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The Climate Emergency Demands a New Kind of History

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Viewpoint

The Climate Emergency Demands a New Kind of History: Pragmatic Approaches from Science and Technology Studies, Text Mining, and Affiliated Disciplines

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Abstract: How shall we judge the element of practicality or urgency for scholars working in the era of the 2030 deadline for action on climate change? This essay surveys the reaction to climate change by scholars who work with data, using the philosopher Stephen Gardiner's conceit of "corrupt institutions" to organize the approaches according to an index of pragmatic orientation. This survey will lead to the identification of some challenges for those seeking to engage the climate deadline with data, especially work making climate data more transparent, text mining to identify aspects of corruption and reform within contemporary institutions, and building infrastructure for citizen participation.

As Jürgen Renn notes in his study of "knowledge economies" in the Anthropocene, one embodiment of "urgency" is a "quest" for forms of knowledge suited to forms of social and political action that can trigger reactions at a scale appropriate to a planetary dilemma.[1] The dilemma in question is how to best refashion scholarship, teaching, and the institutions of governance to support an appropriate response to climate change. According to climate scientists and many of the scholars who review their work, the moment in which we live is an emergency, marked by a deadline that requires political and corporate institutions around the globe to

organize a major reduction in carbon emissions in order to avert human catastrophes related to forced migration, starvation, and other outcomes of changing weather patterns.

Ethical concerns about climate raise questions about the materiality, abstraction, construction, and application of knowledge. Renn favors a response that we might call *pragmatic*—that is, one that tailors scholarly questions and approaches to the demands of contemporary reality—arguing that "the history of science has … become somewhat scholastic, concerned more with its internal affairs and connections to closely related fields in the humanities rather than the world of science and its impact on the human predicament." He has prescribed a cure for practitioners of science and technology studies: to "become experimental again."[2]

STS is already rife with experimentation geared toward a new engagement with issues of climate science and climate citizenship—a search, as Renn frames it, for the forms of scholarship appropriate to life in an emergency. Historians of science have engaged with the climate problem in important and creative ways in recent years, perhaps out of a desire to promote understanding in the public mind; examples include Naomi Oreskes and Erik Conway's counterfactual novella, *The Collapse of Western Civilization* (2014), which imagines a future where climate change is solved. Their historical work was also, notably, taken to wider audiences by a 2014 documentary based on their writings. The *Distillations* podcast from the Science History Institute has offered the public capsules of important moments when science and public engagement have worked together, often giving an accessible synopsis of pertinent scholarship about successful engagements with climate in the past—for instance, in the episodes that took on Rachel Rothschild's[a] account of the struggle to contain acid rain.[3] On its web portal, the journal

[a] I'm sorry that I don't know the answer to this question and hence must ask. The book you cite in note 3 is by Rachel Emma Rothschild. Is she writing on Alice Rothschild? Or—? *You're right – not Alice! Rachel.*

Environment and Society offers a variety of multimedia "shorts" designed to provide brief lessons about our evolving relationship with nature. Elsewhere, environmental humanists have created "observatories" to manufacture accounts of human relationships with the environment, with a similar purpose.[4] There are other interventions too, beyond scholarship, where the builders of datasets and information infrastructures support ongoing community monitoring of polluted landscapes and corrupted institutions. Pragmatism sometimes suggests still more applied and less scholastic prescriptions: Andreas Malm, for instance, advocates that his readers take up direct destructive action, learning from the success of militant movements past.[5] We might regard these different experiments—from novels to blogs to data to direct action—as the "cultures of experimentation" that mark out the many, emergent, and diverse responses of the STS community. These cultures of experimentation and their diversity are a sure sign of the talents, imagination, passion, and responsiveness of the scholars involved.

This essay will review some of the cultures of experimentation in the world of STS, asking of each: How far does this experiment go toward addressing the urgency of our current situation? Scholars like Jürgen Renn have urged us to think through the ethical demands of the planetary dilemma of climate change and to ask a difficult question: How in line with the pragmatic demands of the current emergency are our ways of knowing?

Drawing on that review, I will recommend a method, albeit one still in need of refinement. "Text mining" refers to the arena of the digital humanities concerned with the counting of words and phrases. Applied to problems of history, text mining suggests counting and modeling language over time, and it has offered historians and literary scholars a tool for generalizing about aggregate change. Applied to treatises on canon law, poetry, newspapers, political debates, political speeches, and the novel, text mining allows historians to track how

concepts and discourses change from year to year, how individual speakers and writers differ from each other, sometimes revealing hitherto unknown transitions and enriching our understanding of turning points.[6] Using text mining, scholars have begun to analyze the discourse, history, and rhetoric of politics of international organizations, drawing on the readily accessible transcripts of the World Bank and the United Nations.[7] Text mining is also being adopted by political scientists as a yardstick for understanding contemporary trends in journalism. For example, a recent study of the political bias of BBC journalists tracked their "follows" on Twitter and reached the conclusion that "the BBC leans to the centre right."[8] Scholars are using text mining to review contemporary institutions via the automated count of words and phrases in their publications.

Applied to the problem of planetary climate change, text mining offers another kind of intervention that melds the questions of the history of science with a concern for urgent response. My personal choice to explore the digital humanities was motivated by ethical questions about how text mining and web-based portals provide new opportunities for citizens to interact on a global scale. Wrestling with my responsibility to the environment drove me to explore methods, genres, geographies, and time periods more diverse than those I would have pursued as a traditional historian of technology.[9] I certainly don't think that mining text is the only sound ethical reaction to concern about the environment. However, as I shall explain below, my path shows how engagement with pragmatic questions can lead to wrestling with traditional modalities of research and publishing.

I believe that we can embrace text mining not as a goal in and of itself but as an amanuensis for the concerns of scholarship oriented around the climate emergency. For such a move to be successful, both the strategies of text mining and the datasets on which we work must

be tailored to the needs in question. But the work is worth doing, I believe, because text mining has much to offer scholars concerned with the climate emergency. Importantly, it promises to speed up the analysis of discourse around climate, allowing scholars, journalists, and citizens to monitor institutional reactions of bodies like the U.S. Congress, the World Bank, major corporations, and newspapers, tracking their discursive reactions to climate change in real time against reactions of the past.

Some scholars who remain serious about climate governance have challenged claims of urgency as unhelpful.[b] Some scholars have challenged the language of "emergency" and "deadline" as unhelpful to analysis. A decade ago, Naomi Oreskes argued that talk of "emergency" was less politically useful than gradual measures such as the taxation of carbon. "There is a long history of climate deadlines being set publicly by commentators, politicians and campaigners … and then of those deadlines passing with the threat unrealized," writes another geographer, Mike Hulme, in his review of environmental discourse.[10] Some scholarship has aimed to theorize or deconstruct the approaching deadline for climate action as merely one in a series of alarmist measures, while other reflections indicate that we should be engaged in collective mourning for a planet already dying.[11] One group of geographers and sociologists has even warned that too much attention to deadlines, or "deadline-ism," might offer the pretext for shifting benchmarks—or, worse, for a rise of authoritarian climate solutions.[12] More recently, some scholars have condemned academic calls to action as an expression of "panic," casting panic not in terms of Greta Thunberg's famous invocation of it as an appropriate response ("I

[b] I'm sure this is true, but I don't think it's supported by your particular examples. Oreskes's earlier de-emphasis of "emergency" talk was not the result of a lack of seriousness; nor are the reflections of scholars in mourning for what they perceive as a dying planet unserious. Can you recast this? Or—perhaps you mean that to be a stand-alone remark? Perhaps then we could say something like "Some who are serious have challenged the language…" and then go on with the discussion as it stands? (I apologize if I am being dim here.) *Good point.*

want you to panic") but, rather, as an embodiment of the failure of intellectual engagement.[13] Still others have attempted to parse for *whom* the deadline matters and whether it is already too late for many citizens in the developing world.[14]

Several responses from the humanities and social sciences have taken the view that the era of climate change requires a new outlook on history and causal relationships—if not a turn toward emergency measures. Historians have worried over the complex causality behind climate change (whose legacy stretches back to the Industrial Revolution of the nineteenth century but also to the agrarian revolution ten thousand years ago) and the equally complicated metrics of ascribing responsibility, when today's major polluters—China and India—are also the nations that benefited least from the Industrial Revolution and the era of imperialism that we now understand to be intimately entangled with nineteenth-century carbon-producing economies.[15] One literary scholar has sought to contextualize climate science fiction against a longer tradition of apocalyptic and utopian narratives.[16] Contextualizing the "Anthropocene" as a turning point has become, perhaps, the most common response to the deadline—one that fits into existing narratives of the Industrial Revolution, the Scientific Revolution, empire, and globalization, even while it occasions new opportunities for intellectual debate.

Underscoring how the grounds of debate are being shifted in the present moment by climate discourse represents the focus of another group of scholars. "It lives!" exclaims Bruno Latour about the planet Earth, comparing environmentalist perspectives associated with the Gaia hypothesis to Galileo's attributed remark, "And yet it moves." Jürgen Renn, consolidating the case that climate change requires new knowledge economies that abstract our embeddedness in climate in new ways, highlights the stakes of success, concluding that "we are not outside observers" of the Earth.[17] Recognizing a human relationship embedded in nature and planetary

horizons is unavoidable, they argue, at the present moment as never before. Despite their engagement with climate politics, and their insight into how present realities shift our views of scientific discourse in the past and the present, the tone of much climate writing in the humanities and social sciences is far from urgent. Indeed, in the main, most interventions of this kind have fallen short of treating climate change's temporality, impending as it is, as an *emergency* that requires immediate and practical adjustments to daily life.

Meanwhile, however, such a note of urgency has lately come into view from another part of the university. Jem Bendell, whose academic home is in management science, has produced a review of climate science that urges the possibility of societal collapse. He makes the case that knowledge of climate change strongly suggests that scholars have an ethical obligation to retool their teaching and research in appropriate ways while they still can.[18]

Bendell's critique begins with the failures of nations to keep up with the commitments to developing national climate plans that they undertook in 2015 and the similar shortcomings of the "adaption finance" programs agreed on by major financial communities. He urges scholars to prioritize practical teaching and investigation of the "systems of denial" that contribute to a crisis of collective inaction around the climate emergency. He urges a "deep adaptation agenda" for teaching and research to investigate opportunities "to adapt to changing circumstances so as to survive with valued norms and behaviors," including information about how individuals can successfully shift their "livelihoods and lifestyles" under the certainty of near-term collapse.[19]

Drawing on historical and speculative studies of civilizational collapse, Bendell voices a dire warning about the criticality of climate change for all human systems—economic, political, and pedagogical—whose work is premised on predictable access to food and water. "We might pray for time," he writes. "But the evidence before us suggests that we are set for disruptive and

probably uncontrollable levels of climate change, bringing starvation, destruction, migration, disease and war."[20]

Bendell's position is not uncontroversial, but one of the strengths of the article "Deep Adaptation" is his willingness to highlight how the temporality of emergency itself requires a pragmatic response that implies a disruption of business as usual. Admitting that his tone might strike some readers as "unacademic," Bendell nevertheless underscores that a shift of rhetoric is nevertheless the accurate reflection of a changed situation described vividly in numerous scientific papers. His words are chosen, he writes, in order to "cut through the sense that this topic is purely theoretical."[21] The urgent call for adjustment in how and what we teach and research has resonated with interlocutors across the humanities. [The art historian Gary Braasch has noted that the "dangers" around climate change also imply the opportunities "to take action in response," in part through creating narrative accounts of climate history that point towards the possibility of specific actions in the present that are designed to engage or to avert various possible futures.][c] Other historians have reflected more generally on the problem of urgency, underscoring the nature of the emergency in language that mirrors Bendell's. "Time may work against our best interests," write the environmental historian Poul Holm and his coauthors. "Action now may promise high returns in decades to come, but the immediate cost may deter us."[22]

Yet *what* actions are appropriate, given a deadline in which human survival hangs in the balance, and which are the zones where meaningful action should play out? The answer is not entirely obvious. Renewing national and financial alignments with the U.N. Climate Accords

[c] Please check my revisions in this sentence; the original seemed to go off in several different directions, and I chose one. Have I preserved your intended meaning? If not, please revise accordingly. *Yours is fine, but I clarified some more*

may make sense for those involved with policy. Bendell and his colleagues in management studies may concentrate on transitioning communities to off-grid energy while investigating the small-scale manufacture of aspirin. We have few examples of what so applied an agenda might look like in the humanities, although one comes from the historian Andreas Malm—mentioned earlier—who has used history to excavate examples of activism that have the capacity to disrupt contemporary climate politics, especially the example of 1980s environmentalists in Germany and the United Kingdom who favored violent disruption of the energy industry.[23]

A wider perspective on the need for an urgent response can help to broaden the conversation about what appropriate action looks like in other fields. We might identify Bendell's stance with pragmatism, a position that requires dealing with things on the basis of practical considerations rather than looking to those that are chiefly theoretical, intellectual, or artistic in nature.[24]

A direct engagement with the space between theory and action comes to us from the philosopher Stephen Gardiner, who in his book *A Perfect Moral Storm* (2011)[d] has modeled climate inaction as a crisis of collective action generated by "corrupt institutions" that are incentivized to minimize efforts to solve climate change, despite obvious and compelling incentives to pursue the planet's—and our species'—collective survival. Gardiner casts the explanation for collective inaction around climate change as a "perfect moral storm," where an entire set of storytelling and modeling systems that we use to understand decision making about long-term crises has somehow broken down. By making recognition of the opportunity to act a focus of his analysis, Gardiner speaks directly to the problems of urgency and action under a

[d] Please check this date. Note 25 gives 2011, and that is also the date I've found in a brief online investigation. *Thank you!*

deadline; he highlights self-interested corruption as one dimension of the *delay* that constitutes a crisis of collective action around a climate emergency.

"Delay and procrastination" form a major component of Gardiner's diagnosis of the symptoms of a failure to address climate change. Quoting the 2007 report of the Intergovernmental Panel on Climate Change, Gardiner underscores that we have long known that delaying climate mitigation strategies will increase the cost of dealing with climate change for future generations. He explains, "One way in which a generation may act badly is if it puts in place a set of future circumstances that make it morally required for its successors (and perhaps even itself) to make other generations suffer either unnecessarily, or at least more than would otherwise be the case."[25] His book probes the institutional factors that have contributed to a delayed response to an ethical mandate for immediate action.

Gardiner's critique of delay operates by pointing to a variety of institutions where the "corruption" of ethical thinking has justified a delay. As he explains, "corrupted" institutions have trouble focusing on the threat of climate change and taking effective action in the form of restructuring their resources according to our knowledge of threats to humanity over medium time frames. Gardiner develops his idea of "corrupt" institutions with reference to the self-serving relatives in Jane Austen's *Sense and Sensibility* who cut off their own cousins, arguing that poverty enriches the soul. Drawing a parallel to the present, Gardiner labels "corrupt" those proponents of free-market idealism who recommend market-based innovation without concern for the sacrifices that our policies may require of later generations or other nations.[26]

A sterling example of how historians can engage with the problem of delay can be seen in Naomi Oreskes and Erik Conway's *Merchants of Doubt*. Oreskes and Conway draw attention to one political moment that might be seen as the wellspring of the problematic of "delay and

procrastination" diagnosed by Gardiner. Working with the history of scientific reports to Congress and how they were presented in the national media, Oreskes and Conway demonstrate that the evidence of climate change has been virtually unchanged since the 1960s and that the oil industry intentionally distorted the evidence to which it had access in order to preserve its commercial interest.[27] They conclude that "doubt" about climate change—and the political delay and stagnation that followed—was manufactured. If *delay* is what later generations will read as the sovereign sin of the twentieth century, Oreskes and Conway give us a highly specific account of who was responsible. Delay was the work of fossil fuel–funded climate scientists whose work, in the 1990s, diverted public questions from a pragmatic response to the climate catastrophe. Finding those responsible for delay and passing judgment on their actions is one of the best examples of the history of science in a pragmatic setting. Applied to corrupt institutions to ask why and how inaction arises, the critical reading of documents and narratives becomes what I have elsewhere called an "audit"—in the sense of a survey that enables a detailed, document-based holding to account.[28]

With its careful attention to the individual narratives and actors responsible for destabilizing faith in scientific expertise, *Merchants of Doubt* draws the reader's attention to public arenas where questions of data have been manipulated to produce a broadly accepted [distortion of the truth][e] whose acceptance runs against the public interest. The key to *holding to account* in such a work is clear: diagnosing the manufacture of consent in science, Oreskes and Conway elucidate the evidence that offered a clarifying assessment of reality and the political discourses that constituted a crisis of collective action.

[e] Phrase okay? Isn't what's produced in fact a distortion of truth, however convincingly produced and however broadly accepted? *I've tweaked further.*

Other examples of *holding to account* from environmental studies and the history of science are easy to find: Robert Bullard's *Dumping in Dixie*, Nancy Langston's *Toxic Bodies*, and Robert Proctor's *Golden Holocaust* have investigated the legacy of environmental racism, toxic chemicals, and tobacco with explicit reference to how the failure adequately to review and regulate science impacts the daily lives of ethnic minorities, women, and children.[29] Importantly, the history of science offers case studies for showing how science has been assembled, legitimized, and acted on, driving reactions to climate change beyond proxy public-assessment polling.

Here is where the practical innovations from text mining can help—by amplifying rather than by challenging these important studies. Computers give us the power to generalize the work of Oreskes and Conway and others, locating the many institutional discourses that have prevented our culture from responding to the urgency of the climate emergency. Text mining, that is, can be used to update Oreskes and Conway. If we can translate their insights into code, we can then reapply the critique to Congress, newspapers, or American corporations on a regular basis, measuring how far language has changed. We can use text mining to identify the mechanisms of *delay*, to identify ethical forms of *corruption* latent in the language of institutional discourse, to hold institutions and individuals to *account*, and to update our diagnosis of responsibility on a regular schedule.

As I have explained elsewhere, one way to conceive of the cultural and political power of text mining is to see the practice as a form of *audit*, rather than through the classical metaphors for understanding humanistic analysis as litigation or critique. Companies perform internal audits on a regular basis. Where textual data is updated on a regular basis—as in the debates of Congress, the quarterly reports of corporations, or newspapers—scholars who use computational

tools have an opportunity to apply code on a systematic schedule to test how the institution's language is evolving.

The traditional way to engage a critique is to replicate it or extend it through writing and teaching, a gradual process where in each case the action has to be performed by an intellectual who remains deeply engaged with a critical tradition.[f] The tradition is passed down through individuals, kept alive by individual acts of reception and interpretation. The tradition is only as healthy as the schedule of the seminar or the issues of the journal. Computational power breaks down these limits. Code brings *routine application* to bear on critical readings of institutions; computational text mining implies the possibility of *automating* criticism, turning a one-time critical reading into a routine audit.

A text-mining audit might start from an analysis of the institutional discourse of Congress or a newspaper, but what makes it an *audit* is the possibility of replicating the same historical analysis up to the minute, based on more recent data. Auditing implies the expectation of returning later to the same review of accounts. It also suggests the possibility of a mechanism for changing the culture of institutions, whether through the stick of negative opinion or the carrot that rewards altered performance. Indeed, in certain quarters of the social sciences, text mining is already being put to such uses on behalf of the environment. Using text mining, economists have monitored climate news stories for data that they then used to hedge the stocks of companies linked negatively to climate events.[30] Routine application implies responsive adjustment—for instance, short-selling the stocks of companies that exhibit a certain pattern of discourse.

An example of text mining applied to climate looks at how speeches given in the U.S. Congress from 1970 to 2009 handled the problem of the environment. The words associated with

[f] Please clarify: to teach these critiques to others? Or—? *Clarified with some additions.*

the terms “environment” and “environmentalist” changed during that period, and the nuances of that shift are the subject of a research project currently in development.[31] The dominant form of denouncing environmental advocacy—as “overzealous” (4 counts in 1970–1974), “rabid” (frequent in 1980–1999), and “antibusiness” (1975–1999)—experienced a marked decline in the 1980s; all three terms[g] all but disappeared from the political lexicon by 1995. After 1980, a new set of two-word phrases began to appear with regularity when environmentalism was invoked: these phrases used the words “liberal,” “activist,” “crazy,” and “extremist.”

Figure 1 presents an overview of two-word phrases including the word “environmentalist.” The epigrams “radical environmentalist” and “extreme environmentalist” surged after 1985, the former term witnessing exponential growth in its use from 1995 to 1999. The rise in a collection of interlinked keywords suggests the rise of a discourse, although it remains for historians of party politics to investigate whether this rhetoric was the work of a few individuals, an organized campaign, a shift in worldview that responded to trends in the media, a spontaneous cultural phenomenon, or some combination.

What the numbers illustrate beyond a doubt, however, is a focused political trend hostile to environmentalism, not simply characterizing environmentalism as one possible economic concern among others (for instance, the economic interests of coal miners) but, rather, tarring environmentalism as the invention of privileged special interests—that is, the “liberal” and the “wealthy,” who show up after 2000 in the phrases “liberal environmentalist” and “wealthy environmentalist” as rhetorical figures whose presence in political storytelling suggests a hidden conspiracy of the elite.

[g] What does “both terms” refer to? *corrected*

This data does not present a new narrative, of course, so much as it adds specific details about the timing of a political shift, the role of Congress as a rhetorical battleground, and a political style of disengagement that can be tracked in discourse today. Identifying the shift complements what we already know from Oreskes and Conway about concerted campaigns to cast doubt on scientific evidence.

The data identifies three members of the U.S. Congress who together contributed 60 percent of the phrases graphed in Figure 1: Ted Stevens, senator for Alaska (1968–2009); Dana Rohrabacher, representative for California (1989–2019); and John Duncan, representative for Tennessee (1988–2018). All three were Republicans. Together with three other speakers—Walter Herger of California, Virginia Foxx of North Carolina, and Orrin Hatch of Utah—this tiny group of Republicans contributed 90 percent of the epigrams shown in Figure 1, inflating occasional complaints about "overzealous" advocacy into what amounted, after 1995, to an onslaught of condemnation directed at the advocates of science-based policy.

The data represents two clear turning points in the genesis of the anti-environmentalist lexicon. Stevens alone, of this group, began experimenting with negative epigrams targeting environmentalists as early as 1970, as Figure 2 shows. Representatives Herger and Duncan began their campaigns in 1990, soon followed by a resurgence of activity by Mr. Stevens. After the year 2000, they were joined by Mr. Hatch and Mr. Rohrabacher, with Ms. Foxx adopting the lexicon briefly in 2005. As Duncan and Herger led an onslaught of coordinated phrases, Mr. Stevens's own use of the negative epigrams began to swell, suggesting that either he renewed his use of a negative vocabulary, charged with enthusiasm by the example of his fellow congressmen, or that the negative attacks on environmentalists after 1990 represented a coordinated campaign explicitly designed to attack contemporary environmental policy. While

further details of this political campaign remain to be worked out, it is clear that the story of the rhetoric used to support the dismissal of environmental science adds a new dimension to the story told by Oreskes and Conway, wherein the role of politicians and their orchestration of language are key.

Technically, my demonstration fails one of my own criteria for a proper audit in that the data stops in 2010, the last year in the Stanford database. My research would become an "audit" if it were applied to more recent debates and if a mechanism were set up for scraping new data from debates on a routine monthly or quarterly basis, redrawing the list of phrases and participants to target new trends.[32] A further caveat should be offered as well: that text mining of the kind modeled here will rarely be sufficient, on its own, to support a historical explanation. The data analysis modeled in Figures 1 and 2 isn't, properly speaking, sufficient for what we normally consider historical research. It doesn't tell us everything that a careful study of congressional debate would, [although the visualization could support further investigations that I will not go into here.][h] Iterative investigations might redraw the visualizations to highlight differences in party and region or to target the moment when the new rhetoric first appeared. Archival sources might be used to dig into the motivations of the individual speakers and the degree to which their rhetorical strategies were coordinated.

STS scholars will recognize other cautions about the promise of a tool for generating statistical updates on the status of the body politic. The distortions of COVID data and its reception strongly predict certain limits for text mining as a tool. Just as there are multiple ways of testing for and modeling epidemic diseases, so there are a variety of models of text mining, some more valid than others. As STS scholars know, COVID tracking is problematic, given the

[h] Please check my revision of this sentence. Have I preserved your intended meaning? Or not? *Perfect.*

use of highly different measuring instruments in different countries. The COVID data visualization case also shows that data is not sufficient to produce a political consensus; one study of data visualizations circulated on social media showed how conservative and liberal groups used the data to support orthogonal conclusions.[33]

Just like pandemic tracking, text mining provides no ultimate truth about reality. In both cases, the abstractions offered are a series of mirrors, each of which may conceal distortions or biases that expert readers are aware of. Each representation, in turn, conveys truths that may also be lost or distorted[i] in reception. Nor is text mining a silver bullet for democratic dissent, guaranteed to produce political consensus about climate change.

Reader, don't get me wrong: I am absolutely not saying that text mining is a *substitute* for critique, for Oreskes and Conway's careful work in the archives, or for the labor of critical thinking and teaching out of which most careers in the humanities are made. All of that is an effective precondition for a savvy data science, whose practitioners are capable of creating code-enabled audits to track social and political realities and real time. Nor do I mean to diminish the importance of other important research about the ethical dimensions of Artificial Intelligence, documented by authors such as Safiya Noble and Wendy Chun.[j] Nor should any reader of *Isis* turn a blind eye to important studies about the high energy consumption that has been documented as an aspect of research via AI models and word embeddings in particular.[k]

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[i] I.e., misunderstood or misrepresented? I'm trying to avoid repeating "distortions"/"distorted," but I don't want to, um, distort what you're saying here. *This helped. I've broken down the sentences, which may also help.*

[j] Wendy Hui Kyong Chun, *Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition* (Cambridge: MIT Press, 2021); Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York: NYU Press, 2018).

[k] Emma Strubell, Ananya Ganesh, and Andrew McCallum, "Energy and Policy Considerations for Modern Deep Learning Research," in *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 34, 2020, 13693–96.

All I am saying is that simple visualizations are within our grasp and may accomplish the purpose of routinizing critiques which humanists forge with great labor and care. Simple visualizations have their uses. The daily data visualizations about Covid[l], with all their faults, have illuminated the reality of the pandemic in recent times, and text mining could offer historians a similar tool for intervening in public discourse. If text mining does no more than to provide a window on a shared experience, it would still amplify the state of our knowledge about how and where discourse about climate is changing today. The promise of text mining for historical research has already been well established. Many literary scholars today use the "distant" reading of texts alongside the "close" reading of particular samples of text that are exemplary of or exceptional to the quantitative model of the whole—a tactic that has lately been used to survey postwar racism in the American novel.[34] Text mining in the service of auditing institutions could complement traditional historical research and contribute to public discourse. It could support, and even drive, a more disciplined practice of regular attention to how public figures of many kinds speak and write about climate. It is not a magic arrow. It can be duped by greenwashing and naïve analysis. But text mining could at least help us to ask: have our cities, states, nations, corporations, and newspapers persisted in keeping attention on real-time developments in climate change this year, this month, or this week? Who leads and who lags according to some simple metrics of truth-telling?

The exercise demonstrated here also suggests what text mining can offer public discourse. My hasty survey of the negative assessments of environmentalism in Congress establishes the scope of what is within our grasp: extending our historical analysis into replicable assessments of political language, conducted on a regular basis through automated analysis of

[l] I.e., COVID data? *This helped.*

language, speakers, and institutions. The real benefit of the auditing practice that I describe is an intervention in time: a practice of haste to produce regular records of certain metrics. Taken as the amanuensis for audits of public speech, text mining invites us to imagine web-based portals that deliver data about contemporary discourse *in real time*, offering a mirror of how far we have come in the last month, year, or decade. A real-time statistic can offer an invaluable aid for decision making and a spur to public debate. Much like the daily and weekly charts that plotted the progress of the COVID pandemic, data-driven visualizations can inform decision makers at a variety of levels, from individuals to schools to national governments, about how climate discourse is changing—and where an appropriate response might be called for. For COVID, daily data visualizations provided valuable mirrors—however distorted, various, and subject to improvement they were—that proved vital to the work of states, cities, schools, families, and individuals assessing appropriate actions in a rapidly changing environment. Covid charts are vital precisely because they help the teacher to determine when, one week, it might be safe to take off the mask, even while, another week, the mask must go back on. What is the equivalent in terms of climate change? It might be a simple metric that helps us to establish which leaders, politicians, and corporations have treated climate reality like an emergency by responding to real-time events and opportunities with outstanding contributions of attention, language, and nuance.

In extending the possibility of automating a "real time" representation of shifts in political speech, text mining models a possible scholarly *haste*, a natural antidote to the politics of *delay* that Oreskes and Conway and Gardiner have highlighted as key to the collective failure of climate action over recent decades. Whereas delay operates through the shrouding of evidence—for example, by the corporations studied by Oreskes—*haste* can enable scholars to

produce a relatively quick rejoinder to tendencies in papers or media discourse, allowing the rapid manufacture of audits similar to those that have long been pursued in environmental studies and the history of science by scholars such as Bullard, Langston, Proctor, Oreskes and Conway, and others, typically reviewing printed documentation by analogue means. That is, a collection of a million scientific papers can be subjected to word-count analysis for their general themes and how those themes change over time, while a similar study depending on close reading, even where it engages the practices of sampling, might take far longer.

Text mining means that at least some studies of political language and institutional behavior can be automated for regular tracking or developed in short order as a response to political crises—for instance, the failure of the 2021 Congress to ratify a Green New Deal.

Even more important, hasty work with text mining can in turn directly support the "culture of experimentation" with strategies for bridging scholarship and public culture, which scholars like Renn have urged is so crucial at this moment. As some scholars choose to become the designers of digital infrastructure, text mining can support the work of modeling discussions of climate governance, investment choices, and public debate into abstractions, perhaps working to monitor the zones of corruption identified by Gardiner.[35] Of course, infrastructures for sharing information do not always work in the service of the truth, yet peer-to-peer technologies have also offered important opportunities for creating participatory infrastructures where advancing a shared narrative is more important than enforcing a bubble.[36] By creating the possibility of surveillance from below, such interventions would answer Gardiner's call to disrupt climate inaction by drawing public attention to corrupt institutions and to the possibility of change.

The abstracted analysis over time offered by text mining has a social role to play that is important beyond the contributions of text mining in research. Thinking through the importance

of abstraction in childhood development (as documented by Piaget) and the historical development of devices of abstraction such as accounting, Jürgen Renn has argued that we need "commonly understandable cultural abstractions" to help human actors understand the abstract dimensions of adaptation. Imagining what appropriate abstractions might look like, he at first suggests data-driven representations of "our ecological footprint."[37] Were text mining to be embraced by more scholars in these fields, haste would move from being a subject of analysis—as in the haste and delay associated with climate discourse in the past—to becoming an active principle that scholars can embrace as they undertake the auditing of institutions in more and more pragmatic ways.

Jo Guldi[m] is author of *The Long Land War: The Global Struggle for Occupancy Rights, 1881-1974* (Yale 2022), the coauthor of *The History Manifesto* (Cambridge, 2014), and the author of *Roads to Power* (Harvard, 2012). Her forthcoming book from Cambridge, *The Dangerous Art of Text Mining*, puts modern natural language processing into conversation with the philosophy of history. In recent years, she has explored, in a series of articles, questions about the "fit" between text mining, historical explanation, public-facing portals for serving data, democratic engagement, and ethical problems such as climate change. She teaches courses on text mining as a tool for historical analysis, working in both R and Python. With a group of international colleagues, she leads a bimonthly Zoom-based seminar on Text Mining Parliamentary Democracy: https://www.umu.se/en/events/mining-parliamentary-data-seminar-comparing-national-parliaments_10524310/. She was formerly a member of the Harvard Society of Fellows and Hans Rothfels Professor of History at Brown University. Today she is Director of the Program in the Digital Humanities, affiliated faculty of the Data Science Institute, and Associate Professor of the History of Britain and Its Empire at Southern Methodist University in Dallas, as well as external faculty of the Stevanovich Institute for the Formation of Knowledge at the University of Chicago. In the summer of 2022, she is Visiting Professor at the University of Jyväskylä in Finland. Department of History, 60 Dallas Hall, Dallas, Texas 75208, USA; jguldi@smu.edu.

[1] Jürgen Renn, *The Evolution of Knowledge: Rethinking Science for the Anthropocene* (Princeton, N.J.: Princeton Univ. Press, 2020), p. 33.

[2] *Ibid.*, pp. xv, xvi.

[m] This is the bio that appeared with "The Modern Paradigms of Explanation." Not only has it been a while; these footnotes indicate that you have a lot to add! Please update.

[3] Naomi Oreskes and Erik M. Conway, *The Collapse of Western Civilization: A View from the Future* (New York: Columbia Univ. Press, 2014); Rachel Emma Rothschild, *Poisonous Skies: Acid Rain and the Globalization of Pollution* (Chicago: Univ. Chicago Press, 2019); and *Distillations* podcast, Science History Institute, 24 June 2016, https://www.sciencehistory.org/distillations/podcast.

[4] "Arcadia | Environment and Society Portal," http://www.environmentandsociety.org/arcadia (accessed 1 Dec. 2020); "Archive of Hope and Cautionary Tales | Humanities for the Environment," https://hfe-observatories.org/project/archive-of-hope-and-cautionary-tales/ (accessed 1 Dec. 2020); and Poul Holm *et al.*, "Humanities for the Environment—A Manifesto for Research and Action," *Humanities*, 2015, *4*:977–992, https://doi.org/10.3390/h4040977.

[5] Andreas Malm, *How to Blow Up a Pipeline* (New York: Verso, 2021). For a survey of other interventions[n] see Jo Guldi, "Scholarly Infrastructure as Critical Argument: Nine Principles in a Preliminary Survey of the Bibliographic and Critical Values Expressed by Scholarly Web-Portals for Visualizing Data," *Digital Humanities Quarterly*, 2020, *14*(3).

[6] For an overview of the field see Hannu Salmi, *What Is Digital History?* (Medford, Mass.: Polity, 2021). For a hands-on introduction for beginners interested in text mining see Julia Silge and David Robinson, *Text Mining with R: A Tidy Approach* (Beijing: O'Reilly Media, 2017). For text mining applied to novels, poetry, newspapers, parliamentary debates, political speeches, and canon law see Richard Jean So, *Redlining Culture: A Data History of Racial Inequality and Postwar Fiction* (New York: Columbia Univ. Press, 2020); Ted Underwood, *Distant Horizons: Digital Evidence and Literary Change* (Chicago: Univ. Chicago Press, 2019); Sandeep Soni, Lauren F. Klein, and Jacob Eisenstein, "Abolitionist Networks: Modeling Language Change in

[n] "Introduction" to this part of the note okay? Please modify as necessary. Thank you! *great*

Nineteenth-Century Activist Newspapers," *Journal of Cultural Analytics*, 2021, *1*(2):18841, https://doi.org/10.22148/001c.18841; Jo Guldi, "The Official Mind's View of Empire, in Miniature: Quantifying World Geography in Hansard's Parliamentary Debates," *Journal of World History*, 2021, *32*:345–370, https://doi.org/10.1353/jwh.2021.0028; Luke Blaxill, *The War of Words: The Language of British Elections, 1880–1914* (Woodbridge, Suffolk: Boydell, 2020); Kellen Funk and Lincoln A. Mullen, "The Spine of American Law: Digital Text Analysis and U.S. Legal Practice," *American Historical Review*, 2018, *123*:132–164, https://doi.org/10.1093/ahr/123.1.132; and Cameron Blevins, "Space, Nation, and the Triumph of Region: A View of the World from Houston," *Journal of American History*, 2014, *101*:122–147, https://doi.org/10.1093/jahist/jau184.

[7] Franco Moretti and Dominique Pestre, "Bankspeak: The Language of World Bank Reports," *New Left Review*, 2015, *92*:75–99; and Alexander Kentikelenis and Erik Voeten, "Legitimacy Challenges to the Liberal World Order: Evidence from United Nations Speeches, 1970–2018," *Review of International Organizations*, 2021, *16*:721–752, https://doi.org/10.1007/s11558-020-09404-y.

[8] Tom Mills, "What the BBC Can Learn from Its Journalists' Use of Twitter," *Guardian*, 2 Dec. 2020, https://www.theguardian.com/commentisfree/2020/dec/02/bbc-journalists-twitter-study-reporters. The sentences in this paragraph overlap with those in a book chapter that concentrates on surveying text mining applied to climate change problems: Jo Guldi, "Working on a Deadline," in *Debates in the Digital Humanities 2020*, ed. Lauren Klein and Matthew Gold (Minneapolis: Univ. Minnesota Press, forthcoming, 2021).[o]

[o] Is this volume out yet? If so, can you supply inclusive page numbers? Also, an essay with the same title is said in note 28 to be forthcoming in the journal *KNOW*. Are these the same essay, appearing in two different publications? Or—? *Not out yet. The KNOW title is different and has been corrected.*

[9] For method see Jo Guldi, "Parliament's Debates about Infrastructure: An Exercise in Using Dynamic Topic Models to Synthesize Historical Change," *Technology and Culture*, 2019, *60*:1–33. For genre see Guldi and David Armitage, *The History Manifesto* (Cambridge: Cambridge Univ. Press, 2014). For geography and time period see Guldi, *The Long Land War: The Global Struggle for Occupancy Rights, 1881-1974* (New Haven, Conn.: Yale Univ. Press, 2022).[p]

[10] Naomi Oreskes, "Metaphors of Warfare and the Lessons of History: Time to Revisit a Carbon Tax?" *Climatic Change*, 2011, *104*:223–230, https://doi.org/10.1007/s10584-010-9887-5, esp. pp. 224–225; and Mike Hulme, "Is It Too Late (to Stop Dangerous Climate Change)? An Editorial," *WIREs Climate Change*, 2020, *11*:e620, https://doi.org/10.1002/wcc.619.

[11] For deconstructing the deadline see Shinichiro Asayama *et al.*, "Why Setting a Climate Deadline Is Dangerous," *Nature Climate Change*, 2019, *9*:570–572; for mourning and palliative care see Debbie Horsfall *et al.*, "Palliative Care for the Planet," *Journal of Applied Arts and Health*, 2014, *5*:281–292, https://doi.org/10.1386/jaah.5.2.281_1.

[12] Asayama *et al.*, "Why Setting a Climate Deadline Is Dangerous," p. 570.

[13] For invocation of climate change as a reason to contemplate new approaches, labeled "panic" and cast as the abandonment of traditional humanistic concerns, see Deborah Cohen and Peter Mandler, "*The History Manifesto*: A Critique," *Amer. Hist. Rev.*, 2015, *120*:530–542. For their target see Guldi and Armitage, *History Manifesto* (cit. n. 9).

[14] Carol Farbotko, "Is It Too Late to Prevent Systemic Danger to the World's Poor?" *WIREs Climate Change*, 2020, *11*:e609, https://doi.org/10.1002/wcc.609; and Kyle Whyte, "Too Late for Indigenous Climate Justice: Ecological and Relational Tipping Points," *ibid.*, e603, https://doi.org/10.1002/wcc.603.

[p] Will this volume be out by (roughly) the time the June issue appears? If not, I'll substitute "forthcoming" for the year. *It's due out in April 2022.*

[15] Dipesh Chakrabarty, "The Climate of History: Four Theses," *Critical Inquiry*, 2009, *35*:197–222; Chakrabarty, *The Climate of History in a Planetary Age* (Chicago: Univ. Chicago Press, 2021); and Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (New York: Verso, 2016).

[16] For contemporary climate fiction see Peter Y. Paik, *From Utopia to Apocalypse: Science Fiction and the Politics of Catastrophe* (Minneapolis: Univ. Minnesota Press, 2010).

[17] Bruno Latour, *Facing Gaia* (Cambridge: Polity, 2017), p. 59[q]; and Renn, *Evolution of Knowledge* (cit. n. 1), p. 4.

[18] Jem Bendell, "Deep Adaptation: A Map for Navigating Climate Tragedy," IFLAS Occasional Paper 2 (Ambleside: Univ. Cumbria, 27 July 2018), http://www.lifeworth.com/deepadaptation.pdf.

[19] *Ibid.*, pp. 21, 14, 23–24.

[20] *Ibid.*, p. 13. Certain sentences summarizing Bendell in this section are recapitulated in Jo Guldi, "From Critique to Audit: A Pragmatic Response to the Climate Emergency from the Humanities and Social Sciences, and a Call to Action," *KNOW: A Journal on the Formation of Knowledge*, 2021, *5*:169–196, https://doi.org/10.1086/716854.

[21] Bendell, "Deep Adaptation," p. 14. For critiques of Bendell, which mainly focus on his interpretation of the science of rapid ice melt and how irreversible the process is once it has begun, see Tom Nicholas, Galen Hall, and Colleen Schmidt, "The Faulty Science, Doomism, and Flawed Conclusions of Deep Adaptation," openDemocracy, July 14, 2020, https://www.opendemocracy.net/en/oureconomy/faulty-science-doomism-and-flawed-conclusions-deep-adaptation/.
[r]

[22] Gary Braasch, "Climate Change: Is Seeing Believing?" *Bulletin of the Atomic Scientists*, 2013, *69*(6):33–41, on p. 35; and Holm *et al.*, "Humanities for the Environment" (cit. n. 4), p. 982.

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[q] I checked the print edition and added the page number; hope that's okay. *Thanks!*
[r] Please complete this footnote. *Done.*

[23] Malm, *How to Blow Up a Pipeline* (cit. n. 5).

[24] Historically, pragmatism arose in philosophy and the social sciences as an alternative to discourse unhinged from the practical needs of a society; William James, one of the founders of the American school of pragmatism in philosophy, defined it as a "method for settling metaphysical disputes that might otherwise be interminable." William James, *Pragmatism: A New Name for Some Old Philosophy, Old Ways of Thinking: Popular Lectures on Philosophy* (New York: Longmans, Green, 1907), p. 28.

[25] For quotation in text, Stephen Mark Gardiner, *A Perfect Moral Storm: The Ethical Tragedy of Climate Change* (New York: Oxford Univ. Press, 2011), p. 40. For where Gardiner's inquiry begins with the IPCC report, p. 20.[s]

[26] Gardiner, *Perfect Moral Storm*, pp. 302–338.

[27] In Oreskes and Conway's account, the discovery of a climate emergency in the 1960s was met with successive cries for research, which mobilized independent reports by the group of physicists assembled as the Jasons, the National Academy of Sciences, and a series of later government commissions. While scientists uniformly pressed that climate change was a problem that required immediate action, politicians uniformly reacted by prescribing more research—in short, by reacting to the data-driven deadline with pretexts for delay. The historians chronicle the deliberate distortion of the analysis of climate change by three scholars: one affiliated with certain Washington think tanks, another of whom seized the opportunity of his coauthor's convalescence in hospital to assert a faulty version of climate variability out of keeping with the scientific consensus, and a third who attempted to take down one of climate science's rising stars on the basis of hearsay about a revision process. In each of these three cases, distorted data was

[s] Please check; your original note 20 is now note 15, which does not refer to the IPPC (not IPC, correct?) report. *It should be IPCC*

used as fuel to create political conflict—for instance, in the form of a series of attacks on Senator Al Gore's ideas about climate in 1992. The political attacks further postponed action that had been recommended almost unanimously by scientists since the 1960s. See Naomi Oreskes and Erik M. Conway, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury, 2010), 169-215.[t]

[28] I develop the notion of an "audit" further with examples from the digital humanities in Jo Guldi, "From Critique to Audit."[u] In that article I contrast ongoing and automated "audits" with what I call the "litigative" mode of reviewing documents from the past in preparation for a single trial. By this definition, the works of Oreskes and Conway, Robert Proctor, Robert Bullard, and Nancy Langston—cast here as "audits"—are actually pieces of "litigation" because their critique is not designed to be reiterated on a regular basis.

[29] Robert D. Bullard, *Dumping in Dixie: Race, Class, and Environmental Quality* (London: Routledge, 1990); Nancy Langston, *Toxic Bodies: Hormone Disruptors and the Legacy of DES* (New Haven, Conn.: Yale Univ. Press, 2010); and Robert N. Proctor, *Golden Holocaust: Origins of the Cigarette Catastrophe and the Case for Abolition* (Berkeley: Univ. California Press, 2012).

[30] Robert F. Engle III *et al.*, "Hedging Climate Change News," Working Paper (National Bureau of Economic Research, Apr. 2019), https://doi.org/10.3386/w25734.

[31] For sentence data on speeches from the U.S. Congress see Matthew Gentzkow, Jesse M. Shapiro, and Matt Taddy, "Congressional Record for the 43rd–114th Congresses: Parsed Speeches and Phrase Counts" (Palo Alto, Calif.: Stanford Libraries [distributor], 16 Jan. 2018), https://data.stanford.edu/congress_text. The process described below uses word embeddings as a

[t] Publication information correct as added? Also, do you want to provide specific section or page citations? *done*
[u] Please see my query at note 8. *corrected*

method of understanding historical change. For this approach see Austin C. Kozlowski, Taddy, and James A. Evans, "The Geometry of Culture: Analyzing the Meanings of Class through Word Embeddings," *American Sociological Review*, 2019, *84*:905–949, https://doi.org/10.1177/0003122419877135; and Melvin Wevers, "Using Word Embeddings to Examine Gender Bias in Dutch Newspapers, 1950–1990," *ArXiv*:1907.08922, 21 July 2019, http://arxiv.org/abs/1907.08922. My project applies the Gensim Word2Vec software package to the data, bundling text into periods of five years before analysis. The words modeled in Figure 1 were first identified as phrases of interest using the word embeddings model, but the data modeled there is based on simple word counts over time.

[32] For instances of semantic networks used to track discourse change see Paul Nulty's work with semantic networks, as documented in Peter De Bolla *et al.*, "The Conceptual Foundations of the Modern Idea of Government in the British Eighteenth Century: A Distributional Concept Analysis," *International Journal for History, Culture, and Modernity*, 2019, *7*(1), https://doi.org/10.18352/hcm.575; and De Bolla *et al.*, "Distributional Concept Analysis," *Contributions to the History of Concepts*, 2019, *14*(1):66–92, https://doi.org/10.3167/choc.2019.140104.

[33] Crystal Lee *et al*., "Viral Visualizations: How Coronavirus Skeptics Use Orthodox Data Practices to Promote Unorthodox Science Online," in *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (New York: Association for Computing Machinery, 2021), art. 607, pp. 1–18, https://doi.org/10.1145/3411764.3445211.

[34] For distant and close readings of the postwar novel see So, *Redlining Culture* (cit. n. 6). For more on the method of moving between quantitative and qualitative readings, "distant" and "close," and the role of exceptional and exemplary passages see *ibid.*; Andrew Piper,

Enumerations: Data and Literary Study (Chicago: Univ. Chicago Press, 2019); and Underwood, *Distant Horizons* (cit. n. 6). The visualization need not serve as the endpoint of an intervention; it might be an invitation to a deeper debate. As I have explained elsewhere, mathematical abstractions such as word embeddings, topic models, and other devices of text modeling via Natural Language Processing do not confer a universal truth but, rather, a perspectival one. No single visualization can give us the entire truth of how the word "environmentalist" was used; there are a dozen different algorithms for modeling word context we could use, which would represent near but slightly different histories. See Jo Guldi, "Critical Search: A Procedure for Guided Reading in Large-Scale Textual Corpora," *J. Cult. Analyt.*, 2018, *3*(1):1–35, https://doi.org/10.22148/16.030.

[35] A scholarly praxis aimed against corruption could begin by building macroscopes aimed at making transparent how democratic representatives have discussed science and the environment, and perhaps aimed even more broadly at reflecting real differences in how, say, Fox News, Reddit, and the *Wall Street Journal* treat climate news—as well as how their perspectives have evolved over time. See Guldi, "Scholarly Infrastructure as Critical Argument" (cit. n. 4).

[36] Philosophers have lately parsed the working of "epistemic bubbles" on social media sites such as Facebook, where fake stories abound and distrust is bred against individuals from outside the community. See C. Thi Nguyen, "Echo Chambers and Epistemic Bubbles," *Episteme*, 2020, *17*:141–161, https://doi.org/10.1017/epi.2018.32. As early as 2005, the anthropologist Chris Kelty identified a "recursive public sphere" of geeks who self-consciously understand their work in coding and "hacking" as an intervention in social relationships. See Christopher M. Kelty, *The Participant: A Century of Participation in Four Stories* (Chicago: Univ. Chicago Press, 2020).

[37] Renn, *Evolution of Knowledge* (cit. n. 1), p. 33.

Figure 1. Negative bigrams associated with “environmentalist,” 1965–2009.[v]

Figure 2. The key speakers responsible for 90 percent of the figures of speech in Figure 1.

[v] Your figures will be typeset separately, so I have disembedded them from the text.