans.) New York: Monthly Review Press.

American Geographical Union. (2010). AGU statement: Investigation of scientists and officials in L'Aquila, Italy, is unfounded. Eos, Transactions of the American Geophysical Union, 91, 248.

Archer, L. (2014). *Validating Vaccines: Understanding the Rhetorical Dynamics of Expertise Amid a Manufactured Controversy*. Diss. University of Washington.

Asen, R. (2004). A Discourse Theory of Citizenship. *Quarterly Journal of Speech, 90*(2), 189-211.

Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Durham, NC: Duke University Press.

Barnes, B. & Bloor, D. (1995). *Scientific Knowledge: A Sociological Analysis.* Chicago, IL: University of Chicago Press.

Barton B. F., & Barton, M. S. (2004). Ideology and the map: Toward a postmodern visual design practice. In J. Johnson-Eilola & S. A. Selber (eds.), *Central works in technical communication* (pp. 232-252). New York, NY: Oxford University Press.

Beck, U. (1992). *Risk Society: Towards a New Modernity.* London, UK: Sage.

---. (1999). *World Risk Society.* Malden, MA: Blackwell Publishers.

---. (2009). *World at Risk.* Malden, MA: Blackwell Publishers.

Bennett, J. (2010). *Vibrant Matter*. Durham, NC: Duke University Press.

Bertolaso, G. (2009, March 30). A summons to hold a meeting in the Abruzzo Region. Retrieved from https://processoaquila.files.wordpress.com/2012/10/2cgr-convoc-310309.pdf

Bijker, W.E., Bal, R., & Hendriks, R. (2009). *The Paradox of Scientific Authority: The Role of Scientific Advise in Democracies.* Cambridge, MA: MIT Press.

Birdsell, D. & Groarke, L. (1996). Toward a Theory of Visual Argument. A*rgumentation and Advocacy*. 33, 1-10.

Block, M. (2013, February 18). Italian seismologists convicted of manslaughter. All Things Considered. National Public Radio. Retrieved from http://www.npr.org/2012/10/23/163499530/italian-seismologists-convicted-of-manslaughter

Blythe, S., Grabill, J.T., & Riley, K. (2008). Action Research and Wicked Environmental Problems: Exploring Appropriate Roles for Researchers in Professional Communication. *Journal of Business and Technical Communication*, 22, 272–98.

Bogost, I. (2012). *Alien Phenomonology, or What It's Like to Be a Thing*. Minneapolis, MN: University of Minnesota Press.

Bone, J. (2012, October 24). Shock over Italian quake scientists' kill verdict. The Australian. Retrieved from http://www.theaustralian.com.au/news/world/ shock-over-italian-quake-scientists-kill-verdict/story-fnb64oi6-1226501812363
Boschi, E. (2013). L'Aquila's Aftershocks Shake Scientists. *Science, 341*, 1451-1452.
Bostrom, A., Anselin, L., & Farris , J. (2008, April 11). Visualizing seismic risk and uncertainty: a review of related research. *Annals of New York Academy of Science*, 29-40.
Brander, R. W., Drozdzewski, D., & Dominey-Howes, D. (2014). "Dye in the Water" A Visual Approach to Communicating the Rip Current Hazard.". *Science Communication, 36*(6), 802-810.
Brasseur, L. E. (2003). *Visualizing Technical Information: A Cultural Critique.* Amityville, NY: Baywood.
Brown, T. (2012, October 23). A chilling verdict in L'Aquila. The Guardian. Retrieved from http://www.theguardian.com/science/2012/oct/23/chillingverdict-laquila-earthquake
Bryant, L. (2011). *The Democracy of Objects*. London: Open Humanities Press.
Buehl, J. (2016). *Assembling Arguments: Multimodal Rhetoric and Scientific Discourse.* Columbia, SC: University of South Carolina Press.
Callon, M., Lascoumes, P., & Barthe, J. (2009). Acting in an uncertain world: An essay on technical democracy. Cambridge, MA: MIT Press.
Campbell, K.K. (2005). Agency: Promiscuous and Protean. *Communication and Critical/Cultural Studies*, 2(1), 1-19.
Caporale, G. (2012, January 18). Quando Bertolaso riun`ı gli esperti di terremoti ''Mi servono per un'operazione mediatica.'' La Repubblica. Retrieved from http:// inchieste.repubblica.it/it/repubblica/rep-it/2012/01/18/news/il_terremoto_negato28369392/
Cas, R. (2012). The IAVCEI response to the conviction of the six scientists in Italy over the 2009 L'Aquila earthquake disaster and the issues arising. IAVCEI News, 4, 2–3.
Center for Disease Control (CDC). (2014). *Crisis and Emergency Risk Communication.* US Department of Health and Human Services.
Ceccarelli, L. (2011). Manufactured scientific controversy: Science, rhetoric, and public debate. *Rhetoric and Public Affair*s, 14, 195–228.
---. (2013). To whom do we speak? The audiences for scholarship on the rhetoric of science and technology. *Poroi, 9*(1), Article 7. doi:10.13008/2151-2957.1151
Cello, G., Mazzoli, S., & Tondi, E. (1998). The crustal fault structure responsible for the 1703 earthquake sequence of central Italy. *J Geodyn*, 443-460.
Cicero. (1939). *Brutus. Orator.* (Vol. V). (G. Hendrickson, & H. Hubbell, Trans.) Cambridge, MA: Harvard University Press.
Ciccozzi, A. (2013). *Parola di scienza: il terremoto dell'Aquila e la Commissione Grandi rischi : un'analisi antropologica.* Rome: DeriveApprodi.
Civil Protection Department. (n.d.). Retrieved December 23, 2016, from Protezione Civile: http://www.protezionecivile.gov.it/jcms/en/dipartimento.wp;jsessionid=DF8A321E0E6050BFC9087A9FFD0011DF.worker1
Civil Protection Department, Presidency of the Council of Ministers. (2006, April 3). Presidential Decree of the Councils of Ministers No. 1250. Retrieved May 9, 2014, from http://www.protezionecivile.gov.it/resources/cms/documents/ DPCM_03_04_2006.pdf

Cocco, M., Cultrera, G., Amato, A., Braun, T., Cerase, A., Margheriti, L., . . . Todesco, M. (2015). The L'Aquila Trial. In S. Peppoloni , & G. Di Capua, *Geoethics: the Role and Responsibility of Geoscientists* (pp. 44-58). London: Geological Society.

Coen, D. (2013). *The Earthquake Observers: Disaster Science from Lisbon to Richter*. Chicago, IL: University of Chicago Press.

Collins, H. (2004). Interactional Expertise as a Third Kind of Knowledge. *Phenomenology and the Cognitive Sciences*, 3, 125-143.

Collins, H. (2011) Language and practice. *Social Studies of Science*, 41(2):271–300.

---. (2016). Studies of Expertise and Experience. *Topoi*. doi:10.1007/s11245-016-9412-1

Collins, H. M. & Evans, R. (2002). The Third Wave of Science Studies: Studies of Expertise and Experience. *Social Studies of Science*, 32(2): 235–96.

---. (2003). King Canute Meets the Beach Boys: Responses to the Third Wave. *Social Studies of Science*. 33(3), 435-452.

---. (2007). *Rethinking Expertise.* Chicago: University of Chicago Press.

---. (2015). Expertise Revisited, Part I - Interactional Expertise. *Studies in History and Philosophy of Science*, 54, 113-123.

---. (2017). The Bearing of Studies of Expertise and Experience (SEE) on Ethnography. *Qualitative Inquiry, 23*(6), 445-451.

Collins, H., Evans, R., & Gorman, M. (2007). Trading Zones and Interactional Expertise. *Studies in History of Philosophy of Science*, 38(4), 657-666.

Collins, H., Evans, R., Ribero, R., & Hall, M. (2006). Experiments with Interactional Expertise. *Studies in History of Philosophy of Science*, 37, 656-674.

Collins, H., Evans, R., & Weinel, M. (2016). Expertise Revisited, Part II: Contributory Expertise. *Studies in History and Philosophy of Science*, 56, 103-110.

Collins, H. & Weinel. M. (2011). Transmuted Expertise: How Technical Non-Experts Can Assess Experts and Expertise. *Argumentation*, 25, 401-413.

Collins, H., Weinel, M., & Evans, R. (2010). The Politics and Policy of the Third Wave: New Technologies and Society. *Critical Policy Studies*, 4(2), 185-201.

Commission of Grand Risk. (2009, March 31). Meeting of March 31, 2009— L'Aquila [Meeting minutes]. Retrieved from https://processoaquila.files.wordpress.com/2012/11/3b-bozza-cgr-310309eng.pdf

Condit, C.M., Gronnvoll, M., Landau, J., Shen, L., Wright, L., Harris, T.M. (2009). Believing in both genetic determinism and behavioral action: A materialist framework and implications, *Public Understanding of Science*, 18(6), 730-746.

Coole, D. & Frost, S. (2010). *New Materialisms: Ontology, Agency, and Politics*. Durham, NC: Duke University Press.

Cooper, M. M. (2011). Rhetorical Agency as Emergent and Enacted. *College Communication and Composition, 62*(3), 420-449.

Crick, N. (2014). When We Can't Wait on Truth: The Nature of Rhetoric in the Rhetoric of Science. *Poroi*, 10(2), 1-27.

Crowley, S., & Hawhee, D. (2004). *Ancient Rhetorics for Contemporary Students* (3rd ed. ed.). Needham Heights: Allyn, Bacon, and Longman.

Danisch, R. (2010). Political Rhetoric in a World Risk Society. *Rhetoric Society Quarterly, 40*, 172–192.

Danisch, R., & Mudry, J. (2008). Is it Safe to Eat That? Raw Oysters, Risk Assessment and the Rhetoric of Science. *Social Epistemology, 22*(2), 129-143.

Davis, G. H. (2012, October 25). Italian court action likely to harm efforts to mitigate earthquake losses. Geological Society of America. Retrieved from http:// www.geosociety.org/news/pr/12-76.htm
Defossez, E. (2016). Between Control and Constraint: Charting Three Rhetorics of Patient Agency. *POROI*, 12(1), 1-21;
DeLuca, K.M. (1999). *Image Politics: The New Rhetoric of Environmental Activism*. New York: Guilford Press.
Department of Civil Protection. (2007). *The Civil Protection Handbook for Families.* Retrieved from www.protezionecivile.it
DeVasto, D. (2015). Being Expert: L'Aquila and Issues of Inclusion in Science-Policy Decision Making. *Social Epistemology*. doi:10.1080/02691728.2015.1065928
Ding, H. (2009). Rhetorics of alternative media in an emerging epidemic: SARS, censorship, and extra-institutional risk communication. *Technical Communication Quarterly, 18*, 327-350.
Dixon, Z. P. (2016). Material Expertise: An Ontological Approach to Stakeholder Participation in Marine Policy. *Marine Policy*, 72, 107-114.
Dobos, A. R., Orthia, L. A., & Lamberts, R. (2015). "Does a picture tell a thousand words? The uses of digitally produced, multimodal pictures for communicating information about Alzheimer's disease.". *Public Understanding of Science, 24*(6), 712-730.
Dobrin, S., & Morey, S. (2009). *Ecosee: Image, Rhetoric, and Nature.* Albany, NY: SUNY Press.
Doheny-Farina, S. (1992). *Rhetoric, Innovation, Technology: Case Studies of Technical Communications in Technology Transfer*. Cambridge, MA: MIT Press.
Dragga, S. & Voss, D. (2001). Cruel Pies: The Inhumanity of Technical Illustrations. *Technical Communication*. 48(3), 265-274.
Druschke, C.G. (2014). With Whom Do We Speak? Building Transdisciplinary Collaborations in Rhetoric of Science. *POROI, 1*0(1).
Dumit, J. (2004). *Picturing Personhood:Brainscans and Biomedical Identity*. Princeton, NJ: Princeton University Press.
Dyehouse, J. (2011). 'A Textbook Case Revisited': Visual Rhetoric and Series Patterning in the American Museum of Natural History's Horse Evolution Display. *Technical Communication Quarterly, 20*(3), 327-346.
Earthquake Scientists Guilty of Manslaughter in Italy: Experts Respond. (2012, October 23). Science Media Centre. Retrieved from http://www.sciencemediacentre.co.nz/2012/10/23/earthquake-scientists-guilty-of-manslaughter-in-italyexperts-respond/
Eppler, M., & Aeschimann, M. (2008). *Envisioning Risk: A Systematic Framework for Risk Visualization in Risk Management and Communication.* University of Lugano. Retrieved from http://www.knowledge-communication.org/pdf/envisioning-risk.pdf
Evans, R. & Plows, A. (2007). Listening without Prejudice?: Re-discovering the Value of the Disinterested Citizen. *Social Studies of Science*, 37(6), 827-853.
Executive Committee, International Human Rights Network of Academies and Scholarly Societies. (2012, October 26). Statement by the executive committee. Conviction of Italian Scientists in L'Aquila Trial. Retrieved from http://www7. nationalacademies.org/humanrights/cs/groups/chrsite/documents/webpage/chr_ 073302.pdf

Fahnestock, J. (1999). *Rhetorical Figures in Science.* New York: Oxford University Press.
Farrell, T.B., & Goodnight, G.T. (1981). Accidental Rhetoric: The Root Metaphors of Three Mile Island. *Communication Monographs*, 48(4), 271-300.
FEMA. (2015, 12 23). *Earthquake Information for Public Policy Makers and Planners*. Retrieved 3 7, 2018, from https://www.fema.gov/earthquake-information-public-policy-makers-and-planners
Finnegan, C. (2001). The Naturalistic Enthymeme and Visual Argument: Photographic Representation In The 'Skull Controversy.' *Argumentation and Advocacy*, 133–149.
Fleckenstein, K.S., Hum, S. & Calendrillo, L.T. (2007). *Ways of Seeing, Ways of Speaking: The Integration of Rhetoric and Vision in Constructing the Real*. West Lafayette, IN: Parlor Press.
Fountain, T. K. (2014). *Rhetoric in the Flesh: Trained Vision, Technical Expertise, and the Gross Anatomy Lab.* New York: Routledge.
Fox Keller, E. (1995). *Refiguring Life*. New York: Columbia University Press.
Freelon, D. (2010). ReCal: Intercoder reliability calculation as a web service. *International Journal of Internet Science, 5*(1), 20-33.
Gad, C. & Jensen, C.B. (2010). On the Consequences of Post-ANT. *Science, Technology, and Human Values*, 35(1), 55–80. doi:10.1177/0162243908329567.
Galison, P. (1997). *Image and Logic: A Material Culture of Microphysics.* Chicago: University of Chicago Press.
Geisler, C. (2004). How ought we to understand the concept of rhetorical agency? Report from the ARS. *Rhetoric Society Quarterly, 34*(3), 9-17. doi:10.1080/02773940409391286
Gieryn, T. F. (1983). Boundary-work and the demarcation of science from non-science: Strains and interests in professional ideologies of scientists. American Sociological Review, 48(6), 781–795. doi:10.2307/2095325
---. (1999). *Cultural Boundaries of Science: Credibility on the Line.* Chicago, IL: University of Chicago Press.
Goodnight, T. (1982). The personal, technical, and public spheres of argument: A speculative inquiry into the art of public deliberation. *Journal of the American Forensics Association, 18*, 214-227.
Goodwin, J. (2014). Introduction: Collaborations between scientists and rhetoricians of science/technology/medicine. *PORO*I, 10 (1).
Grabill, J. T. (2007). *Writing Community Change: Designing Technologies for Citizen Action.* Cresskill, NJ: Hampton Press.
Grabill, J. T., & Pigg, S. (2012). Messy Rhetoric: Identity Performance as Rhetorical Agency in Online Public Forums. *Rhetoric Society Quarterly, 42*, 99–119.
Grabill, J. T., & Simmons, W. M. (1998). Toward a Critical Rhetoric of Risk Communication: Producing Citizens and the Role of Technical Communicators. *Technical Communication Quarterly, 7*(4), 415-441.
Graham, S. S. (2009). Agency and the Rhetoric of Medicine: Biomedical Brain Scans and the Ontology of Fibromyalgia. *Technical Communication Quarterly, 18*, 37-41.
---. (2011). Dis-ease or Disease? Ontological Rarefaction in the Medical-Industrial Complex. *Journal of Medical* Humanities, 32(3), 167–86.
---. (2015). *The Politics of Pain Medicine.* Chicago: University of Chicago Press.
Graham, S. S., & Herndl, C. (2013). Multiple Ontologies in Pain Management: Toward a Postplural Rhetoric of Science. *Technical Communication Quarterly, 22*, 103-125.

Graham, S.S., Kim, S-Y., DeVasto, D.M. & Keith, W. (2015). Statistical genre analysis: Toward big data methodologies in technical communication. *Technical Communication Quarterly,* Special Issue on Contemporary Research Methodologies, 24(1), 70-104.
Greene, R. W. (2004). Rhetoric and Capitalism: Rhetorical Agency as Communicative Labor. *Rhetoric and Philosophy, 37,* 188-206.
Gries, L. E. (2015). *Still Life with Rhetoric: A New Materialist Approach for Visual Rhetoric.* Boulder: Utah State University Press.
Gronnvoll, M. (2013). Review Essay: Material Rhetorics Meet Material Feminisms. *Quarterly Journal of Speech, 99*(1), 98-113.
Gross, A. G., & Harmon, J. E. (2013). *Science from Sight to Insight: How scientists illustrate meaning.* Chicago: University of Chicago Press.
Gross, A. G., Harmon, J. E., & Reidy, M. S. (2002). *Communicating Science: The scientific article from the 17th century to the present.* New York: Oxford University Press.
Gruber, D.R. (2014). Mirror Neurons in a Group Analysis 'Hall of Mirrors': Translation as a Rhetorical Approach to Neurodisciplinary Writing. *Technical Communication Quarterly*, 23, 207–26.
Guidoboni, E. C. (2012). Ancient and medieval earthquakes in the area of L'Aquila (northwestern Abruzzo, central Italy), AD 1–1500: a critical revision of the historical and archaeological data. *Bulletin of the Seismological Society of America, 102*(4), 1600-1617.
Hall, S. S. (2011). At fault? *Nature*, 477, 264–269.
Haraway, D. J. (1991). *Simians, Cyborgs, and Women: The Reinvention of Women.* NY: Routledge.
---. (1997). *Modest_Witness@Second Millennium. FemaleMan_Meets_OncoMouse: Feminism and Technoscience.* New York: Routledge.
Hariman, R., & Lucaites, J. L. (2007). *No Caption Needed: Iconic photographs, public culture, and liberal democracy.* Chicago: University of Chicago Press.
Harmon, G. (2009). *Prince of Networks: Bruno Latour and Metaphysics.* Prahran: Re.press.
Hartelius, J. E. (2010). *The Rhetoric of Expertise.* Lanham, MD: Lexington Books.
Hayes, A. F., & Krippendorff, K. (2007). Answering the call for a standard reliability measure for coding data. *Communication Methods and Measures*, 77-89.
Heazle, M. 2006. *Scientific uncertainty and the politics of whaling* (No. 11). Seattle, WA: University of Washington Press.
Herndl, C.G. & Cutlip, L.L. (2013). 'How Can We Act?' A Praxiographical Program for the Rhetoric of Technology, Science, and Medicine. *Poroi*, 9(1), 1–13.
Herndl, C.G., Goodwin, J., Honeycutt, L., Wilson, G., Graham, S.S., & Niedergeses, D. (2011). Talking Sustainability: Identification and Division in an Iowa Community. *Journal of Sustainable Agriculture*, 35 (4): 436–61. doi:10.1080/10440046. 2011.562068.
Herndl, C. G., & Graham, S. S. (2015). Getting Over Incommensurability: Latour, New Materialisms and the Rhetoric of Diplomacy. In P. Lynch, & N. Rivers, *Thinking with Bruno Latour in Rhetoric and Composition* (pp. 40-58). Carbondale: Southerin Illinois University Press.
Herndl, C. G., & Licona, A. C. (2007). Shifting Agency: Agency, Kairos, and the Possibilities of Social Action. In M. Zachry, & C. Thralls, *Communicative Practices in Workplaces and the Professions* (pp. 133-153). Amityville, NY: Baywood .
Hess, R., Visschers, V. H., Siegrist, M., & Keller, C. (2011). How do people perceive graphical risk communication? The role of subjective numeracy. *Journal of Risk Research*, 47-61.

Hill, C. A., & Helmers, M. (2004). *Defining Visual Rhetorics.* Mahwah: Lawrence Erlbaum.
Holm-Nielsen, L., & Tindemans, P. (2012, October 26). Euroscience on L'Aquila: Science to learn, not to be sentenced; public authorities to be centre stage. Euroscience. Retrieved from http://www.euroscience.org/wp-content/uploads/pdf/L'%20Aquila%20statement.pdf
Hoppe, R. (2005.) Rethinking the science-policy nexus: From knowledge utilization and science technology studies to types of boundary arrangements. *Poiesis and Praxis*, 3, 199-215.
International Federation of Red Cross. (2011). *Public awareness and public education for disaster risk reduction: A Guide.* Retrieved from http://www.ifrc.org/Global/Publications/disasters/reducing_risks/302200-Public-awareness-DDR-guide-EN.pdf
Jasanoff, S. (1990). *The Fifth Branch: Science Advisers as Policymakers.* Cambridge, MA: Harvard University Press.
---. (2003). Breaking the Waves in Science Studies: Comment on H.M. Collins and Robert Evans, 'The Third Wave of Science Studies'. *Social Studies of Science*, 33(3): 389–400.
Johnson, N.R. & Johnson, M.A. (2016). Glitch as Infrastructural Monster. *Enculturation*, 22, http://www.enculturation.net/glitch-asinfrastructural-monster.
Joss, S. & Durant, J. eds. (1995). *Public Participation in Science: The Role of Consensus Conferences in Europe.* London: NMSI Trading.
Keith, W.M. & Majdik, Z. (2011). Expertise as Argument: Authority, Democracy, and Problem-Solving. *Argumentation*, 25(3), 371–84.
Kelly, A. R. & Maddalena, K. (2015). Harnessing Agency for Efficacy: "Foldit" and Citizen Science. *POROI*, 11(1).
---. (2016). "Networks, Genres, and Complex Wholes: Citizen Science and How We Act Together through Typified Text." *Canadian Journal of Communication*, 41, 287-303.
Keränen, L. (2007). "'Cause Someday We All Die": Rhetoric, Agency, and the Case of the "Patient" Preferences Worksheet.". *Quarterly Journal of Speech, 93*(2), 179-210.
---. (2008). Bio(in)security: Rhetoric, Scientists, and Citizens in the Age of Bioterrorism. *Sizing Up Rhetoric.* Ed. David Zarefsky and Elizabeth Benacka. Long Grove, IL: Waveland, 2008. 227–249.
---. (2013). Conspectus: Inventing futures for the rhetoric of science, technology, and medicine. *POROI*, 9(1), 1-9.
Kerr, R. (2009). After the quake: in search of the science--or even a good prediction. *Science*, 324-332.
Kessler, M.M. (2017). *Bodily Boundaries: Inflammatory Bowel Disease and Rhetorical Enactments of Self.* Diss. University of Wisconsin-Milwaukee.
Khokhar, D. (2015). *Gephi Cookbook.* Packt.
Kimball, M. (2006). London through rose-colored graphics: Visual rhetoric and information graphic design in Charles Booth's maps of London poverty. *Journal of Technical Writing & Communication*, 36, 353-381.
Kleinman, D.L., Powell, M., Grice, J., Adrian, J., & Lobes, C. (2007). A Toolkit for Democratizing Science and Technology Policy: The Practical Mechanics of Organizing a Consensus Conference. *Bulletin of Science, Technology & Society*. 27(2), 154–69.
Knight, F. H. (1921). *Risk, uncertainty and profit*. New York, NY: Schaffner and Marx.
Koerber, A. (2006). Rhetorical agency, resistance, and the disciplinary rhetorics of breastfeeding. *Technical Communication Quarterly,* 15, 87–101.

Kostelnick, C. (2008). The Visual Rhetoric of Data Displays: The Conundrum of Clarity. *IEEE Transactions on Professional Communication, 51*(1), 116-130.
Kostelnick, C., & Hassett, M. (2003). *Shaping Information: The Rhetoric of Visual Conventions.* Carbondale, IL: Southern Illinois University Press.
Kostelnick, J. C., McDermott, D., Rowley, R. J., & Bunnyfield, N. (2013). A Cartographic Framework for Visualizing Risk. *Cartographica, 48*(3), 200-224.
Kress, G., & Van Leeuwen, T. (2006). *Reading Images: The Grammar of Visual Design* (2nd ed.). New York: Routledge.
Krueger, S. (2012, October 23). Re: Scientists convicted for not predicting an earthquake [Web log message]. Retrieved from geo-techtonics@jiscmail.ac.uk
Landau, J., Groscurth, C. R., Wright, L., & Condit, C. M. (2009). Visualizing nanotechnology: the impact of visual images on lay American audience associations with nanotechnology. *Public Understanding of Science, 18*(3), 325-337.
Latour, B. (1993). *We Have Never Been Modern*. Translated by Catherine Porter. Cambridge, MA: Harvard University Press.
---. (1999). *Pandora's Hope: Essays on the Reality of Science Studies.* Cambridge, MA: Harvard University Press.
---. (2004). Why has critique run out of steam? From matters of fact to matters of concern. *Critical inquiry, 30*(2), 225-248.
---. (2005). *Reassembling the Social.* New York: Oxford University Press.
---. (2008). *What is the style of matters of concern? Two lectures in empirical philosophy.* Assen, Netherlands: Koninklijke Van Gorcum.
Latour, B., & Woolgar, S. (1986). L*aboratory life: The social construction of scientific facts*. Princeton, NJ: Princeton University Press.
Lauta, K. C. (2014). New Fault Lines? On Responsibility and Disasters. *European Journal of Risk Regulation*, 137-145.
L'Aquila earthquake trial: UK seismologists react with dismay at jailing of Italian scientists. (2012, October 22). The Huffington Post UK. HPMG News. Retrieved from http://www.huffingtonpost.co.uk/2012/10/22/laquila-earthquake-trial-verdict-uk-reaction_n_2001964.html
L'Aquila quake: Italy scientists guilty of manslaughter. (2012, October 22). BBC News Europe. British Broadcasting Corporation. Retrieved from http://www. bbc.com/news/world-europe-20025626
LaWare, M. L. (1998). Encountering Visions of Aztlan: Arguments for Ethnic Pride, Community, Activism, and Cultural Revitalization in Chicano Murals. *Argumentation and Advocacy, 34*(3), 140-154.
Leff, M.C. (2012). Tradition and Agency in Humanistic Rhetoric. *Philosophy and Rhetoric*, 45(2), 213-226.
Leshner, A. I. (2010, June 29). Letter to Giorgio Napolitano. Retrieved from http:// www.aaas.org/sites/default/files/migrate/uploads/0630italy_letter.pdf
Lomnitz, C. (1989). Comment on 'Temporal and Magnitude Dependence in Earthquake Recurrence Models" by CA Cornell and Sr Winterstein. *Bulletin of the Seismological Society of America, 79*(5), 1662.
Lundberg, C., & Gunn, J. (2005). 'Ouija Board, Are There Any Communications?' Agency, Ontotheology, and the Death of the Humanist Subject, or, Continuing the ARS Conversation. *Rhetoric Society Quarterly, 35*(4), 83-105.

Lyne , J., & Howe, H. F. (1986). "Punctuated Equilibria": Rhetorical Dynamics of a Scientific Controversy. *Quarterly Journal of Speech, 72*, 132-147.
Lyne, J., & Howe, H. F. (1990). The rhetoric of expertise: EO Wilson and sociobiology. *Quarterly Journal of Speech, 76*(2), 134-151.
Majdik, Z.P. (2009). Judging Direct-to-Consumer Genetics: Negotiating Expertise and Agency in Public Biotechnological Practice. *Rhetoric & Public Affairs*, 12(4), 571-605.
Majdik, Z. P., & Keith, W. M. (2011). The Problem of Pluralistic Expertise: A Wittgensteinian Approach to the Rhetorical Basis of Expertise. *Social Epistemology, 25*(3), 275-290.
Mikalsen, K. H., & Jentoft, S. (2001). From user-groups to stakeholders? The public interest in fisheries management. *Marine Policy, 25*(4), 281-292.
Mileti, D. S., & Fitzpatrick, C. (1993). *The Great Earthquake Experiment: Risk Communication and Public Action.* Boulder, CO: Westview Press.
Miller, C. R. (2003). The Presumptions of Expertise: The Role of Ethos in Risk Analysis. *Configurations: A Journal of Literature, Science, and Technology, 11*(2), 163-202.
---. (2007). What Can Automation Tell Us About Agency? *Rhetoric Society Quarterly, 37*(2), 137-157.
Mitchell, G.R. & McTigue, K.M. (2012). Translation Through Argumentation in Medical Research and Physician-Citizenship. *Journal of Medical Humanities*, 33, 83–107.
Mol, A. (2003). *The Body Multiple: Ontology in Medical Practice.* Durham: Duke University Press.
Molin, D., Mucci, L., & Rossi , A. (11-13 November 1997). Terremoto del Fucino (Abruzzo) del 13 gennaio 1915: distribuzione del numero e della percentuale delle vittime. *Convegno Nazionale.* Rome: Gruppo Nazionale di Geofisica della Terra Solida.
Mullen, J. (2012, October 23). Italian scientists resign over L'Aquila quake verdicts. CNN. Retrieved from http://www.cnn.com/2012/10/23/world/europe/italy-quakescientists-guilty/
Nigg, J. M. (1982). Communication under conditions of uncertainty: Understanding earthquake forecasting. *Journal of Communication, 32*(1), 27-36.
Nosengo, N. (2012, October 31). L'Aquila verdict row grows. Nature. Retrieved from http://www.nature.com/news/l-aquila-verdict-row-grows-1.11683
Oreskes, N. (2000). Why Predict? Historical Perspectives on Prediction in Earth Sciences. In D. Sarewitz, R. A. Pielke, Jr., & R. Byerly, Jr., *Prediction: Science, Decision Making, and the Future of Nature* (pp. 23-40). Washington D.C.: Island Press.
Parks, S.B. (2014). Is There Room for a Student of Rhetoric in a Giant NSF Grant Project? P*OROI*, 10(1).
Paroske, M. (2009). Deliberating International SciencePolicy Controversies: Uncertainty and AIDS in South Africa. *Quarterly Journal of Speech, 95*(2), 148-170.
Perrault, S. (2013). *Communicating Popular Science: From Deficit to Democracy.* New York: Palgrave MacMillan.
Petersen, M. D., Mueller, C. S., Moschetti, M. P., Hoover, S. M., Llenos, A. L., Ellsworth, W. L., . . . Rukstales, K. S. (2016). *One-year seismic hazard forecast for the Central and Eastern United States from induced and natural earthquakes.* US Geological Survey. doi:10.3133/ofr20161035
Pickering, A. (2010). *The Cybernetic Brain*. Chicago, IL: University of Chicago Press.
Pielke, R., Jr. (2007). *The Honest Broker: Making sense of science in policy and politics.* New York, NY: Cambridge University Press.

Pietrucci, P. (2016). Voices from the Seismic Crater in the Trial of the Major Risk Committee: A Local Counternarrative of "The L'Aquila Seven." *Interface: A Journal for and about Social Movements*. 8(2), 261-285.
Pilkey, O.H. & Pilkey-Jarvis, L. (2009). *Useless Arithmetic: Why Environmental Scientists Can't Predict the Future*. NY: Columbia University Press.
Pielke, R. Sarewitz, D. & Dilling, L. (2010). *Usable Science: A Handbook for Science Policy Decision Makers*. Retrieved from http://cstpr.colorado.edu/sparc/outreach/sparc_handbook/brochure.pdf.
Popolazione Assistita. (2016, October 30). Retrieved from Citta dell'Aquila: http://www.comune.laquila.gov.it/pagina663_popolazione-assistita.html
Prelli, L. J. (1997). The Rhetorical Construction of Scientific Ethos. In R. A. Harris, *Landmark Essays on Rhetoric of Science: Case Studies* (pp. 87-104). New York: Routledge.
---. (2005). "Stasis and the Problem of Incommensurate Communication." In *Rhetoric and incommensurability*. Ed. Randy A. Harris. Parlor Press.
---. (2006). *Rhetorics of Display* . Columbia, SC: University of South Carolina Press.
---. (2013). The Prospect of Invention in Rhetorical Studies of Science, Technology, and Medicine. POROI, 9(1).
Prelli, L.J. & Condit, C. (2013). Projecting Possible Sight Lines for RSSTM. *Poroi*, 9(1).
Processoaquila. (2014, November 10). Ultima udienza del processo di Appello: dichiarazioni di Giulio Selvaggi. [Blog post]. Retrieved from https://processoaquila.wordpress.com/2014/11/10/ultima-udienza-del-processo-di-appello-dichiarazioni-di-giulio-selvaggi/
Propen, A. (2007). Visual Communication and the Map: How Maps as Visual Objects Convey Meaning in Specific Contexts. *Technical Communication Quarterly*, 16(2), 233-254.
Rawlins, J. D., & Wilson, G. D. (2014). Agency and Interactive Data Displays: Internet Graphics as Co-Created Rhetorical Spaces. *Technical Communication Quarterly*, *23*(4), 303-322.
Reeves, C. (2011). Scientific visuals, language, and the commercialization of a scientific idea: the strange case of the prion. *Technical Communication Quarterly*, *20*(3), 239-273.
Reinberger, H. (2010). *An Epistemology of the Concrete: Twentieth-Century Histories of Life*. Durham, NC: Duke University Press.
Reynolds, B., & Seeger, M. W. (2005). Crisis and Emergency Risk Communication as an Integrative Model. *Journal of Health Communication*, 43-55.
Richards, D. P. (2015). Testing the Waters: Local Users, Sea Level Rise, and the Productive Usability of Interactive Geovisualizations. *Communication Design Quarterly*, *3*(3), 25-29.
Rickert, T. (2013). *Ambient Rhetoric.* Pittsburgh, PA: University of Pittsburgh Press.
Rip, A. (2003). Constructing Expertise: In a Third Wave of Science Studies? S*ocial Studies of Science*, 33 (3), 419–34.
Ropeik, D. (2012, October 22). The L'Aquila verdict: A judgment not against science, but against a failure of science communication. Scientific American. Retrieved from http://blogs.scientificamerican.com/guest-blog/the-laquila-verdict-a-judgment-not-against-science-but-against-a-failure-of-science-communication/
Rosner, M. (2001). Theories of Visual Communication: Looking at the Human Genome. *Journal of Technical Writing and Communication*. 31.4,391-413.
Roth, F. (2012). *Visualizing Risk: The Use of Graphical Elements in Risk Analysis and Communications.* Zurich: Center for Security Studies.

Sauer, B. (2003). *The Rhetoric of Risk: Technical Documentation in Hazardous Environments.* Mahwah, NJ: Lawrence Erlbaum.
Schneider, B. & Nocke, T. (2014). *Image Politics of Climate Change: Visualizations, Imaginations, Documentations.* Transcript Verlag.
Scott, J. B. (2003). Extending Rhetorical-Cultural Analysis: Transformations of Home HIV Testing. *College English, 65*(4), 249-267.
---. (2006). Kairos as Indeterminate Risk Management: The Pharmaceutical Industry's Response. *Quarterly Journal of Speech, 92*(2), 115–143.
Scott, B., Segal, J.Z. & Keranen, L. (2013). The Rhetorics of Health and Medicine: Inventional Possibilities for Scholarship and Engaged Practice. POROI, 9(1).
Serres, M. (1995). *Conversations on Science, Culture, and Time: Michael Serres with Bruno Latour*. Translated by Roxanne Lapidus. Ann Arbor, MI: University of Michigan Press.
Severtson, D. J., & Burt, J. E. (2012). The Influence of Mapped Hazards on Risk Beliefs: A Proximity-Based Modeling Approach. *Risk Analysis, 32*(2), 259-280.
Shapin, S. & Schaffer, S. (2011). *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*. Princeton, NJ: Princeton University Press.
Simmons, M. (2007). *Participation and Power: Civic Discourse in Environmental Policy Decisions.* Albany: SUNY Press.
Smekens, J.-F. (2012, October 30). VOLCANO: Scientists condemned for l'Aquila deaths [Electronic mailing list message]. Retrieved from volcano@asu.edu
Smith, K., Moriarty, S., Barbatsis, G., & Kenney, K. (2005). *Handbook of Visual Communication.* Mahwah, NJ: Lawrence Erlbaum.
Stephens, S. H., DeLorme, D. E., & Hagen, S. C. (2014). An analysis of the narrative-building features of interactive sea level rise viewers. *Science Communication, 36*(6), 675-705.
Stucchi, M., & Cavallo, G. (2014, Oct 14). *4. About communication, glass of wine and the expert meeting output: Part 1.* Retrieved Oct 16, 2016, from Earthquakes and great risks: Opinions and material on the L'Aquila trial to the seven earthquake scientists and officials: https://eagris2014.com/2014/10/14/4-about-communication-glass-of-wine-and-the-expert-meeting-output-part-1-m-stucchi-and-g-cavallo/
Succhi, M., Pinho, R., & Cocco, M. (2016). After the L'Aquila Trial. *Seismological Research Letter, 87*(3), 591-596.
Teston, C. (2012). Moving from artifact to action: A grounded investigation of visual displays of evidence during medical deliberation. *Technical Communication Quarterly, 21*(3), 187-209.
Teston, C. & Graham, S.S. (2012). Stasis Theory and Meaningful Public Participation in Pharmaceutical Policy-Making. *Present Tense*, 2(2). http://www.presenttensejournal.org/volume-2/stasis -theory-and-meaningful-public-participation-in-pharmaceutical-policymaking/
Teston, C. B., Graham, S. S., Baldwinson, R., Li, A., & Swift, J. (2014). Public Voices in Pharmaceutical Deliberations: Negotiating "Clinical Benefit" in the FDA's Avastin Hearing. *Journal of Medical Humanities, 35*, 149-170.
Tufte, E. R. (1990). *Envisioning Information.* Cheshire, CT: Graphics Press.
Tufte, E. R. (2001). *The visual display of quantative information* (2nd ed.). Cheshire, CT: Graphics Press.
US Geological Survey. (2007). *Putting Down Roots in Earthquake Country.* Retrieved from https://pubs.usgs.gov/gip/2005/15/

---. (2015). Earthquake Hazards 101 -- The Basics. *Earthquake Hazards Program*. Retrieved May 8, 2015, from Earthquake Hazards Program: https://earthquake.usgs.gov/hazards/learn/basics.php
Ventura, V., Frisio, D. G., Ferrazzi, G., & Siletti, E. (2016). How Scary! An analysis of visual communication concerning genetically modified organisms in Italy. *Public Understanding of Science, 26*(5), 547-563.
Walker, K.C. (2014). Rhetorical Properties of Scientific Uncertainties: Public Engagement in the CarsonScholars Program. P*oroi* 10(1), 1-9. http://ir.uiowa.edu/poroi/vol10/iss1/6/
---. (2015). *Rhetorics of Uncertainty: Networked Deliberations in Climate Risk*. Diss. University of Arizona.
---. (2016). Mapping the Contours of Translation: Visualized Un/Certainties in the Ozone Hole Controversy. *Technical Communication Quarterly*. 25(2), 104-120.
---. (2017). Rhetorical Principles on Uncertainty for Transdisciplinary Engagement and Improved Climate Risk Communication. *Poroi*. 12(2), 1-13.
Walker, K., & Walsh, L. (2012). "No one yet knows what the ultimate consequences may be": How Rachel Carson transformed scientific uncertainty into a site for public participation in Silent Spring. *Journal of Business and Technical Communication, 26*(1), 3-34.
Walsh, L. (2009). Visual strategies to integrate ethos across the ''is/ought'' divide in the IPCC's Climate Change 2007: Summary for policy makers. *Poro*i, 6, 32–61.
---. (2013). *Scientists as Prophets: A Rhetorical Geneology*. New York: Oxford University Press.
---. (2014). 'Tricks,'Hockey Sticks, and the Myth of Natural Inscription: How the Visual Rhetoric of Climategate Conflated Climate with Character. In B. Schneider, & T. Nocke, *Image politics of climate change: Visualizations, imaginations, documentations* (pp. 81-104). Transcript Verlag.
---. (2015). The Visual Rhetoric of Climate Change. *WIREs Climate Change*, 6(4), 361-368.
Walsh, L., Miller, C.R., Wynn, J., Kelly, A.R., Walker, K.C., White, W.J., … Wilson, G**.** (2016). The great chain of being: Manifesto on the problem of agency in science communication. *POROI*, 12(1), doi: 10.13008/2151-2957.1246
Walsh, L. & Walker, K.C. (2016). Perspectives on Uncertainty for Technical Communication Scholars. *Technical Communication Quarterly*. 25(2), 71-86.
Weisenfeld, G. S. (2012). *Imaging Disaster: Tokyo and the Visual Culture of Japan's Great Earthquake of 1923.* Oakland: University of California Press.
White, R. (2010). What is Spatial History? Stanford University. Spatial History Project. http://web.stanford.edu/group/spatialhistory/cgi-bin/site/pub.php?id=29
Wilson, G.D. (2001). *Articulation Theory and Disciplinary Change: Unpacking the Bayesian-Frequentist Paradigm Conflict in Statistical Science*. Diss. New Mexico State University.
Wilson, G. & Herndl, C.G. (2007). Boundary Objects as Rhetorical Exigence: Knowledge Mapping and Interdisciplinary Cooperation at the Los Alamos National Laboratory. *Journal of Business and Technical Communication*. 21(2), 129-154.
Winsor, D. (2006). Using writing to structure agency: An examination of engineer's practice. *Technical Communication Quarterly, 15*, 411-430.
Wolford, R. M. (2011). *Women Farmland Owners in Iowa: Cultivating Agency through Rhetorical Practice*. Diss. Iowa State University.
Wolman, D. (2014). The Aftershocks. *Matter. Medium*, 10 October, 2014. https://medium.com/matter/the-aftershocks-7966d0cdec66

Woodman, A. (2013). Facilitating informed choice: The communication obligations of scientists to the public, and the 2009 L'Aquila earthquake (Unpublished doctoral dissertation). Trinity College, London.
Wynn, J. & Walsh, L. (2013). Emerging Directions in Science, Publics and Controversy. *POROI,* 9(1).
Wynne, B. (1989). Sheep Farming after Chernobyl: A Case Study in Communicating Scientific Information. *Environment: Science and Policy for Sustainable Development*, 31(2): 10–39.
---. (1992). Misunderstood Misunderstanding: Social Identities and Public Uptake of Science. *Public Understanding of Science*, 1(3), 281–304.
----. (2003). Seasick on the Third Wave? Subverting the Hegemony of Propositionalism: Response to Collins and Evans. *Social Studies of Science*, 33(3), 401–17.
Wysocki, A. F. (2004). The Multiple Media of Texts: How Onscreen and Paper Texts Incorporate Words, Images, and Other Media. In Bazerman, C. & Prior, P., *What Writing Does and How It Does It.* NJ: Lawrence Erlbaum, 123-164.
---. (2005). awaywithwords: On the Possibilities in Unavailable Designs. *Computers and Composition, 22*(1), 55-62.
Yeo, M. (2014, December). Fault lines at the interface of science and policy: Interpretative responses to the trial of scientists in L'Aquila. *Earth-Science Reviews, 139*, 406–419.
Zehr, S. C. (1999). Scientists' Representations of Uncertainty. In S. M. Friedman, S. Dunwoody, & C. L. Rogers, *Communicating Uncertainty: Media Coverage of New and Controversial Science* (pp. 3-21). Mahwah, NJ: Lawrence Erlbaum.
---. (2000). Public representations of scientific uncertainty about global climate change. *Public Understanding of Science*, 9(2), 85–103. doi:10.1088/0963-6625/9/2/301

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EDUCATION

Ph.D. **English – Rhetoric and Composition | 2018**
Department of English, University of Wisconsin-Milwaukee
Dissertation title: Negotiating Matters of Concern: Expertise, Uncertainty, and Agency in Rhetoric of Science
Dissertation Advisor: S. Scott Graham

M.A. **English – Rhetoric and Composition | 2012**
Department of English, University of Wisconsin-Milwaukee
Thesis title: At the Intersection of the Visual and the Verbal: A Rhetorical Analysis of Artist Statements
Thesis Advisors: Alice Gillam, Anne Wysocki

B.S. **Education (English, English as a Second Language) | 2008**
University of Wisconsin-Milwaukee

PUBLICATIONS

Creighton, J., **DeVasto, D.,** Gallagher, S. (2017). Illuminating northern lights: Exploring science communication in the planetarium. *Planetarian*. 46(3).

Kim, S., Graham, S. S., Ahn, S., Olson, M. K., Card, D. J., Kessler, M. M., **DeVasto, D.M.**, Roberts, L. R., Bubacy, F. A. (2016). Correcting biased Cohen's Kappa in NVivo. *Communication Methods and Measures,* 10(4), 217-232.

DeVasto, D. (2016). Matters of concern and the politics of who: A response to Herndl. *Social Epistemology Review and Reply Collective,* 5(7), 14-17.

Graham, S.S., Harley, A., Kessler, M.M., Roberts, L., **DeVasto, D**., Card, D.J., Neuner, J., and Kim, S.-Y. (2016). Catalyzing transdisciplinarity: A systems ethnography of cancer-obesity comorbidity and risk coincidence. *Qualitative Health Research,* doi: 10.1177/1049732316656162

Walsh, L., Miller, C.R., Wynn, J., Kelly, A.R., Walker, K.C., White, W.J., … Wilson, G**.** (2016). The great chain of being: Manifesto on the problem of agency in science communication. *POROI,* 12(1), doi: 10.13008/2151-2957.1246

DeVasto, D. (2016). Being expert: L'Aquila and issues of inclusion in science-policy decision making. *Social Epistemology*, 30(4), 372-97.

DeVasto, D., Graham, S.S., & Zamparutti, L. (2016). Stasis and matters of concern: The conviction of the L'Aquila Seven. *Journal of Business and Technical Communication*, 30(2), 131-164.

Publications, continued

Graham, S.S., Kim, S-Y., **DeVasto, D.M**. & Keith, W. (2015). *Statistical genre analysis: Toward big data methodologies in technical communication.* Technical Communication Quarterly, Special Issue on Contemporary Research Methodologies, 24(1), 70-104.

DeVasto, D. (2015). Review of *Science from Sight to Insight: How Scientists Illustrate Meaning* by Alan G. Gross and Joseph E. Harmon. *Rhetoric Review*, 34(3), 367-371.

DeVasto, D. (2013). Review of *New Natures: Joining Environmental History with Science and Technology Studies,* edited by Dolly Jørgensen, Finn Arne Jørgensen, and Sara B. Pritchard. *Composition Studies*, 41(2).

Cook, N., Freese, S., **Hartke, D.**, Jamnik, B., Kautzer, J., MacDonald, M., … Wilson, M. (2007). Response to "Prattle of the Sexes." *The Writing Lab Newsletter,* 32(1), 11-13.

PRESENTATIONS & WORKSHOPS

National

DeVasto, D. (2018). Passive people and powerful quakes: Configuring the potential for action in seismic risk visuals. Rhetoric Society of America, Minneapolis, MN.

DeVasto, D. & Graham, S.S. (2018). Agentive network modeling throwdown: Gephi vs R Shiny. Digital Praxis Poster, CCCC, Kansas City, MO.

DeVasto, D. (2017). Visualizing agency and the agency of visuals in seismic hazard communication. Research Network Forum, CCCC, Portland, OR.

DeVasto, D. (2016). Images at work: The implications and affordances of seismic hazard maps and earthquake modeling. Association of Rhetoric of Science, Technology, and Medicine, Atlanta, GA.

DeVasto, D. (2015). An expertise of doing: Exploring grounds for inclusion in science-policy decision making. National Communication Association, Las Vegas, NV.

Card, D.J., Kessler, M.M., **DeVasto, D**., Roberts, L., Olson, M.K. & Graham, S.S. (2015). Laboratories and lived experiences: Assessing patient inclusion in FDA pharmaceuticals regulation. National Communication Association, Las Vegas, NV.

Graham, S.S. & **DeVasto, D.M**. (2015). Questioning the value of democracy in science and technology policy. Association for Teachers of Technical Writing, Tampa, FL.

DeVasto, D. (2015). Reinterpreting *Stases* for Matters of Concern: The Conviction of the L'Aquila Seven. Research Network Forum at CCCC, Tampa, FL.

Presentations, continued

Graham, S.S., Card, D., Kessler, M.M., Keith, W.M., Kim, S-Y., & **Hartke D.M**. (2014). The effects of differential inclusion on FDA pharmaceuticals policy deliberation. National Communication Association, Chicago, Il.

National Presentations, continued

Hartke, D.M. and Graham, S.S. (2013). Dangerous democratization: Normative models of science-policy debate and the incarceration of the L'Aquila Seven. Association of Rhetoric of Science and Technology, Washington D.C.

Regional

Heatherington, T. & **DeVasto, D**. (2017). Enhancing graduate professional development across the disciplines. UWM Teaching and Learning Symposium, Milwaukee, WI.

Graham, S.S., Kim, S.-Y., Kessler, M.M., Card, D.J., **DeVasto, D.M**., Ahn, S., Olson, M., Bubacy, F., Roberts, L. (2015). The effects of differential inclusion on FDA pharmaceuticals policy deliberation. Seventh International Conference on Science in Society, Chicago, IL.

Hartke, D., Stratton, R. & Pegram, A. (2013). Seizing opportunities to move from "say" to "do": The very real work of enhancing public sphere literacy. North Carolina Symposium on Teaching Writing, Raleigh, NC.

Green, J., **Hartke, D.,** & Nordstrom, I. (2011). The (im)possibility of peerness: Graduate student tutors in the writing center. Midwest Writing Centers Association Conference, Madison, WI.

Hartke, D. (2011) Exhibiting writing. Workshop for the Ohio Art League, Columbus, OH.

Hartke, D. (2011). Debriefing: "Composing connections between high school and college writing teachers." *Emerging Compositions–First-Year Composition Professional Development Conference*, Milwaukee, WI.

Hartke, D. (2011). Writing your artist statement. Workshop for Mother Artists at Work, Columbus, OH.

Hartke, D. (2010). Transmediation: Crossing sign systems and the high school/college divide. Poster presentation at the UWM/Marquette First-Year Composition Graduate Student Conference, Milwaukee, WI.

Hartke, D. (2010). More than a copycat: Using imitation to build reading comprehension. Workshop for NEA Foundation/National Writing Project/Milwaukee Public Schools professional development series, Milwaukee, WI.

Hartke, D. and Houston, A. (2009). City mouse meets country mouse, or how technology brought our classrooms together. Wisconsin Council of Teachers of English Annual Convention, Milwaukee, WI.

TEACHING EXPERIENCE

Graduate Teaching Assistant, UW-Milwaukee | 2010-2013, 2014-present
Undergraduate courses
Introduction to College English (face-to-face and online)
College Research and Writing
Business Writing (online)
Advanced College Writing in English as a Second Language
Engineering Materials
Graduate courses
Preparing Future Faculty and Professionals (hybrid and online)

Adjunct Instructor, Southern New Hampshire University | 2013-present
College Writing 1 (online)
College Writing 2 (online)

Part-time Faculty, Pierce College, Puyallup, WA | 2013-2014
Reading for ESL Students
Writing for ESL Students
Study Techniques I
Transitions to College

Adjunct Instructor, Milwaukee Institute of Art and Design | 2012-2013
Writing Studio I
Writing Studio II

Writing Tutor, UW-Milwaukee | 2006-08, 2010-2012

Teacher, Riverside University High School, Milwaukee Public Schools | 2008-2010
English 11
English 12
Pre-AP Literature
Writing through Literature
ESL Intermediate

CURRICULUM DEVELOPMENT

Curriculum developer, Preparing Future Faculty and Professionals (G) | 2016, 2017

Curriculum developer, Transitions to College | 2014

Curriculum developer, Writing Studio II (UG) | 2013

Curriculum developer, Writing Studio I (UG) | 2012

RESEARCH EXPERIENCE

Researcher, Public Engagement and Science Communication, School of Freshwater Sciences, UW-Milwaukee | 2016-present

Research Assistant, Dr. S. Scott Graham, English, UW-Milwaukee | 2013-2016

Research Assistant, Dr. Donna Pasternak, Curriculum and Instruction, UW-Milwaukee | 2012-2015

Project Assistant, Drs. Karen Rigoni & Donna Pasternak, Curriculum and Instruction UW-Milwaukee | 2010-2012

ADMINISTRATIVE EXPERIENCE

Professional Development Coordinator, Graduate School, UW-Milwaukee | 2016-17

HONORS, AWARDS, & FELLOWSHIPS

Tinsely Helton Dissertator Fellowship, UW-Milwaukee | 2018

Distinguished Dissertator Fellowship, UW-Milwaukee | 2016

Lauer Award, Rhetoric Society of America | 2015

The Professional and Technical Writing Award for Writing Excellence, UW-Milwaukee | 2015

Chancellor's Graduate Student Award, UW-Milwaukee | 2010, 2012, 2015

Wisconsin Council Teachers of English Outstanding First Year Teacher Award | 2008

PROFESSIONAL SERVICE & DEVELOPMENT

Attendee, Midwestern Winter Workshop, Rhetoric of Society of America, Indiana U | 2018

Attendee, Summer Institute, Rhetoric Society of America, UW-Madison | 2015

Attendee, Earth-Centered Communication for Cyberinfrastructure Field Trip, EarthCube, National Science Foundation | 2015

Writing judge, Virginia Burke Writing Contest, UW-Milwaukee | 2013

Reader, First-Year Composition Program Assessment, UW-Milwaukee | 2012

Professional service and development, continued

Facilitator, Composing connections between high school and college writing teachers. UW-Milwaukee Composition Forum | 2011

Presenter, Working with the assignment sequence in class. Workshop for the UW-Milwaukee First-Year Composition New Instructor Orientation | 2011

Manuscript reviewer, *The Wisconsin English Journal, Journal of Business and Technical Communication* | 2011-current

Curriculum developer and teacher facilitator, Across the Divide, UW-Milwaukee | 2010
Teacher consultant, UW-Milwaukee Writing Project | 2009-current