



“Without Evidence, there is No Answer”: Uncertainty and Scientific Ethos in the *Silent Spring*[s] of Rachel Carson

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ABSTRACT The 50th year anniversary of Rachel Carson’s monumental *Silent Spring* invites reflection on how the controversy over chemical pesticides shaped environmental discourse in the modern era. This essay focuses on uncertainty as a boundary device that shapes scientific ethos in crucial ways and negotiates a relationship between technical science and public deliberation. Situated in rhetorical analysis, the author takes a comparative approach towards the use of uncertainty and scientific ethos in the *Silent Spring* controversy. Drawing from Carson’s published book, and from the famous *CBS Reports* investigative television program seven months after the book’s publication, this essay demonstrates how *CBS Reports* directly received, and amplified, Carson’s uncertainty frameworks, and used them to drive the public evaluation of scientific ethos. This analysis reveals three ways uncertainty shapes scientific ethos: uncertainty as a probability (ethos of expertise), as a moral certainty (ethos of civic participant), and as an unknown or unconcern (ethos of ignorance). Finally, the author suggests that the circulation of these uncertainty frameworks of scientific ethos helped drive the momentum from the books’ publication, to public evaluation, to policy-making, and suggests these uncertainty frameworks are enduring forces in debates about the role of experts in scientific controversies.

Silent Spring was not just a book. It was an event that kept happening, a debate that kept circulating, and a felt conversation that kept people talking. In the 50th anniversary year there is an impulse to fixate on the single moment of the book’s publication. But as others have noted, *Silent Spring* was published at least three different times, in three genres, reaching three distinct audiences—*The New Yorker* serialization in June 1962, the book in September 1962, and the “CBS Reports” investigative journalism show in April 1963.¹ Rarely has a book circulated so widely, drawn the ire of private industry so vehemently, and gotten the Federal Government to investigate its veracity so quickly. So it is worth remembering what happened in between these multiple *Silent Spring*[s]. In its immediate context the book was quickly

¹ Gary Kroll, “The ‘Silent Springs’ of Rachel Carson: Mass Media and the Origins of Modern Environmentalism,” *Public Understanding of Science* 10 (2001): 415.

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overshadowed on the national stage by the Cuban Missile Crisis in early October, and by late 1962 the news cycle had moved on. But living in the United States in the early sixties a sense of crisis was tangible in many areas of social and political life: Nuclear weapons, Cold War tensions, rapid technological progress, and the change in social consciousness characteristic of a generational shift all contributed to a growing structure of uncertainty. So while the controversy surrounding *Silent Spring* receded to the background for a few months that feeling of uncertainty was palpable.

Imagine middle-class Americans coming home on Wednesday night, 3 April, 1963, and imagine they happened to catch the news on TV that night. They might have heard that the Southern Christian Leadership Conference volunteers had kicked off a sit-in protest campaign against racial segregation in Birmingham, Alabama. If they turned their channel to CBS at 7:30 p.m. EST they would have seen an investigative journalism program hosted by Eric Sevareid called, "CBS Reports," which that particular Wednesday aired "The Silent Spring of Rachel Carson," produced and written by Jay McMullen, who worked over eight months on the report.² If that particular subject interested them, they might have watched, as a network estimated 10 to 15 million people did.³ If they were watching they would have witnessed two scientists in a verbal jostle about the calculated risks of using synthetic chemicals: first, Rachel Carson, shown in a long dress, bird-watching through the coastal woods of Maine, looking up and down, walking through light and shadow with one hand in her jacket pocket, and one hand clutching her binoculars; and Robert White-Stevens, spokesperson for American Cyanamid Company, sitting in his chemistry lab with a white coat and tie, black-rimmed glasses, pencil-thin moustache, and slicked back hair, speaking in a deep straight-forward tone. Then, toward 8 p.m., at the fulcrum of McMullen's narrative, they would have seen government scientists encircled in a conversation about uncertainty, beginning with Dr. James Hartgering, staff member of the President's Science Committee, and the Federal Council on Science and Technology, and then Dr. Page Nicholson, of the Public Health Service:

Hartgering: There is a great deal that *we do not know* about the biological *effects* of the pesticides as they relate to soil, water and animals in our country as well as man himself.

McMullen: What don't we know about the effect of pesticides on soil?

Hartgering: *We do not know* very much about the newer pesticides, particularly as how they relate to particular soils in particular parts of the country.

McMullen: Does this involve what you do not know about the staying power in the soil?

Hartgering: *We do not know* how long the pesticide stays in the soil. In some cases *we do not know* ways which it is held in the soil, how much is taken out by the plant or by the animal.

McMullen: Do you know what the effect of pesticides on microorganisms in the soil may be?

Hartgering: *Not very much is known* about this, because *we don't know* a whole lot about the microorganisms that are in the soil.

² Eric Sevareid and Jay McMullen, "The Silent Spring of Rachel Carson," *CBS Reports*. 3 April 1963. Transcript: 28.

³ Linda Lear, *Rachel Carson: Witness for Nature* (New York: Henry Holt and Co., 1998), 450.

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McMullen: Do you know how long the pesticides persist in the water once they get into it?

Nicholson: *Not entirely.*

McMullen: Do you know the extent to which our ground water may be contaminated right now by pesticides?

Nicholson: *We don't know that either,* nor do we know if concentration may be occurring in ground water.

McMullen: Do you know the effect of long-term exposure of pesticides on aquatic life?

Nicholson: *Not completely.*

McMullen: Do you know how pesticides may inter-react within water organisms?

Nicholson: This, too, is an area where *we need to know more.*

McMullen: Well, Doctor, you say you need to know more about these questions. I gather then you think they are important to ask and important to have more research done concerning them. Is that correct?

Nicholson: They are very important if we're ever to evaluate the impact of these pesticidal chemicals on our aquatic environment.

...

Sevareid: Earlier in this program, a Public Health Service toxicologist stated: "There is no evidence that the small doses of pesticides we get are causing harm." But is there no evidence as a result of investigation, or is there no evidence because no investigation has been made? The total number of pesticides studied by the Public Health Service for cumulative effects on humans: three.⁴

The program had a large effect on the many millions of viewers watching CBS Reports that night. After a lull in the debate over *Silent Spring*, the controversy had been sparked again. The next day after the broadcast, Senator Hubert Humphrey (D-Minnesota) announced the beginnings of a broad congressional review on environmental toxins.⁵ Then in a move from the executive branch one month later, President John Kennedy's Science Advisory Committee published their report, *Use of Pesticides*, largely vindicating the findings of *Silent Spring*, and setting the stage for the domestic ban on DDT. As Linda Lear noted "CBS Reports amounted to nothing less than a special printing of *Silent Spring*. ... What viewers saw was a graphically compelling portrayal of Carson's thesis that 'we know not what harm we face.'"⁶

Surprisingly there has been little investigation into that thesis of uncertainty in the *Silent Spring* controversy. While we know much about the chemical industry's well-funded, but ultimately unsuccessful personal attack on Carson;⁷ while we know much about what happened to *Silent Spring* after its publication;⁸ and while we know how her thesis of balance

⁴ Sevareid, and McMullen, "The Silent Spring of Rachel Carson," 19-21, 23. Emphasis added.

⁵ Lear, *Rachel Carson*, 450.

⁶ Lear, *Rachel Carson*, 449-450.

⁷ Kim Groshon, "The Noisy Reception of *Silent Spring*," in *An Element of Controversy: The Life of Chlorine in Science, Medicine, Technology and War*, eds. Hasok Chang and Catherine Jackson (London: Oxford University Press, 2007), 360-380; Lear, *Rachel Carson*; Smith, "Silence, Miss Carson!"; Waddell, "The Reception of Rachel Carson's *Silent Spring*."

⁸ Frank Graham, *Since Silent Spring* (Boston: Houghton Mifflin Company, 1970); Pricilla Coit Murphy, *What a Book Can Do: The Publication and Reception of Silent Spring* (Cambridge MA: University of Massachusetts Press, 2005);

to counter the domination of nature has continued in various strands of the environmental movement;⁹ there has been little research into how Carson used uncertainty to shape the terms of debate in the controversy over the use of toxic chemicals. Lynda Walsh and I set out to remedy this gap with an archival study of Carson's production of *Silent Spring*, particularly looking at her adoption of uncertainty from her sources, and her adaptations of it in her drafting process. We argued that Carson deliberately took uncertainty from her sources and strategically drafted them into her text. The core of her strategy was to articulate uncertainty in the form of ignorance to destabilize the science and in the form of risk to actualize potential harm by linking it to an emotionally charged case study. Managing uncertainty in this way, we argued, transformed it into a site for public participation, and the vivid case study supplied the means by which the public injected their values and fears about the science into the public policy process.¹⁰ Unlike the many examples of using uncertainty to delay science policy, as in the well-documented cases of tobacco, acid rain, and global warming,¹¹ here we suggested that uncertainty was flexible, and was deployed to drive public policy forward.

As the quotes above demonstrate, the "CBS Reports" version of *Silent Spring* also used uncertainty strategically, and communicated it through the mass media genre of the investigative television report. Here I propose to undertake a comparative analysis of scientist's articulations of uncertainty in *Silent Spring*, and Jay McMullen's CBS Reports "The Silent Spring of Rachel Carson," as a way to understand how scientific *ethos* is constructed through forms of uncertainty in the mass media genres of a non-fiction book and an investigative television program. From this comparative work, I make an argument about reception by revealing three different frameworks for uncertainty and scientific ethos: first, a scientific uncertainty in the form of a moral certainty that frames scientific ethos as a negotiator between public and scientific community; second, a scientific uncertainty in the form of ignorance about risk that frames scientific ethos as an unknowing and unconcerned technocrat; and third, a scientific uncertainty in the form of a calculated probability that frames scientific ethos as an aloof expert. Thus, this comparative work reveals specific strategies for how uncertainty is an unavoidable and irreducible rhetorical strategy in public science contexts, used not just for the erosion but also for the tactical construction of scientific ethos in public forums. First I review the relevant literature on uncertainty and scientific ethos, and then I compare the representations of scientists who articulate uncertainty in *Silent Spring*, to those in the "CBS Reports" broadcast in order to demonstrate how the television program both adopted and adapted uncertainty as a

Zuoyue Wang, *In Sputnik's Shadow. The President's Science Advisory Committee and Cold War America* (New Jersey: Rutgers University Press, 2009).

⁹ William Cronon and Thomas R. Dunlap, eds., *DDT, Silent Spring, and the Rise of Environmentalism* (Seattle: Washington University Press, 2008); Mark Hamilton Lytle, *The Gentle Subversive: Rachel Carson, Silent Spring, and the Rise of the Environmental Movement* (Oxford: Oxford University Press, 2007).

¹⁰ Kenny Walker and Lynda Walsh, "No One 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* January (2010): 3-34.

¹¹ N. Oreskes, and E. Conway, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury Press, 2010).

framework for scientific ethos from *Silent Spring* and used it to shape the debate around public values and actions when "we know not what harm we face."

Uncertainty and Scientific Ethos in Rhetoric and Risk Communication

Before the CBS broadcast date, Carson was worried that the program had stacked the deck against her. Most of their interviews were with government scientists and industry representatives. As Lear notes, Carson had never allowed her picture on the jacket-sleeve of her widely popular books, let alone appeared on television. So her appearance on "CBS Reports" was the first time the public was able to see the famous author. But despite her worries, Carson felt vindicated by the published broadcast. Thousands wrote to her, congratulating her on how she appeared on television, even though she had secretly undergone major chemo-therapy treatments to eradicate her breast cancer.¹² The program portrayed Carson as a biologist and science writer dissenting from the white-coated laboratory scientists of the chemical industry. This dichotomy of two distinct scientific *ethoi* was excellent fodder for a hit news story—scientist versus scientist; biologist versus chemist; popularizer versus expert; woman versus man; nature versus technological progress.¹³

Carson's concern about her television appearance is not surprising considering that appearance is essential to the effective communication of a credible ethos. In his treatise *On Rhetoric*, Aristotle argues that ethos does not solely come from what the speaker says, but also who the speaker appears to be when she speaks. In this way, ethos is a negotiation with the audience between self-representation and audience perception. Aristotle gives three reasons why character is persuasive beyond logical demonstrations: "these are practical wisdom [*phronesis*] and virtue [*arête*], (both aspects of ethos) and good will [*eunoia*] (an aspect of *pathos*). [. . .] Therefore a person seeming to have all these qualities is necessarily persuasive to the hearers."¹⁴ But whether they are innate qualities of the speaker or not, practical wisdom, virtue, and goodwill must be demonstrated through language, translated via the medium, and perceived by the audience.¹⁵ In other words, ethos must be rhetorically constructed.

One of the first scholars to theorize the ethos of a scientist was sociologist Robert K. Merton, who in his studies identified a set of institutional norms that scientists often refer to in order to establish their credibility.¹⁶ Since then other studies identified counter-norms, which called into question the stability of a Mertonian ethos. Lawrence Prelli gave the discussion more nuance with his contention that:

the constituents of the scientific *ethos* function like rhetorical *topoi* for inducing favorable or unfavorable perceptions of scientific *ethos*. [. . .] Rhetors respond to, or seek to avoid

¹² Lear, *Rachel Carson*, 450.

¹³ Kroll, "The 'Silent Springs' of Rachel Carson," 415.

¹⁴ Aristotle, *On Rhetoric: A Theory of Civic Discourse*, trans. George A. Kennedy (New York: Oxford University Press, 1991), 121.

¹⁵ Others might interpret Aristotle's ethos as an embodied moral characteristic within the speaker, but I'm using the most common interpretation here. See p. 121 for an example.

¹⁶ Robert K. Merton, "The Normative Structure of Science," in *The Sociology of Science: Theoretical and Empirical Investigations*, ed. Norma W. Storer (Chicago: University of Chicago Press, 1973), 270-278. Merton identified universalism, communal knowledge, disinterestedness, and organized skepticism as norms of the scientific ethos.

creating, ambiguities and conflicts about their scientific credibility [. . .] by choosing from among a range of strategic options that are best suited to situational contingencies.¹⁷

While the model Prelli developed did not apply to communications between scientists and the public, his notion that scientific ethos is rhetorically constructed through *topoi*, or common topics of discussion, does give scholars of public science grounds to work. Prelli tacitly acknowledges this when he writes that when scientists disagree about public policy, non-expert, lay audiences are often called upon “to adjudicate boundary disputes.” In these settings “scientists will . . . choose from among the special *topoi* of scientific ethos to construct public images favorable to their respective interests and objectives.”¹⁸ As an extension of Prelli’s notion, my work in this article demonstrates how uncertainty is one crucial common topic that constructs scientific ethos in a variety of ways in communications with the public.

Uncertainty is a foundational concept for both rhetoric and for the discipline of risk communication. Aristotle famously defined rhetoric as “an ability in each particular case to see the available means of persuasion.” For Aristotle, rhetoric essentially was a way to argue from probability, a way to “debate about things that seem to be capable of admitting two possibilities.”¹⁹ As Carolyn Miller has noted, the so-called rhetorical turn in the mid-20th century was made possible by a re-reading of Aristotle, the introduction of the *New Rhetoric*, and the attendant “expansion of uncertainty into the territories beyond ethics and politics to philosophy, science, and the academic disciplines in general.” She continues, “what is central to both the old, Aristotelian rhetoric and to this new, extended rhetoric is the function of deliberation, which is made possible and useful by uncertainty.”²⁰ In a variety of spheres then, uncertainty creates the grounds for modern deliberation about future courses of action. And as Thomas Goodnight put it, all deliberation involves the “creative resolution and the resolute creation of uncertainty.” So a study of why uncertainties appear, and in which forms they appear, is important because “knowledge of argument’s varieties may illuminate the values, character, and blindspots of an era, society, or person.”²¹ Thus, studying the management of uncertainty as a strategy of argumentation allows for a reading of historical, socio-cultural contexts, and character.

The extensive research on uncertainty has produced an array of models from a variety of disciplines, each tracking the dimensions of uncertainty as they are communicated to the public or other scientists. This research makes it clear that scientific uncertainty is a complex, flexible, topic that functions differently depending on who articulates it, in what forms, at what level, in what context, and to what audience. Friedman, *et al.*, define scientific uncertainty

¹⁷ Lawrence Prelli, *A Rhetoric of Science: Inventing Scientific Discourse* (Columbia: University of South Carolina Press, 1989), 88.

¹⁸ Prelli, *A Rhetoric of Science*, 91.

¹⁹ Aristotle, *On Rhetoric*, 37, 41.

²⁰ Carolyn Miller, “The Rhetoric of Decision Science, or, Herbert A. Simon Says,” in *The Rhetorical Turn: Invention and Persuasion in the Conduct of Inquiry*, ed. Herbert W. Simons (Chicago: University of Chicago Press, 1990), 162.

²¹ Thomas Goodnight, “The Personal, Technical, and Public Spheres of Argument: A Speculative Inquiry into the Art of Public Deliberation,” in *Contemporary Rhetorical Theory: A Reader*, eds. John Lucaites, Celeste Condit, and Sally Caudill (New York, NY: Guilford, 1999), 252.

narrowly as "a lack of scientific knowledge or disagreement over the knowledge that currently exists."²² Roger Pielke, Jr. defines uncertainty as "a situation with more than one outcome consistent with our understanding," a situation that he further subdivides into ignorance and risk.²³ I employ a combination of these definitions where scientific uncertainty is both *ignorance*, in its limited understanding of lack of knowledge or lack of consensus over that knowledge, and *risk*, the uncertainties that frame the range of outcomes that have the potential to cause significant harm.²⁴ What I uncover here are three forms that strategic articulations of uncertainty take on and how these forms construct varieties of scientific ethos in public debates around scientific controversies.

This treatment of uncertainty closely adheres to the work of sociologist Brian Campbell who contends that "the problem of uncertainty is not fundamentally quantitative. It is a problem of social definition and negotiation."²⁵ Relatedly, from the discipline of risk communication, Beverly Sauer argues for a view of uncertainty as a reflective and epistemic tool for the integration of stakeholder knowledge with technical expertise in risk scenarios: "By drawing attention to what we do not know, the process can help us develop methods to increase our understanding of risk. This process can take place within scientific communities, but stakeholders can also contribute to the process."²⁶ Shackley and Wynne agree that the relationship between authority and uncertainty is not simply an inverse one—uncertainty doesn't just challenge the authority or credibility of science in policy making. Instead they identify a number of ways in which uncertainty functions as a boundary term. They claim uncertainty, and particularly risk, is a boundary term that holds "different groups together under a semblance of mutual understanding and cooperation," even when multiple, diverging interpretations exist.²⁷ As a boundary term, uncertainty offers scientists, as Steven Zehr put it, "another occasion for performing real scientific work. Scientific knowledge is essentially being constructed in these public settings, just as it is in the scientific laboratory or on the pages of a peer-reviewed journal article."²⁸

What the literature tells us then is that uncertainty is a boundary term between scientists and publics, and it has an ability to invite public participation into epistemological frameworks, and the decision-making process. One crucial aspect of that ability is the power to

²² S. M. Friedman, S. Dunwoody, and C. L. Rogers, eds., *Communicating Uncertainty: Media Coverage of New and Controversial Science* (Mahwah, NJ: Lawrence Erlbaum, 1999), xxi.

²³ Roger A. Pielke, *The Honest Broker: Making Sense of Science in Policy and Politics* (Cambridge, Cambridge University Press, 2007), 55-57.

²⁴ This definition is consistent with my previous co-written work on uncertainty and Carson. In both I also distinguish direct uncertainty claims of "ignorance" and "risk" from hedging modalities (may be, might, could be, suggests, etc.), even though these terms do appear in other classifications of uncertainty (See Hyland).

²⁵ Brian Campbell, "Uncertainty as Symbolic Action in Disputes among Experts," *Social Studies of Science* 15 (1985): 450. And as I show later, a misunderstanding of uncertainty in public venues as a problem of quantification carries its own risks.

²⁶ Beverly Sauer, *The Rhetoric of Risk: Technical Documentation in Hazardous Environments* (Mahwah, NJ: Lawrence Erlbaum, 2003), 100.

²⁷ Simon Shackley, and Brian Wynne, "Representing Uncertainty in Global Climate Change Science and Policy: Boundary-Ordering Devices and Authority," *Science Technology Human Values* 21 (1996): 286.

²⁸ Stephen Zehr, "Scientists Representations of Uncertainty," in *Communicating Uncertainty: Media Coverage of New and Controversial Science*, eds. S. M. Friedman, S. Dunwoody and C. L. Rogers (Mahwah, NJ: Lawrence Erlbaum, 1999), 8.

shape the public perception of scientific ethos. Citing Aristotle, Carolyn Miller has pointed out how under conditions of uncertainty, when there is little else to base decisions on, ethos gets foregrounded and the public places its trust in those who appear to have practical wisdom, moral values, and goodwill. In these situations the public must measure “the character of the persuader against the character and conventions of the culture.”²⁹ This power can be wielded in any number of ways depending on the scientists’ positionality, political program, and ability to represent uncertainty in ways that strategically construct the perception of ethos. While the most common uses by critics will seek to erode scientific ethos, and uses by scientists will seek to solidify credibility and perpetuate their research,³⁰ as Sauer points out, it is also true that uncertainty can be used as a reflective and epistemic tool that requires the public to take on a decision-making position. In short, uncertainty condenses technical complexities into common terms that function as a site of negotiation and interpretation for both scientists and publics. What is needed are studies that describe how forms of uncertainty function as models of intentional behavior. As Daena Goldsmith has noted, these kinds of studies have the potential to uncover a normative approach to uncertainty.³¹ A basic description of how this relationship works in the controversy over *Silent Spring* in both the book and in the “CBS Reports” television show is what I turn to next.³²

Strategic Managements of Uncertainty and Scientific Ethos in Rachel Carson’s *Silent Spring[s]*

As I noted in the introduction, historian Gary Kroll has argued for three distinct versions of *Silent Spring* based upon the medium that shaped its message—*The New Yorker* magazine publication in June 1962; the book in September 1962; and the “CBS Reports” investigative show in April 1963. Kroll argues that each medium conveyed a unique “‘Silent Spring’ to a different public sphere.” The book publication specifically targeted “a suburban audience situated in a Cold War domestic ideology”, and “CBS Reports” challenged the undying faith in “science’s ability to know and control nature.”³³ But as distinct as the public audiences may have been, the rhetorical strategies surrounding uncertainty were remarkably similar. Not only did Carson use uncertainty to create a site for public participation, and provide vivid case studies to motivate public valuation, her strategies were iterated and added onto in the “CBS Reports” broadcast. The popular media format dichotomized representations of the science, as Kroll notes: “[the broadcast] immediately introduced the dichotomy: biology versus chemistry. It coded biology as soft, familiar, and female. In contrast, it made chemistry cold, hard, rational,

²⁹ Carolyn Miller, “The Presumptions of Expertise: The Role of *Ethos* in Risk Analysis,” *Configurations* 11 (2003): 167.

³⁰ Stephen Zehr, “Scientists Representations of Uncertainty,” 10.

³¹ D. Goldsmith, “A Normative Approach to the Study of Uncertainty and Communication,” *Journal of Communication* 51, no. 3 (2001): 526.

³² Although I don’t deal with it here, the postwar period is a crucial moment for the scientific ethos because it is held to ethical strictures in the wake of wartime abuses of scientific knowledge and power. For a review of the fascinating history of the scientific ethos in the postwar era see Lynda Walsh, “Visual Strategies for Establishing Ethos across the ‘is/ought’ Divide in the IPCC’s Report on Climate Change 2007: Summary for Policy Makers,” *Poroi* 6, no. 2 (2009):33–61 and Steven Shapin, *The Scientific Life: A Moral History of a Late Modern Vocation* (Chicago: Chicago University Press, 2008).

³³ Kroll, “The ‘Silent Springs’ of Rachel Carson,” 416.

male, and patriarchal."³⁴ But more than this, the show framed the biology ethos of Carson as a negotiator of public concern, while the chemistry ethos of Robert White-Stevens as, in the words of one Carson supporter, "fiendish."³⁵

Carson used both scientific and literary sources to deliberately draft various codes of uncertainty into 33 places in the text of *Silent Spring*. Of those 33 sites, Carson directly quotes scientists who address uncertainty in six, each time carefully contextualizing their entry into her narrative, and tactically using uncertainty to transform scientific uncertainty into a moral certainty thereby framing their scientific *ethoi* as willing negotiators who realize a need for public participation in scientific controversies.³⁶ For example, early in Chapter 4 about water pollution, Carson quickly establishes both the ignorance and risk involved with synthetic chemicals in the water supply: "Ever since chemists began to manufacture substances that nature never invented, the problems of water purification have become *complex* and *the danger to users* of water has increased."³⁷ Describing the production, variety, and distribution of synthetic chemicals, Carson notes, "Often they cannot even be identified," and she adds that sanitary engineers despairingly refer to this water pollution as "gunk." This sets the stage for Carson's scientist:

Professor Rolf Eliassen of the Massachusetts Institute of Technology testified before a congressional committee to the impossibility of predicting the composite effect of these chemicals, or of identifying the organic matter resulting from the mixture. "We don't begin to know what that is," said Professor Eliassen. "What is the effect on the people? We don't know."³⁸

The uncertainty expressed by Eliassen opens up valences to solidify his scientific ethos in the public mind, perhaps paradoxically, by acknowledging ignorance about what the gunk is and what its effects might be. The scientific ethos of Eliassen, who *testifies* about the effects, contrasts with the portrayal of the sanitary engineers' who *despair* at the gunk. Carson's next few images in the book—millions of pounds of agricultural chemicals in the drinking water in Pennsylvania, and river water in Tennessee that kills fish even after purification—attach vivid images to the uncertainty articulation to motivate a moral certainty—an intuitive probability that even if we do not have absolute certainty, we know enough to act on potential risks.³⁹ Thus, Carson uses Eliassen and her carefully selected case studies to transform scientific uncertainty into a moral certainty. In this situation, Eliassen essentially takes on the ethos of the scientific whistle-blower: "I, for one, will tell you that we cannot identify the toxins, and cannot predict the effects." This establishes an ideal public image of the scientist—one who

³⁴ Kroll, "The 'Silent Springs' of Rachel Carson," 415.

³⁵ Lear, *Rachel Carson*, 450.

³⁶ For details on those 33 sites, see Walker and Walsh (2012). My argument here about transforming scientific uncertainty to a moral certainty is a small refinement of our claim there that Carson transformed scientific uncertainty into a political certainty. As we argue there, the political certainty came about from the moral evaluation at the stasis of value and action.

³⁷ Rachel Carson, *Silent Spring* (Fortieth Anniversary Edition. Boston: Houghton Mifflin Company, 2002), 39.

³⁸ Carson, *Silent Spring*, 40.

³⁹ For more on moral certainty versus absolute certainty see Aristotle's *Nicomachean Ethics* (I.iii.4) and James Franklin, *The Science of Conjecture: Evidence and Probability Before Pascal* (Baltimore: John Hopkins University Press, 2001).

appears to honestly warn the public about the risks associated with the lack of knowledge. Constructing scientific ethos with a scientific uncertainty that transforms into a moral certainty opens the science up to social negotiation and interpretation about risk. And in admitting risk, Carson's narrative fortifies Eliassen's scientific ethos with practical wisdom, moral virtue and goodwill toward the audience because he is perceived as the agent of public negotiation.

In *Silent Spring*, Carson places scientists' expressions of uncertainty in crucial spots—either at the close of chapters, or at the close of important sections where Carson didn't have expertise. A good example of the latter is her framing of scientific ethos in the chapter about cancer rates, "One in Every Four." She writes: "a quarter century ago, cancer in children was considered a medical rarity. Today, more American school children die of cancer than from any other disease."⁴⁰ Then after discussing some statistics, she introduces "Dr. W. C. Hueper of the National Cancer Institute, a foremost authority on environmental cancer," who suggests that exposure may begin in utero, since tests on animals demonstrate, the younger one is when exposed, "the more certain the production of cancer." This sets the stage for the scientist who articulates uncertainty: "Dr. Francis Ray of the University of Florida has warned that 'we may be initiating cancer in the children of today by the addition of chemicals [to food] ... We will not know, perhaps for a generation or two, what the effects will be.'"⁴¹ The combined scientific *ethoi* of Hueper and Ray work together in a few important ways. First, Hueper is described as "a foremost authority" and his hedged remarks draw attention to the cause and effect certainties between animal tests and cancer.⁴² The addition of Ray adds scientific uncertainty about the cause and effect scenarios in human children, an example that laces the scientific uncertainty with a moral certainty—by implication, we know enough about the toxicity (it causes cancer in animals) that we should not risk the death of children from cancer. By placing the uncertainty quote here, Carson leaves the cause-effect relationship of toxic chemicals and cancer rates in children open-ended, but also morally provocative. The use of scientific uncertainty to motivate a moral certainty situates Ray's scientific ethos as a public negotiator with the virtue to admit to the uncertainties, and the goodwill to tell the public about them. Again Carson uses the scientist articulating uncertainty to establish credibility through their ability to draw the public into the knowledge-making process, and provide them with enough moral certainty to deliberate about future action. If the best science out there cannot tell us what is happening, yet cancer incidences in children are on the rise, then how do we act? Carson's use of uncertainty frames the scientist as a good public servant who sounds the alarm on the public's right to know and the public's responsibility to make good decisions about how we ought to live.

Throughout the book, scientific uncertainty claims are used by Carson to situate scientific ethos into this ideal space for public communications. By laying the groundwork on ignorance and risk and providing vivid case studies to motivate a moral certainty, Carson is able to invite the public to assess the potential effects of scientific products according to their values and moral evaluations. In other words, it is through her transformation of scientific uncertainty into a moral certainty refracted through a scientific ethos that allows the public to

⁴⁰ Carson, *Silent Spring*, 221, emphasis original.

⁴¹ Carson, *Silent Spring*, 222.

⁴² Interestingly, Hueper was also a well-known denier of the tobacco and cancer connection.

understand scientific work as the advancement of a particular moral agenda, and allows them the capacity to "read the morality of techno-scientific rationality."⁴³ It isn't just uncertainty that does the work of transformation, but importantly the conversion must be supported by the scientists who not only appear to have a knowledgeable, virtuous, and good-willed character, but are also morally motivated to let the public know the risks it is asked to take. This ethos of the scientific citizen contrasts sharply with the image of the scientist as an aloof expert. This strategic management of scientific ethos scaffolds the work of uncertainty to drive public evaluation of science onto a moral level, and the success of this strategy is partly evidenced by the "CBS Reports" adoption and adaptation of a similar approach.

One of the reasons the chemical industry's smear campaign back-fired was because their representation of scientific ethos directly contrasted with the manner in which Carson used it. While they attempted to attack Carson as "hysterical," as we will see in the "CBS reports", they also used uncertainty as a calculated probability, which in effect keeps the public at a distance from any decision-making position. This image of the chemical industry was further compounded by two events just before the CBS Reports show went on air. First, CBS received more letters before a broadcast than ever before, due to a letter writing campaign from the chemical industry demanding the program be fair about the issue. Second, three of the largest commercial sponsors, who had ties to chemical industry, withdrew their support of CBS.⁴⁴ For anyone who read about these events, it helped reinforce the notion that the chemical industry had ulterior motives and an interest in keeping the public in the dark about the identity and effects of their products.

In the "CBS Reports" show, Jay McMullen chose uncertainty strategies to frame Carson's ethos in ways that Carson herself used to frame the ethos of the scientists she quoted in her book. She is first introduced as a biologist and writer. Then with a shot of Carson sitting in her chair overlooking the Maine coast, her first words are: "Chemicals are the *sinister* and *little-recognized* partners of radiation in changing the very nature of the world, the very nature of its life." Acknowledging both a level of ignorance, "little-recognized," and a moral evaluation of risk, "sinister," Carson then attaches this uncertainty to the death of songbirds, fish, plants, and asks "Can anyone believe it is possible to lay down such a barrage of poisons on the surface of the earth without making it unfit for all life? They should not be called Insecticides but biocides."⁴⁵ As Ralph Lutts has noted, another of Carson strategies was to consistently draw an analogy between chemical pesticides and atomic radiation.⁴⁶ Here she also adds uncertainty in the form of ignorance and risk, and finishes with an open-ended rhetorical question. Immediately her ethos is established as open, but critical; knowledgeable, but also directly asking for other interpretations; through her use of uncertainty and the rhetorical question, she occupies the space of the public negotiator who seeks an assent to her moral evaluation of these chemicals as sinister.

⁴³ Robert Danisch, "Political Rhetoric in a World-Risk Society," *Rhetoric Society Quarterly* 40, no. 2 (2010): 188.

⁴⁴ Lear, *Rachel Carson*, 448.

⁴⁵ Severeid, and McMullen, "The Silent Spring," 1. Emphasis added.

⁴⁶ Ralph Lutts. "Chemical Fallout: *Silent Spring*, Radioactive Fallout, and the Environmental Movement," in *And No Birds Sing: Rhetorical Analyses of Rachel Carson's Silent Spring* ed. Craig Waddell (Carbondale, IL: Southern Illinois UP, 2000), 17-41.

In contrast, the opening statement from the spokesperson for American Cyanamid, Robert White-Stevens, is positioned as an argument from expertise, by a certainty of known facts, empirical evidence, and practical experience.⁴⁷ Sitting in his lab, with a white coat, slicked back hair, a pencil-thin moustache, and dark rimmed glasses, he says:

the major claims in Miss Rachel Carson's book, *Silent Spring*, are gross distortions of the actual facts, completely unsupported by scientific experimental evidence, and general practical experience in the field. ... The real threat then to the survival of man is not chemical but biological, in the shape of hordes of insects that can denude our forests, sweep over our crop lands, ravage our food supply and leave in their wake a train of destitution and hunger, conveying to an undernourished population the major diseases and scourges of mankind. If man were to faithfully follow the teachings of Miss Carson, we would return to the Dark Ages and the insects and diseases and vermin would once again inherit the earth.⁴⁸

Among the many fascinating things that occur in this passage, one is that Stevens' approach is to attack Carson as a distorter of scientific facts, and in his statement here there is little uncertainty in the real facts, the experimental evidence, or practical experience. These arguments from expertise can have the effect of creating a scientific ethos that divides expert and layperson because it creates an "us versus them" framework where the public is not offered much of a role in the knowledge-making process of science, or in the deliberations about its application. A lack of trust in scientific expertise, he implies, would lead to "destitution and hunger," a diseased populous, and a concession of the earth to "the vermin." The approach White-Stevens took not only effectively divided the public from the science, the vivid images he uses might easily be categorized as alarmist.

In a section of the "CBS Report" on Carson's most controversial claims about environmental cancer, Carson uses uncertainty to establish a credible ethos and attach her own vivid images of risk in order to establish goodwill toward the audience and rile them with a moral certainty. As the previous example from *Silent Spring* demonstrates, Carson often uses the trope of children for a vivid image to transform scientific uncertainty to a moral certainty. In the "CBS Reports", as Carson speaks of children, the camera moves from a portrait of Carson's face to a profile of her sitting in her home in Maryland:

Carson: [portrait of face] We have to remember, the children born today are exposed to these chemicals from birth, perhaps even before birth. Now, what is going to happen to them in adult life as a result of that exposure? *We simply don't know*, because we never before had this kind of experience. [profile sitting at home] Now, we know from experiments on animals that many of these chemicals accumulate in body tissues. We know that some are liver poisons. Others are nerve poisons, and for still others, we have evidence that they produce mutations, and in various other ways are exceedingly dangerous materials. [portrait of face] [. . .] unless we do bring these chemicals under better control, we are certainly headed for disaster.⁴⁹

⁴⁷ I do not mean to suggest that all of White-Stevens claims are framed with certainty. But his opening statement is.

⁴⁸ E. Severeid and J. McMullen, "The Silent Spring," 1-2.

⁴⁹ E. Severeid and J. McMullen, "The Silent Spring," 10.

Here the producers amplify Carson's uncertainty strategy with their careful camera work. The rhetorical question opens the field of inquiry, and her acknowledgement of what is unknown is followed by images of shocking risks to children—liver poison, nerve poison, and mutations—which inject public moral valuation and fear into the participatory space opened by the uncertainty clause. Uncertainty allows her to not only establish her knowledge, moral virtue, and goodwill toward the audience, paradoxically, it allows her to make a claim on future certainties, and make moral demands on public actions. In the rhetorical joust between Carson and White-Stevens winning requires not just "the plain facts" but frameworks of uncertainty in order to allow the public to participate in scientific decision-making processes and in evaluating the prudence of scientific progress.

As McMullen, the producer and writer of the show, constructed a credible, trustworthy scientific ethos via uncertainty for Carson and the government scientists who sympathized with her position, he also constructed a contrasting frame to critique the complacency of government scientists and assert his own ethos as an investigative journalist. As the opening of this article demonstrates, McMullen's narrative reveals a barrage of government scientists who either directly acknowledge how little they know about the toxicity of pesticides, or who appear to be forced to admit how much they don't know about their potential harm. In an example of the latter, one of McMullen's final uncertainty questions is asked of George Larrick, then commissioner of the FDA: "McMULLEN: Well, since there are *potential hazards* in the use of these new chemicals and still much *we do not know* about them, are we, in a sense, playing a game of Russian roulette when it comes to our food?" While Larrick refuses to assent to the analogy, he does assent to the premise that the FDA "cannot guarantee absolute safety."⁵⁰ Instead of solidifying his ethos by offering his own vivid example in the face of uncertainty, the FDA's commissioner essentially concedes the boundary term of uncertainty to McMullen. The effect is cumulative: McMullen's repetition of uncertainty allows him to establish his role as public informant, and his exposure of government complacency creates the space for a negative public evaluation of some of the government scientists. In this case, uncertainty works to erode scientific ethos. Because McMullen appears to be pulling the uncertainty out of government scientists, they seem to lack the proactive urgency their positions as public defenders demand. Contrasted with Carson's attempt to inject a moral certainty into the debate, here McMullen shows that some powerful government scientists are either uninformed or apparently do not share the same level of concern.

In this final statement, Robert White-Stevens uses his management of uncertainty in the form of a calculated probability to argue for a character distinction he thinks will solidify his case: Carson has the ethos of a critic who is only concerned with *every possible* hazard and danger; while White-Stevens has the ethos of a practitioner who must act, and *weigh probability*, and "assess that against utility."⁵¹ In other words, as a critical outsider, Carson need not be concerned with action and the practical wisdom it brings. But while White-Stevens manages uncertainty to make a distinction between insiders and outsiders, McMullen gives the last quote to Carson who reframes the challenge: "CARSON: now I truly believe that we in this generation must come to terms with nature, and I think we're challenged, as mankind has never been challenged before, to prove our maturity and our mastery, not of nature, but of

⁵⁰ E. Severeid and J. McMullen, "The Silent Spring," 24. Emphasis added.

⁵¹ *Ibid.*, 31. Emphasis added.

ourselves."⁵² In this final statement, Carson identifies what she envisions as the challenge for a generation: to rearticulate "control" and "mastery" away from nature and toward the self. In contrast, White-Stevens narrows the challenge to a calculated probability that makes the expert practitioner the decisive agent of action, thereby erasing the space for public participation. In his model of utility, and in his arguments from authority, he equates his ethos with scientific logic, and as Carolyn Miller pointed out, this can lead to a lack of trust.⁵³ Carson, on the other hand, appeals to a broader vision, and challenges the audience to redefine the American ethos and its notion of progress.

Conclusion

The case study presented here of strategic uses of uncertainty and scientific ethos offers three examples of its various uses. I don't mean to suggest that uncertainty strategies to shape scientific ethos were the only crucial tactic that determined the success of *Silent Spring*. As Prelli notes, establishing a credible scientific ethos in public controversies depends on the particulars of the situation, and uncertainty is simply one important strategy among many. But Carson's use of a participatory scientific ethos was radically different to the omniscient scientific ethos offered by the chemical industry who reduced uncertainty to expert quantification, and who failed to adequately acknowledge the moral concern of lay audiences. Carson's use of scientific ethos also contrasts with some of the government scientists who admit to uncertainties only when directly questioned, and who therefore appear duplicitous. Evidence of Carson and McMullen's persuasion can be found in the announcement of a Senate hearing on synthetic chemicals the day after the CBS broadcast, and more explicitly in the government report, *Use of Pesticides*, published a month later. At least in this example, the method of articulating uncertainty in order to develop a critique and initiate negotiations for alternate solutions based in science and technology was effective in driving the public policy process forward. Uncertainty as a strategic communication tool helped establish an image of a trustworthy scientific ethos, which in turn helped continue a public conversation about how to act in the face of unknown risk.

Toward the end of the "CBS Reports" Jay McMullen sums up the findings of his investigation by pointing to the "appalling scarcity of facts" on both the identity and effects of pesticides. Then in a move that could have been straight from Carson's book, he rhetorically asks, "what about the cumulative and long-range effects of pesticides? Are these chemicals causing genetic damage, or contributing to cancer or leukemia? Without research, there is no evidence; without evidence, there is no answer."⁵⁴ But simply because there is no answer, doesn't mean there is not deliberation on future action. In fact, just the opposite is true. In the absence of evidence, there is still the question of "how do we act now?" and the persuasive answer often hinges on questions of *ethos*, "who do we trust?" And *ethos* hinges on the perception of practical wisdom, moral virtue, and a goodwill toward the audience. In these moments, questions of how to act transform into questions of "what kind of people are we?"

⁵² E. Severeid and J. McMullen, "The Silent Spring," 31.

⁵³ Miller, "The Presumptions of Expertise," 202.

⁵⁴ E. Severeid and J. McMullen, "The Silent Spring," 29.

Both Rachel Carson and Jay McMullen were able to provide a site for public participation in these decisions through dual iterations of uncertainty and shades of scientific ethos. Both the book and the show used uncertainty to re-frame the terms of debate, change minds, and provide the necessary moral motivation to act based on the persuasions of the virtuous scientist speaking truth to power, and communicating risk to the public.

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