The Place of Agnotology in the Field of Ignorance Studies and Industrial Doubt-Making: A Bibliometric Study

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AI Disclosure and Translation Statement:
The original manuscript of this work was authored in Farsi (Persian) by the researcher. The English version was produced through AI-assisted translation and linguistic refinement, utilizing Google Translate and Large Language Models (including Claude, developed by Anthropic). The author has meticulously reviewed, edited, and verified the final English text to ensure that all theoretical nuances, philosophical arguments, and conceptual frameworks accurately reflect the original Persian content. The author remains fully responsible for the integrity and accuracy of the translation. The original Persian manuscript is available from the author upon reasonable request.

Abstract

Background. Robert Proctor presented "agnotology" in 2008 to name the active production of ignorance, with the tobacco industry as the main case. Since then the word has spread, and this article asks two questions. What place does the word hold in the literature on ignorance, and has it moved away from Proctor's problem? And where does research on industrial doubt-making now sit: under this word, or in another tradition?

Method. Using OpenAlex data, we compared works that contain the word (398 works, 2008–2026) with works that cite Proctor and Schiebinger's 2008 volume, works that cite *Merchants of Doubt*, and works that cite a 2006 article by Michaels. We also followed 50 anchor works chosen by the author, and we examined the ozone case and a published list of 28 doubt-making strategies drawn from five industries.

Findings. The word's share of the "ignorance" literature rose about 2.7 times. None of the three hypotheses about drift received clear support, and the intervals are wide. Works that contain the word make up only 8–10% of the works that cite the 2008 volume and 1–2% of the works that cite *Merchants of Doubt*. Among the anchor works we examined, research on industrial doubt-making has continued mainly outside the word, in a parallel tradition with its own references, joined to the word by a few bridges. For ozone we found almost no such research. The 28-strategy list rests on sources of different kinds, and part of it rests on planning documents.

Conclusion. The word has expanded without a clear sign of drift, but the research on Proctor's problem does not depend on it. The analysis is exploratory, and its results do not extend to the whole literature.

Note: This record includes both the main preprint manuscript and the supplementary datasets/materials used in the analysis.

Keywords: agnotology; industrial doubt-making; ignorance studies; bibliometrics; OpenAlex

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Introduction and Background

According to Robert Proctor, Iain Boal coined the word "agnotology" in spring 1992 (Proctor, 2008, pp. 27–28). The word spread widely in 2008, when Proctor and Schiebinger introduced it into the scholarly literature in a volume titled *Agnotology: The Making and Unmaking of Ignorance* (Proctor & Schiebinger, 2008). Their claim was that ignorance is not only an absence of knowledge: people can make it, keep it and distribute it. In 2011 Proctor pursued the same question in his research on tobacco and the history of the cigarette (Proctor, 2011).

We should also mention a very close word, "agnoiology". In the nineteenth century James Frederick Ferrier (1808–1864), professor of moral philosophy and political economy at St Andrews, used it for a different subject and meaning. In *Institutes of Metaphysic: The Theory of Knowing and Being* (Ferrier, 1854), he coined agnoiology for the "theory of ignorance", alongside epistemology and ontology. Agnoiology was a logical and metaphysical inquiry into what not-knowing is and what it can attach to. Ferrier argued that what people call "unknowable" cannot be an object of ignorance, because one can be ignorant only of what can be known. He used this argument against doctrines of unknowability, including those in theology (Mander, 2017).

Proctor's question lies elsewhere. At the start of the first chapter of his 2008 volume, he separates three meanings of ignorance (Proctor, 2008, p. 3):

- ignorance as a native state or resource;
- ignorance as a lost realm or selective choice;
- ignorance as a strategic ploy or active construct. The tobacco industry is the leading example of this meaning in his work.

In this article "Proctor's problem" means the third meaning, and we set the other two aside. So when we say that the word has "drifted" from Proctor's problem, we mean that the share of uses concerned with the strategic production of ignorance has fallen.

In the postscript to the same first chapter, Proctor writes that agnoiology is "obscure and somewhat inharmonious". He adds that people have often taken it in a deeply metaphysical sense, as the doctrine of things of which we are necessarily ignorant (Proctor, 2008, pp. 27–28). He wanted a word that foregrounds how ignorance is made. The chapter does not, however, mention Ferrier or his 1854 book.

Agnoiology has not been hidden from the literature. It has an entry in the *Encyclopaedia Britannica* (Chisholm, 1911) and in the *Cambridge Dictionary of Philosophy* (Pojman, 2015), and at least one study examines Ferrier's theory of ignorance (Cholakova, 2016). Proctor knew the word, since he discusses it in the postscript, so we may suppose that he set it aside deliberately and coined a new one. The two words differ in their problem. Ferrier asked what not-knowing is. Proctor asks how not-knowing is made.

Since 2008 the word has also appeared in sociology, philosophy, education and the media. Figure 1 shows the paths of the two words at a glance.

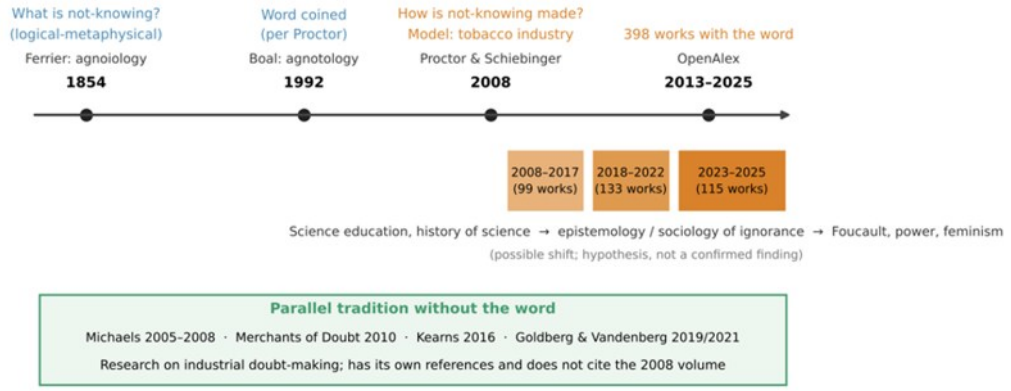


Figure 1. The paths of "agnoiology" and "agnotology".

The field of ignorance studies is larger than one word. Other traditions, such as "strategic ignorance" (McGoey, 2012a, 2012b) and "undone science" (Frickel et al., 2010), also work in it. In neighbouring literature, *Merchants of Doubt* (Oreskes & Conway, 2010) and *Doubt Is Their Product* (Michaels, 2008) study industrial doubt-making. Our data show, for example, that *Merchants of Doubt* has 3,466 citing works, against 1,358 for the 2008 volume (Chapter 2, section 2.1).

This article studies Proctor's word and concept. As the title indicates, it focuses on two questions.

The first question concerns the place of the word in the literature on ignorance. What share does the word hold in the whole literature of the field? What do the works that use it study beyond tobacco? Has the word reached more disciplines, or has it become an "umbrella label" cut off from Proctor's problem?

The second question concerns the place of agnotology in research on industrial doubt-making. Has that research continued under this word, or in another tradition, with its own references and labels? The question arises because the works that contain the word may be only a small part of the works that cite the 2008 volume.

Our data come from OpenAlex, which records citations and metadata (title, abstract and reference list) for scholarly works. Two limits affect how readers should interpret the findings.

First, part of the analysis rests on 50 anchor works, of which OpenAlex held 49. The author chose them from prior knowledge of this tradition. So part of the continuity of research on industrial doubt-making is built into the choice of works, and only the remainder is a finding of the data (section 2.2).

Second, we count only two things: use of the word and citations between works. Citing a work does not show that the citing work continues its path. So the findings concern the literature, not the behaviour of industries or the quality of research. The anchor works are also not a random sample, and we cannot generalise their results to the whole literature.

The article has four chapters:

- Chapter 1, “The word in its own literature”, asks what became of agnotology after 2008 and whether it moved away from Proctor’s problem.
- Chapter 2, “Beyond the word: three layers”, examines research that lacks the word but pursues the same problem.
- Chapter 3, “Industries: ozone and five cases”, tests the findings on a case we searched ourselves (ozone) and on a published list of 28 strategies from five industries (tobacco, coal, sugar, atrazine and climate).
- Chapter 4, “Discussion and limitations”, answers the two questions and sets out what the data cannot show.

The conclusion follows, then a methodology appendix. A single reference list at the end covers the whole document.

Chapter 1. The Word in Its Own Literature

The introduction asked whether agnotology has moved away from Proctor’s problem, the strategic production of ignorance, since its beginning, and whether research on industrial doubt-making still continues under this word or has gone elsewhere. This chapter examines the first part. We first set out where the data come from, which hypotheses we test, and what we found.

Summary of the method

The data come from OpenAlex, an open database of scholarly works with titles, abstracts and reference lists. We downloaded them in October 2026. We use four corpora, and each answers a different question.

Corpus A contains works with "agnotology" or close forms in the title or abstract. It has 398 works from 2008 to 2026, and 347 once we drop 2026, an incomplete year. It asks what the word-bearing works do, and we use it mainly in this chapter. Corpus B contains works that cite the 2008 volume (Proctor & Schiebinger, 2008), excluding Proctor's own works (1,358 works). It asks who cites the foundational book, whether or not they use the word.

Corpus M contains works that cite *Merchants of Doubt* (Oreskes & Conway, 2010; 3,466 works). Corpus C contains works that cite a 2006 article from the line of industrial doubt-making research (Michaels, 2006; 60 works). These two corpora ask the question of Corpus B for two works that lie closer to industrial doubt-making, and the 2006 article is older than both books. In addition, the author chose 50 works from each line of research the author knows as "anchors", two of them controls, so that we can look at specific works instead of counts. Chapter 2 presents B, M, C and the anchors.

We compare the works of Corpus A in three periods: 2008–2017 (99 works), 2018–2022 (133 works) and 2023–2025 (115 works). The periods come from five-year blocks, with one exception. We merged the first two blocks because very few abstracts are available before 2013 (see the methodology appendix).

The claim we test is whether the word has moved away from Proctor's problem since its beginning. As the introduction explained, "drift" means a fall in the share of uses concerned with the strategic production of ignorance. We test three countable hypotheses:

- H1 (industrial focus retained): the share of works with tobacco or industry vocabulary has not fallen.
- H2 (diversification): the word has reached more disciplines.
- H3 (umbrella-ing): the word has moved away both from production vocabulary and from foundational texts.

The methodology appendix defines the indicators precisely.

The analysis is exploratory. We wrote or revised the dictionaries and some indicators after a trial run and after reading a few abstracts, so the analysis is not blind. We also set the ten-point margin for H1 after seeing the first result. For these reasons we report differences with 95% confidence intervals, and we call a wide interval "unclear". Two limits affect everything below. Only about half of the works have reference lists, so "does not cite" sometimes means "is not in OpenAlex". And the percentages rest on few works (71 to 107 per period), so we cannot tell small changes from random fluctuation.

Findings: has anything changed?

H1 remains unclear. The share of works with tobacco or industry vocabulary fell from 21.1% to 16.5%. The interval for the difference is wide, however, and it contains both zero and the ten-point margin. We should not read the direction of the point estimate as drift either. The

absolute number of these works is 15 in both the first and the last period (15 of 71 and 15 of 91), so the fall in the percentage comes only from a larger denominator. In addition, this vocabulary never appears in more than about one fifth (21%) of the abstracts in any period. At the level of our dictionary, then, the industrial focus was a part of the literature from the first period, never its main part.

H2 is not supported. Disciplinary diversity (the Shannon index) fell slightly, from 1.94 to 1.75, and did not rise. Social sciences and humanities account for 81–84% of the works in all three periods. The only sign of change lies in the subfields: the share of "sociology and political science" rose. But this result does not hold when we add 2026, and it was one of about ten comparisons. We treat it as a source of hypotheses, not as a finding.

H3 is not supported either. The share of works without production vocabulary stays almost constant (52%, 54% and 50%), and so does the share citing foundational texts (64%, 65% and 62%). Figure 2 shows this.

A warning: the result depends on the dictionary. With a broader dictionary, the share of works "without production vocabulary" falls clearly. So any claim about "production vocabulary" must state this dependence.

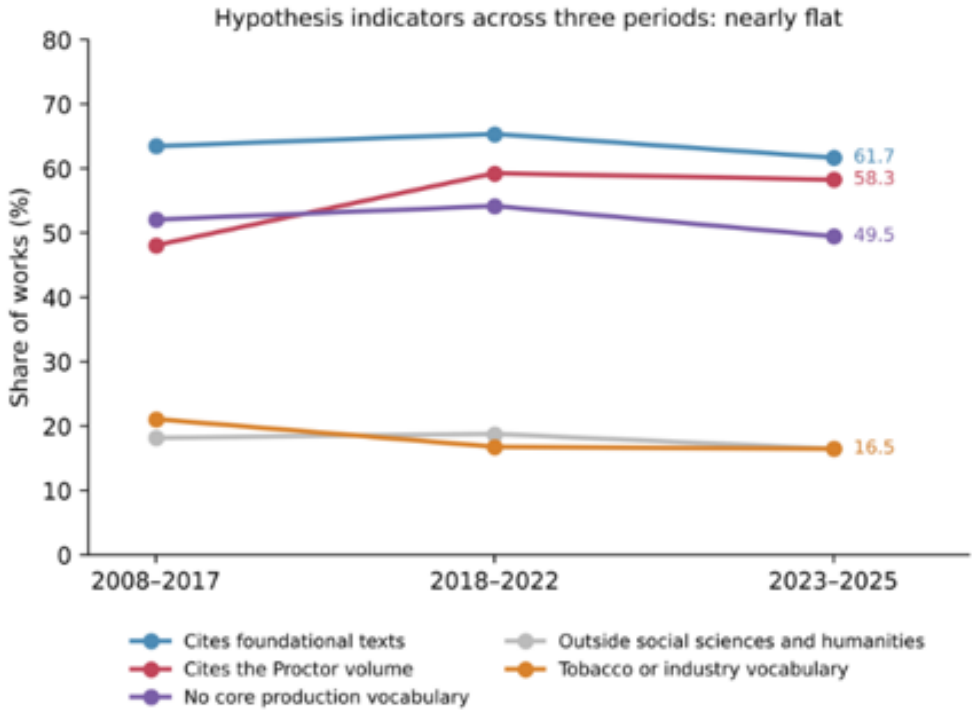


Figure 2. The indicators of the three hypotheses in three periods: almost constant. Points are raw percentages. The confidence intervals are in the appendix, and they are wide.

None of the three hypotheses received clear support. This says only that we see no clear change. It does not yet tell us what this literature is about.

What does the literature study?

From the first period the literature has had no dominant topic. No topic covers more than 9.1% of the works, and topical dispersion did not increase in later periods (appendix). No topic related to tobacco or the tobacco industry appears among the twelve leading topics of any period. This does not contradict the share of industry vocabulary above, because the machine assigns a topic label to the whole work, while the dictionary counts only whether words occur in the abstract. One finding of the first period was unexpected: its most frequent topic is science education, not tobacco or science policy.

Keywords complete the same picture:

- "Tobacco industry" and "scientific consensus" appear among the fifteen leading keywords only in the first period, and only in 6 works.
- "Epistemology of ignorance", "sociology of ignorance" and "strategic ignorance" appear from 2018, and "neoliberalism" and "governmentality" appear in the latest period.

The words that distinguish each period are not meaningful one by one. With thousands of candidate words, such values agree with chance. Only coherent clusters inspire more confidence: education and the history of science in the first period, and production, race, harm and digital knowledge in the latest (Figure 3).



Figure 3. Keywords and topics that emerge in each period. The labels are machine-assigned, and any interpretation of them is a hypothesis.

How far has the word spread?

To separate the "spread of the word" from the "growth of the ignorance literature", we compare the number of word-bearing works with the number of all works that contain the English word "ignorance". Relative to this literature, the word's share grew about 2.7 times (from 3.8 to 10.1 per 1,000 works). We should not trust the share relative to the whole database, because the OpenAlex index has itself expanded. The periods are also unequal (10,

5 and 3 years), so the raw count understates the growth. Per year, the number of word-bearing works is about 10, 27 and 38 (Figure 4).

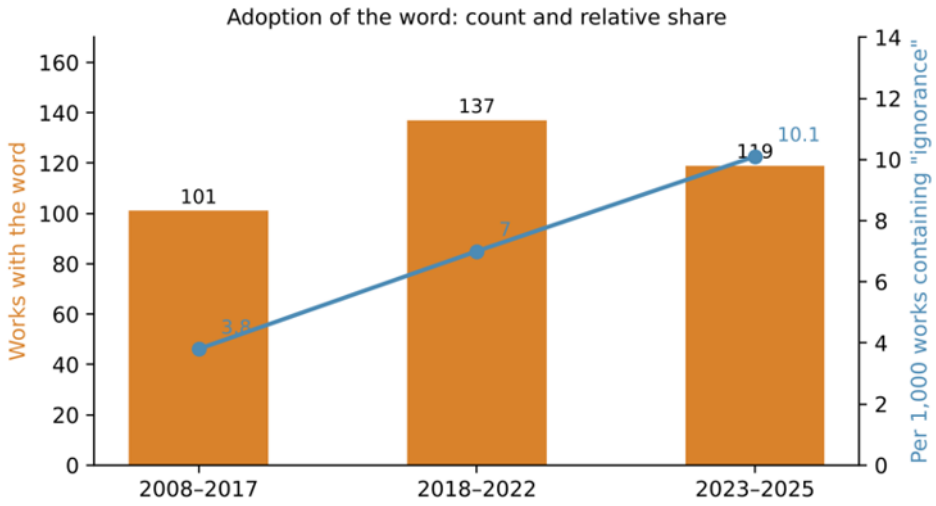


Figure 4. Works that contain the word, and their share of the "ignorance" literature. The share relative to the whole database is unreliable after 2024 because of the expansion of the index.

Summary of the chapter

So far, and only for word-bearing works, the following holds. The word's share of the "ignorance" literature has grown about 2.7 times. Its topics were dispersed from the first period, and the dispersion has not increased. Its link with foundational texts has stayed constant. None of the hypotheses received clear support. We call this pattern "expansion without a clear sign of drift". The intervals are wide, and the absence of a sign is not proof that no drift occurred.

All this concerns works that themselves contain the word. We do not know what the authors who cite the 2008 volume without the word are doing. The next chapter leaves the word to examine this.

Chapter 2. Beyond the Word: Three Layers

If research on industrial doubt-making has continued under another label, Corpus A will not contain it. So we do three things. We compare all the works that cite the 2008 volume and *Merchants of Doubt* (section 2.1). We look at specific works, namely the anchors and the works that cite the 2006 article (section 2.2). And we name what we have seen (sections 2.3 and 2.4).

2.1. Who cites the 2008 volume?

The question is simple: do the works that cite the 2008 volume themselves contain the word? Before seeing the result, we decided to read a citation of the volume as a sign of a link, not as

proof that the citing work continues the volume's path. We also fixed how we would read the outcome. If more than half of the citing works contain the word, label and citation coincide. If most lack the word, and their industry and denial vocabulary is close to that of the works that cite *Merchants of Doubt*, research on industry has continued under another label ("unlabelled continuation").

The data fell into neither case, so after seeing the data we added a third. Most citing works lack the word, and industry and denial vocabulary is clearly less frequent among them. This means they come from another background and use the volume as a general reference ("wordless halo").

The result is this third case. Of the 1,358 works in Corpus B, the works that cite the volume (excluding Proctor's own works), only 8–10% contain the word, and about 90% do not. Among the works that cite *Merchants of Doubt* (3,466 works), the word is rarer still: 1–2%. In both corpora the share of the word is constant across the three periods, so it signals neither a takeover nor an abandonment of the word.

On topic, the two populations differ. Industry and denial vocabulary appears in about a quarter of the volume's wordless citing works, with no trend, and tobacco vocabulary appears in only 1–3%. Among the works that cite *Merchants of Doubt*, the share is about one half to two thirds. The frequent topics among the volume's wordless citing works are epistemology, feminist epistemology, risk perception and misinformation. The works that cite *Merchants of Doubt* come from climate and policy (appendix). So the volume is cited more from the ground of epistemology and theory, and *Merchants of Doubt* from the ground of climate and policy (Figure 5).

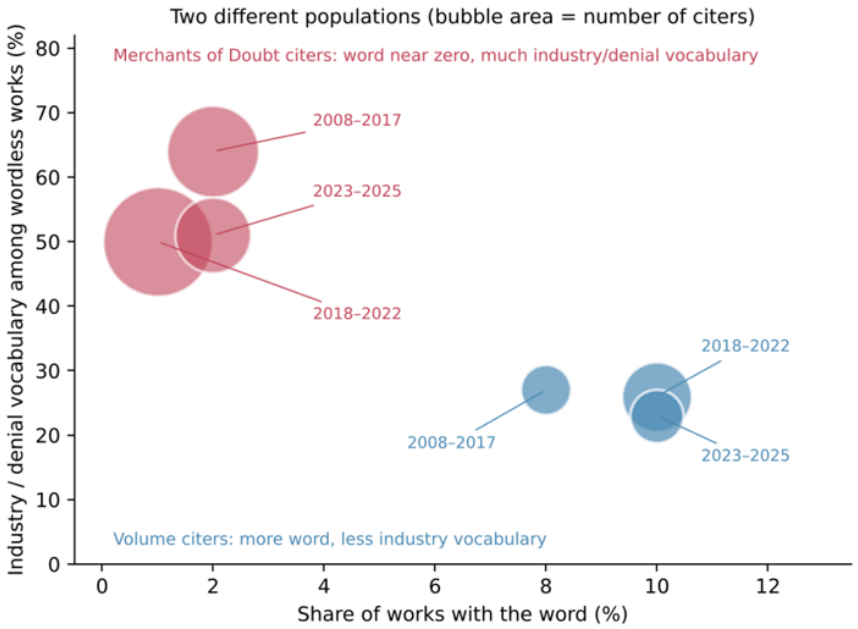


Figure 5. Two different populations: the share of the word (horizontal) against the share of industry or denial vocabulary among wordless works (vertical). Bubble area shows the number of citing works. Only works with abstracts are included, and the share of the word is a lower bound.

A population gives an average. To see what specific works do, we turn to the anchors.

2.2. Specific works: the anchors

The author chose the anchors for each line of research, so they are not a random sample. We can speak only about the works themselves, not about percentages in a population. OpenAlex held 49 of the 50 anchors (the invented control title, correctly, was not found). Of the 49, 31 have reference lists, and in 28 of these the word status is known. Three of the 28 (Jacques et al., 2008; Michaels & Monforton, 2005; Michaels, 2006) appeared in the same year as the volume or before it and could not cite it, so we set them aside. From the other 25 we build four groups:

- Word-bearing anchors that cite the volume (8 works), for example Bedford (2010), Legates et al. (2013) and Pinto (2015).
- Word-bearing anchors that do not cite the volume (2 works): Cook et al. (2014), which comes from inside the community of word-bearing works, and Pinto (2017), which comes through the Michaels line, because it cites Michaels (2008) and Pinto (2015).
- Wordless anchors that cite the volume (6 works), for example Frickel et al. (2010), McGoey (2012a, 2012b), Hendlin and Palazzo (2025) and Supran and Oreskes (2017).
- Wordless anchors that do not cite the volume (9 works), for example Farrell (2016), Goldberg and Vandenberg (2019, 2021), Hess (2020), Kearns et al. (2016) and Rayner (2012).

Our reading is as follows. Of the 10 word-bearing anchors, 8 cite the volume, and of the 15 wordless anchors, 6 do (two fifths). So citing the volume goes with having the word, but the overlap is not complete, and the picture is mixed. “Unlabelled continuation” does not hold uniformly, and neither does “parallel tradition”. The choice of anchors itself depends on this question, because the author knows the word-bearing works from the literature and the wordless works from a targeted search. So the proportions within this group do not describe a population (appendix).

We test the 2006 article from another side. It comes from the industrial line itself, and it predates both the volume and *Merchants of Doubt* (Michaels, 2006). Sixty works cite it (Corpus C). Of the 48 with abstracts, only 3 contain the word (about 6%). Among the wordless works, industry and doubt vocabulary is far more frequent than among the citers of the volume. Their frequent topics are climate, occupational lung disease, public health and the regulation of the pharmaceutical industry.

This corpus is further evidence for a tradition that continues beside the word and outside it. But we added it after seeing the first result, so it is retrospective evidence, not a pre-registered test. The numbers are small, and the exact figures and intervals are in the appendix.

The anchors matter because they cite one another. McGoey (2012a), Goldberg and Vandenberg (2019, 2021) and Hendlin and Palazzo (2025) cite the 2006 article. Six works cite Jacques et al. (2008), among them Brulle (2014), Farrell (2016), Supran and Oreskes (2017) and Bedford (2010). Supran and Oreskes (2017) itself cites the 2008 volume, *Merchants of Doubt*, Jacques et al. (2008), Brulle (2014) and Michaels and Monforton (2005). This network joins at least three islands: the word-bearing works, the “ignorance” works, and research on industrial doubt-making and climate denial (Figure 6).

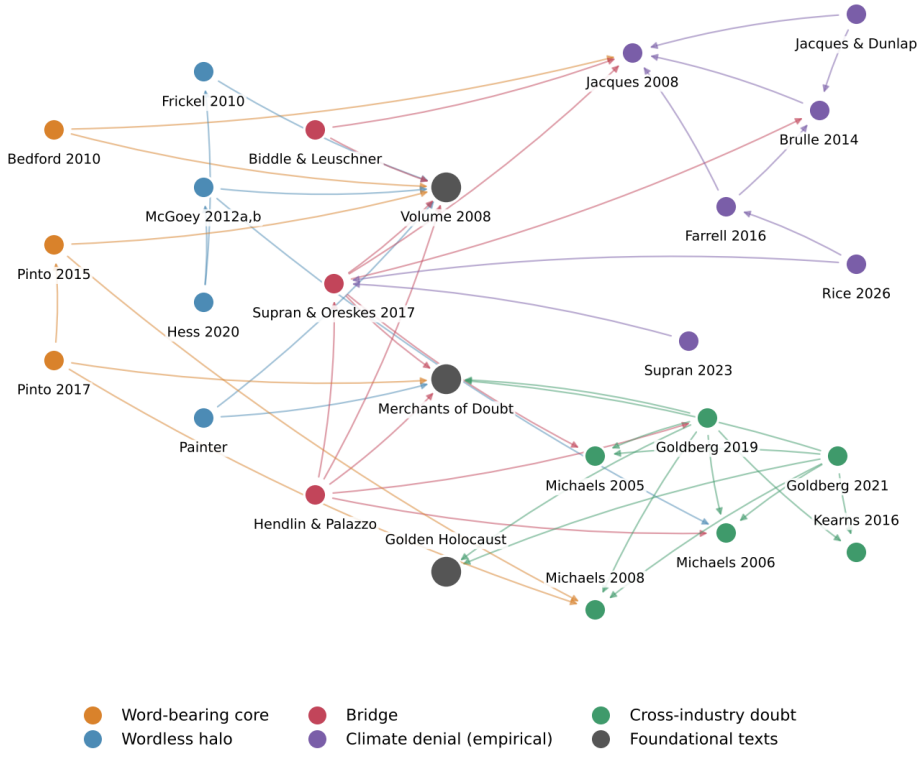


Figure 6. The citation network among the anchors, based on OpenAlex reference lists. The absence of an arrow does not mean the absence of a citation, because the reference lists of many works (especially books) are incomplete or missing in OpenAlex.

2.3. The three layers

The data of Chapter 1 and sections 2.1 and 2.2 show two things. Word-bearing works are only part of the stream, and citing the volume is not the same as having the word. To name what we see, we separate three layers (Figure 7, Table 1).

Layer 1: the word-bearing core. Corpus A is dispersed and has kept its link with foundational texts. Part of it, especially in the first period, concerns climate education (Bedford, 2010; Bedford & Cook, 2013; Cook et al., 2014). Both critics and defenders of the scientific consensus have used the word. One critical article puts the word in its title. It argues that the word is being used to dismiss alternative views instead of showing the complexity of the climate system (Legates et al., 2013). So the word is used for more than the study of strategic production.

Layer 2: a large wordless halo. About 90% of the works that cite the volume lack the word, and only about a quarter of them contain industry and doubt vocabulary. In this halo the volume is cited mostly in texts about knowledge and ignorance in general, not about industry. This reading rests only on machine labels and the dictionary, and it says nothing about the authors' motives.

The anchors on "undone science" and "strategic ignorance" (Frickel et al., 2010; McGoey, 2012a, 2012b) cite the volume without using the word. In the same layer, Hess (2020) does not cite the volume but cites Frickel et al. (2010) and McGoey (2012b). Rayner (2012) likewise does not cite it. So even in this tradition the neighbours cite one another, and the volume is not a necessary condition.

Layer 3: a parallel tradition. This layer has two parts.

First, the empirical core of climate-denial research (Jacques et al., 2008; Brulle, 2014; Farrell, 2016; Jacques & Dunlap, 2025; Rice, 2026). These works cite one another, and the four later ones cite neither the 2008 volume nor *Merchants of Doubt*. This core has its own reference points, but it is not isolated: Supran and Oreskes (2017) and Supran et al. (2023) draw on it in their work on ExxonMobil.

Second, the cluster of cross-industry doubt-making (Goldberg & Vandenberg, 2019, 2021). These works cite *Merchants of Doubt*, Michaels (2008) and Proctor's tobacco book (Proctor, 2011), but not the 2008 volume. OpenAlex holds no usable reference list for Michaels' (2020) book, so we cannot say what it cites. This cluster has the same argumentative structure as Proctor's, namely the gap between what industry knows and what it says. Its link to Proctor himself runs through his tobacco book, and its link to his tradition runs through *Merchants of Doubt*, not through the volume.

So in this layer "unlabelled continuation" does not mean "citing the volume without the word". It is a parallel tradition with its own references, joined to the other layers by a few bridges. In Layer 2 the situation differs, because the "ignorance" works and Supran and Oreskes (2017) do cite the volume (section 2.2).

2.4. Bridges between the layers

The layers are not separate from one another. Five bridges link them.

- A chapter of the volume itself (Oreskes & Conway, 2008). Four word-bearing works cite it. So the climate line was in the volume from the start, and this chapter has been the route by which the volume reached climate education and sociology.
- Supran and Oreskes (2017). It cites the volume, *Merchants of Doubt*, Jacques et al. (2008), Brulle (2014) and Michaels and Monforton (2005), and so it links the core of climate-denial research to Proctor's line.
- Biddle and Leuschner (2015), a bridge between the philosophy of science and the same core.
- Hendlin and Palazzo (2025). It cites the volume, *Merchants of Doubt*, Goldberg and Vandenberg (2019), Supran and Oreskes (2017) and Michaels (2006), without containing the word itself, and it links all three layers.

- The Michaels line. Word-bearing authors such as Pinto (2015, 2017) cite Michaels (2008), and McGoey (2012a) cites his 2006 article. This is a link from word-bearing and "ignorance" works to an author who himself works in the industrial line.

Table 1 sets the three layers side by side with their examples and shows whether each layer contains the word or cites the volume. Figure 7 shows the same map in conceptual form.

Table 1. Three-layer map (based on the named anchors, not a random sample).

Layer	Examples	Contains the word	Cites the 2008 volume
Word-bearing core	Bedford (2010); Legates et al. (2013); Pinto (2015)	Yes	Yes, 8 of 10; exceptions: Cook et al. (2014); Pinto (2017)
Ignorance halo	Frickel et al. (2010); McGoey (2012a, 2012b)	No	Yes
Ignorance halo without citation of the volume	Hess (2020); Rayner (2012)	No	No
Parallel tradition: empirical core of climate-denial research	Brulle (2014); Farrell (2016); Jacques & Dunlap (2025); Rice (2026)	No	No
Parallel tradition: doubt-making cluster	Goldberg & Vandenberg (2019, 2021); Michaels (2005, 2006, 2008); Kearns et al. (2016)	No	No
Bridges	Supran & Oreskes (2017); Biddle & Leuschner (2015); Hendlin & Palazzo (2025)	Varies	Varies

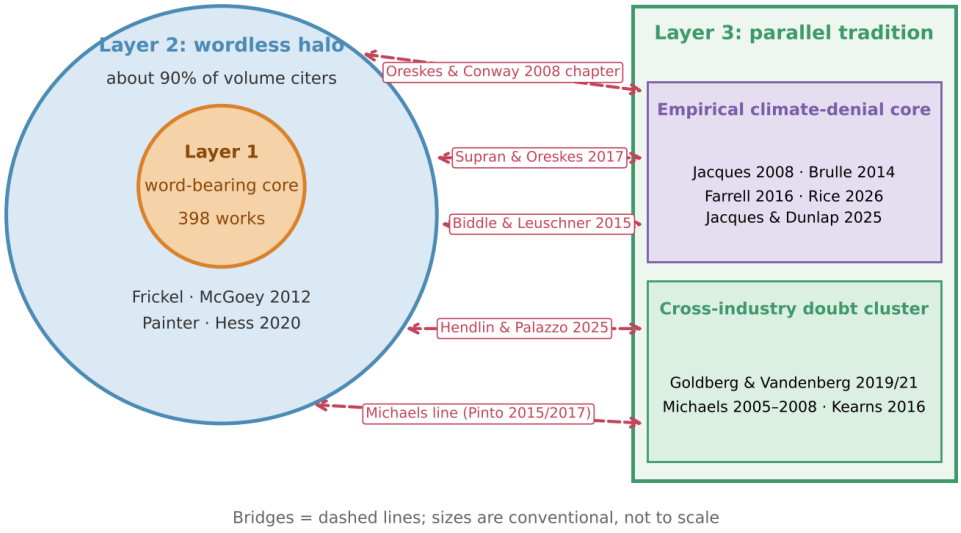


Figure 7. The three-layer model: the word-bearing core, the wordless halo that cites the volume, and the parallel tradition (the empirical core of climate-denial research and the cross-industry doubt-making cluster), with bridges. The figure is conceptual and not to scale.

Summary of the chapter

On the basis of the chosen anchors and the citing works, research on industrial doubt-making has continued, but mainly outside the word. We see three paths. The first is the "ignorance" and "undone science" works, which cite the volume without using the word. The second is a parallel tradition, namely the empirical core of climate-denial research and the cross-industry doubt-making cluster, with its own references and without the volume. The third is a few bridges that join these paths to the word and the volume.

These results answer the two questions of the introduction in part. On the first, the word has spread without detaching from its foundational texts. On the second, research on industrial doubt-making has, on the basis of these anchors, mostly stood apart from the word. The next chapter asks where that research, having continued outside the word, has arrived.

Chapter 3. Industries: Ozone and Five Cases

This chapter asks where research that continued outside the word has arrived on doubt-making in industries. We look at two things. The first is ozone, which differs from the rest: doubt-making failed there and the Montreal Protocol succeeded, and it is the only case we searched ourselves in OpenAlex. The second is the five cases from which a cross-industry article built a list of 28 strategies: tobacco, coal, sugar, atrazine (Syngenta) and climate (scientists at and near the Marshall Institute).

3.1. Ozone

If research on doubt-making had continued everywhere, there should be work on ozone too. The ozone literature is mostly the history of politics and diplomacy, and its frame is not the production of ignorance (Benedick, 1991; Litfin, 1994; Parson, 2003). Our OpenAlex search found 236 works. We searched for works from 2008 to 2025 with ozone or chlorofluorocarbon terms, together with doubt, denial, uncertainty, ignorance or scepticism, in the title or abstract.

Of the 119 works with reference lists, only one cites the 2008 volume. It is a master's thesis on the scientific debate about ozone (Painter, 2023), with 159 references. It also cites *Merchants of Doubt*, but it does not contain the word in its title or abstract. Five other works cite only *Merchants of Doubt* (Oreskes & Conway, 2010). The only work that contains the word is a review of that same book (Roberts, 2012). It has no reference list, and the word appears only in the text that OpenAlex recorded in place of an abstract.

We should not turn these counts into proportions. Most of the 236 works are not about doubt (the most cited include stellar flares and wastewater treatment), so the denominator is contaminated. What remains is this: in OpenAlex, and with these search terms, ozone research

has made almost no use of the framework of the production of ignorance, apart from one thesis. This does not prove that such research does not exist. It has two explanations that the data cannot separate: either the research did not continue, or the success of the Protocol reduced attention. So ozone is one case, and in it research without the word has little trace. The five cases that follow show what that research has reached where it exists.

3.2. The list of 28 strategies

The list comes from the cross-industry article (Goldberg & Vandenberg, 2021). We added no strategy and removed none (see section A6 of the appendix). In the discussion section, and relying on the same review, the authors define manufactured doubt as "the deliberate alteration and misrepresentation of knowable facts and empirical evidence to promote an agenda, often for financial benefit" (Goldberg & Vandenberg, 2021, p. 5). This definition agrees with Proctor's third meaning, ignorance as a "strategic ploy" (Proctor, 2008, p. 8). Yet this research is wordless: neither "agnotology" nor "ignorance" appears even once in the text of the article.

The list has the following shape. Five strategies appear in all five cases: attacking study design, gaining support from reputable individuals, misrepresenting data, using hyperbolic or absolutist language, and influencing government and law. The authors consider them the most effective features of manufactured doubt, but they state that the absence of one is not a sign of failure to establish doubt-making (p. 3). In the middle are strategies that appear in four, three or two cases, such as hiding harmful information and blaming other causes. At the end are three strategies that appear in a single case: altering the product to make it look healthier and inappropriately questioning causality (both in tobacco), and straw-man arguments (in the climate case).

The methodology appendix gives the full list with a definition of each strategy (Table A7).

3.3. What lies beneath the list

Each marked cell in the list means "documented or planned". The authors included methods that industry was documented to use or planned to use (p. 2). The supplementary material gives a source for each cell, and two things follow from it.

First, the sources of the five cases are not of one kind. Tobacco rests mostly on internal industry documents, coal on three investigative journalism reports, sugar on one historical analysis of documents, and atrazine on the appendices of a journalistic investigation. Climate rests almost entirely on one book, *Merchants of Doubt* (Table 2).

Table 2. Dominant source of each case in the list of 28 strategies (the author's count from the supplementary material).

Case	Strategies recorded	Dominant source	Share from that source
Tobacco	25	Internal industry documents (UCSF Industry Documents)	21 of 25
Coal	10	Three investigative journalism reports (Hamby, 2013)	8 of 10
Sugar	15	Historical analysis of documents (Kearns et al., 2016)	10 of 15
Atrazine (Syngenta)	19	Appendices of a journalistic investigation (100Reporters)	15 of 19
Climate (Marshall Institute)	17	*Merchants of Doubt* (Oreskes & Conway, 2010)	15 of 17

Second, of the 86 marked cells, 12 rest only on a proposal, a plan or a request for proposals, judging by the title of the base document. The article itself allows a cell to rest on potential use. The authors' method accepts organisations "documented to use or planned to use" a strategy (pp. 2, 5). Eight of the atrazine strategies trace to a single document: a 2009 proposal from a public relations agency (an RFP). The supplementary material does not say whether anyone carried out the proposal. Our judgement rests only on the titles of the documents, since we have not seen the documents themselves. Until execution is documented separately, we read these cells as "planned" and not as "executed". Of the 19 atrazine strategies, 8 are of this kind.

The authors themselves state cautions that should accompany every use of the list. The article is not a systematic review, and the list is "thorough, but by no means exhaustive" (p. 9). The absence of a strategy may reflect only the absence of documentation (pp. 6, 9). The strategies do not weigh equally, and some have legitimate uses (p. 8). Larger, newer or governmental cases may add other strategies (pp. 8, 10). The methodology appendix gives the full list of cautions.

3.4. The list and our anchors

The source of the list is the same base literature from which we took the anchors. *Merchants of Doubt* (Oreskes & Conway, 2010) appears in 20 cells (5 tobacco cells and 15 Marshall cells), Michaels (2008) in four tobacco cells, and Proctor (2011) in two tobacco cells. So the agreement between the literature descended from Proctor and this list comes in part from a shared source, and it is not independent evidence. Proctor's presence in the list is limited and indirect. It comes through a book on tobacco, not through the 2008 volume or the concept of agnotology.

The list also does not tell us whether these strategies appear in the word-bearing literature, and we have not measured that in this article. For strategies such as "attacking study design"

or “hyperbolic language”, we may find no evidence in the titles and abstracts of that literature. That would itself be a finding, not a failure.

3.5. Industries beyond these five

This section does not review the whole literature. It reports only what the anchor list and the neighbouring literature show about other industries.

Two books on lead and chemicals (Markowitz & Rosner, 2002, 2013) have no reference lists in OpenAlex. Of the two, only the 2002 book is cited by an article in the “undone science” tradition (Frickel et al., 2010).

On sugar, Kearns et al. (2016) cite neither the 2008 volume nor *Merchants of Doubt*, but the cross-industry article cites Kearns et al.

On paraquat, Dorsey and Ray (2023) have the word in their title and cite the 2008 volume. It is the only word-bearing industrial example outside tobacco and climate that we found among the anchors and the neighbouring literature.

Beyond industries, two neighbouring lines cite the volume: “strategic ignorance” (McGoey, 2012a, 2012b) and “undone science” (Frickel et al., 2010). The “uncomfortable knowledge” line (Rayner, 2012) does not cite it. Proctor and Schiebinger’s new book, *Ignorance Unmasked* (2025), has no citations or abstract in OpenAlex, so it is not part of this analysis.

Summary of the chapter

Research outside the word has arrived at a list of strategies shared across industries. But the list is built from sources of different kinds, part of it rests on planning documents, and it shares sources with our anchors. The places where this research is absent, such as ozone, are themselves a finding.

Chapter 4. Discussion and Limitations

This chapter answers the two questions of the article: what became of the word, and what became of research on Proctor’s problem. It then says what we cannot conclude from the data.

What became of the word

On the basis of all the analyses above, the fate of the word is expansion without a clear sign of drift. Three observations from one corpus point the same way. First, the word’s share of the ignorance literature grew 2.7 times. Second, topical dispersion was already high in the first period and did not increase later. Third, the word has not detached from foundational texts, because the share citing them stayed constant. So “umbrella-ing”, if it means topical dispersion, has been present from the start and shows no rising trend. If it means a break with foundational texts, we have no evidence for it. The only indicator in favour of drift is the fall

in tobacco and industry vocabulary, and its confidence interval is so wide that we can neither confirm nor reject it.

So the question "does agnotology still see what Proctor saw?" has only a partial answer for the word-bearing works. They are a small minority: 8–10% of the works that cite the volume and 1–2% of the works that cite Merchants of Doubt. Because many citers of that book work outside ignorance studies, this shows only that the word does not carry its reception. Research on industrial doubt-making is alive, but mostly in a parallel tradition with its own references. Where it links to the word, the link passes through a few bridges: the Oreskes and Conway chapter, Supran and Oreskes, Biddle and Leuschner, Hendlin and Palazzo, and the Michaels line. So the hypothesis of "unlabelled continuation" is partly confirmed. In the "ignorance" works (Frickel et al., 2010; McGoey, 2012a, 2012b) the descent is visible and the label is absent. In the empirical core of climate-denial research and the cross-industry doubt-making cluster, the tradition is parallel, with its own references, and it does not cite the volume.

The industries tell a similar story. The ozone case showed that this research is not everywhere. The list of 28 strategies showed where it has arrived: a set of strategies shared across industries, with five present in all cases. But we do not take the list as independent evidence for our claim, because its sources are the same base literature as our anchors, its climate case rests almost entirely on one book, and 12 of its 86 cells rest on planning documents.

On Proctor's three meanings, keywords such as "epistemology of ignorance", "sociology of ignorance" and "strategic ignorance" appear next to the word from 2018, so Proctor's word is used beside neighbouring traditions. If we read "production" in Proctor's third sense, ignorance as a strategic ploy, then the absence of production vocabulary in half of the works means their distance from this third sense, not necessarily from the other two. There are also signs of a shift: the word "produced" has roughly tripled in the latest period, probably in a structural and social sense, not a strategic and industrial one. This is only a hypothesis, because the works are few and the comparisons many.

Finally, on the relation between Ferrier and Proctor: Ferrier asked what not-knowing is, and Proctor asks how not-knowing is made. Some of today's literature may gather both questions, and others, under one word, without abandoning Proctor's problem. We did not measure this. Yet research on Proctor's problem in its narrow sense often stands outside that word altogether.

Limitations and what we cannot say

- Dictionary words stand near meaning, but they are not the meaning. Topics and keywords are machine labels.
- The word is visible only in titles and abstracts, and about one quarter of the works in the first period have no usable abstract. So the share of word-bearing works is a lower bound.

- "Does not cite" means "is not in the OpenAlex reference list". Coverage of reference lists is incomplete, and it is poorer for books.
- The anchors are the author's selection, and we cannot derive population percentages from them.
- The analysis is exploratory, and we have not corrected for multiple comparisons. The confidence intervals are wide, and they neither confirm nor reject a small change.
- The data say nothing about the behaviour of industries or the quality of research. A citation is not descent: a work may learn from Proctor and not cite him, or cite him and learn nothing.
- The list of 28 strategies is not a systematic review.

The methodology appendix gives the full list of limitations.

Conclusion

This article asked two questions. What place does Proctor's word hold in the literature on ignorance, and has it moved away from his problem, the strategic production of ignorance? And where does research on industrial doubt-making now sit: under this word, or in another tradition?

On the word, the answer is expansion without a clear sign of drift. Its share of the "ignorance" literature rose about 2.7 times. Its topics were dispersed from the start, and its ties to foundational texts held. None of the three hypotheses about drift received clear support, though the intervals are wide and the absence of a sign is not proof that no drift occurred.

Among the anchor works we examined, research on industrial doubt-making has continued, but mostly outside the word. Works that contain the word are a small minority of those that cite the 2008 volume and of those that cite Merchants of Doubt. Many citers of that book work outside ignorance studies, so this shows only that the word does not carry its reception. The research lives in a parallel tradition with its own references, joined to the word by a few bridges. The ozone case shows that such research is not everywhere, and the list of 28 strategies shows what it has reached where it exists, with the cautions we have noted.

These results come from an exploratory analysis of OpenAlex data and from anchors that the author chose. They describe the literature, not the behaviour of industries or the quality of studies, and they do not extend to the whole of the field.

Proctor coined a word to name "manufactured ignorance". But the problem was larger than the word. Today part of the research on how ignorance is made carries on without it. The word has stayed, and the problem, without bearing his name, goes its own way.

Methodology Appendix

Appendix to "The Place of Agnotology in the Field of Ignorance Studies and Industrial Doubt-Making: A Bibliometric Study". This appendix is independent of the article. It describes the data, the indicators, the anchor works, the list of 28 strategies, the history of the analysis and the full limitations, so that a reader can check or repeat the work. Its references are in the single reference list at the end of this document.

A1. Corpora and data

Source. All bibliometric data come from OpenAlex (Priem et al., 2022). OpenAlex records the title, abstract, reference list, topic labels and keywords of each work. We downloaded the metadata on 12 October 2026.

Corpus A (word-bearing works). Corpus A holds works from 2008 to 2026 that contain one of the forms "agnotology", "agnatology", "agnotologie" or "agnotological" in the title or abstract. The search returned 412 raw records. We removed the records of Proctor and Schiebinger's volume itself, non-research record types (paratext, erratum, retraction, peer review) and 8 duplicate titles. That left 398 works: 235 articles, 71 book chapters, 26 preprints, 18 theses, 12 books and others.

Corpus B (citing works of the volume). Corpus B holds all works from 2008 to 2025 that cite the record of Proctor and Schiebinger's volume (OpenAlex ID W184537900), excluding Proctor's own works. It has 1,358 works.

Corpus M (citing works of Merchants of Doubt). Corpus M holds all works from 2008 to 2025 that cite the record of *Merchants of Doubt* (W1560889174). It has 3,466 works.

Corpus C (citing works of the 2006 article). Corpus C holds the works that cite Michaels (2006), "Manufactured uncertainty", in the *Annals of the New York Academy of Sciences*. It has 60 works, of which 48 have abstracts. We added it as a proxy for the readers of the industrial doubt-making line. The article cites neither the 2008 volume nor *Merchants of Doubt*, and at least four other anchors cite it. We added Corpus C after we saw the first result (section A7).

What we measure for each work. For each work in B, M and C we recorded three things. First, whether the word occurs in the title or abstract, and only for works with an abstract of more than 150 characters. So the share of word-bearing works is a lower bound. Second, the share of each topical dictionary (tobacco, climate, ozone, other industries, doubt and denial) among the works without the word. Third, the primary topic. Confidence intervals for proportions are Wilson 95% intervals (Wilson, 1927). The dictionaries count words, not meanings.

The column "other works by Proctor". The script that builds it takes its list from the foundational-text records, and the record of *Golden Holocaust* was not in that list. So this column is incomplete and we do not use it in any table. A direct check of reference lists showed that Goldberg and Vandenberg (2019, 2021) and Pinto (2015) cite the record of *Golden Holocaust* (W2798960623).

A2. Periods

We compare three periods: 2008–2017 (99 works), 2018–2022 (133 works) and 2023–2025 (115 works). The year 2026 is incomplete, and OpenAlex has not yet recorded the reference lists of its works. We therefore leave 2026 out of the periods and use it only in the sensitivity analysis and in the descriptive indicator on adoption.

The first period consists mostly of the years 2014 to 2017 (53 of the 71 works with abstracts), and before 2013 we have fewer than 20 abstracts. So we cannot speak of the "beginning" of the literature. Five-year blocks would have split the first decade into two thin blocks, so we merged them.

A3. Indicators and tests

The assessment of "Proctor's problem" requires judgement. An earlier attempt at manual coding proved unstable and subjective, so we used only indicators that a fixed rule computes without human judgement.

A3.1 Hypothesis indicators

Dictionaries. We applied fixed dictionaries (tobacco, industry, production core, and a broader vocabulary) to the title and abstract of works with an abstract of more than 150 characters (71, 107 and 91 works). We wrote the dictionaries after a trial run and after the author and the assistant had read a few abstracts, so they are not blind. The dictionary fingerprint is 6fc4b6320b9426df (script version v3.1).

Disciplinary diversity. We take the discipline and subfield labels that OpenAlex's machine assigns. We measure diversity with the Shannon index (Shannon, 1948) and obtain its interval by a bootstrap with 2,000 resamples of equal size (Efron, 1979).

Citation of foundational texts. We read the reference lists (52, 81 and 60 works with a usable list). The foundational texts are the record of Proctor and Schiebinger's volume and the records of *Cancer Wars (Proctor, 1995)*, *Merchants of Doubt* and *Golden Holocaust*. We count neither reviews nor incomplete records.

Every comparison is the difference, in percentage points, between the last period and the first, with a 95% Newcombe interval (Newcombe, 1998). Table A1 gives the full results.

Table A1. Share of works by period (k/n) and the difference between the last and first period (percentage points; 95% Newcombe interval). Full version of the article's hypothesis results.

Indicator	2008–2017	2018–2022	2023–2025	Difference [interval]
Tobacco vocabulary	8.5% (6/71)	7.5% (8/107)	4.4% (4/91)	−4.1 [−13.2, +3.8]
Industry vocabulary	21.1% (15/71)	12.1% (13/107)	16.5% (15/91)	−4.6 [−17.2, +7.3]
Tobacco or industry vocabulary	21.1% (15/71)	16.8% (18/107)	16.5% (15/91)	−4.6 [−17.2, +7.3]
Without production-core vocabulary	52.1% (37/71)	54.2% (58/107)	49.5% (45/91)	−2.7 [−17.7, +12.6]
Cites foundational texts (strict)	63.5% (33/52)	65.4% (53/81)	61.7% (37/60)	−1.8 [−19.1, +15.8]
Cites the 2008 volume	48.1% (25/52)	59.3% (48/81)	58.3% (35/60)	+10.3 [−8.0, +27.7]
Outside social sciences and humanities	18.2% (18/99)	18.8% (25/133)	16.5% (19/115)	−1.7 [−12.1, +8.4]

H1 (industrial focus retained). The share of works with tobacco or industry vocabulary fell from 21.1% to 16.5%, with an interval of −17.2 to +7.3. The verdict is "unclear". The yearly trend was borderline when we kept years with at least 4 works ($p = 0.054$) and reached $p = 0.33$ when we required at least 8, so it depended on a few thin years. The highest share of this vocabulary in any period is 21%, and the upper bound of the intervals (32%) stays below 50%. We set the ten-point margin for H1 after we saw the first result.

H2 (diversification). The Shannon index of the discipline labels fell from 1.94 to 1.75 (−0.20 [−0.67, +0.28]), so the hypothesis is not supported. Social sciences and humanities make 82%, 81% and 84% of the works in the three periods. The only interval that excluded zero was the diversity of subfields, in the direction opposite to diversification (−0.67; "sociology and political science" rose from 21% to 33% and 44%). With 2026 added, the interval again includes zero. It was one of about ten comparisons, so it is a source of hypotheses, not a finding.

H3 (umbrella-ing). The share of works without production-core vocabulary is almost constant (52%, 54% and 50%), and so is the share citing foundational texts (64%, 65% and 62%). In an early version we saw an apparent fall in citation, which came wholly from 2026, because OpenAlex does not yet hold the reference lists of that year's works. Only the broader dictionary (with general words such as "production" and "interests") lowers the share "without production vocabulary" significantly (−17.6). This dependence on the dictionary limits any claim about "production vocabulary".

Width of the intervals. In Table A1 the intervals for the differences are between about 17 and 36 percentage points wide. The article therefore calls them "wide" and states no single width.

A3.2 Descriptive indicators

Topics and keywords. For each work we take the primary topic (about 4,500 topics) and the keywords that OpenAlex assigns. Table A2 gives selected keywords.

Distinguishing words. We find words and word pairs that distinguish the periods in titles and abstracts by the log-odds ratio with an informative Dirichlet prior (Monroe et al., 2008), based on whether the word occurs in a work. We include only words that occur in at least 5 works. We fixed the parameters in the script before the run: minimum 5 works, prior strength 10, a list of 20 words and a threshold of $z = 1.5$. The highest z in all comparisons is 3.3. With thousands of candidate words, such values agree with chance, so we cannot treat single words as meaningful. Only clusters that are coherent in meaning and agree with the topic lists earn more confidence (Table A3).

Adoption. We count word-bearing works per year, per 1,000 works with "ignorance" in the title or abstract, and per 100,000 works in all of OpenAlex. The denominator "all works" is invalid after 2024 because the index expanded. The "ignorance" denominator also includes non-theoretical and unrelated senses of the word.

Table A2. Selected OpenAlex keywords (number of works; "–" means the keyword was not among the fifteen leading keywords of that period, so it occurs in at most 4 works).

Keyword	2008–2017 (n = 99)	2018–2022 (n = 133)	2023–2025 (n = 115)
ignorance	15	27	19
misinformation	10	9	15
knowledge production	5	7	14
science communication	7	–	7
tobacco industry	6	–	–
scientific consensus / science and politics	6 / 6	–	–
epistemology of ignorance	–	8	6
sociology of ignorance / strategic ignorance	–	8 / 8	–
non-knowledge	–	5	7
neoliberalism / governmentality	–	–	6 / 5

Table A3. Selected words in titles and abstracts (number of works / works with abstracts in the period).

Cluster	Words	2008–2017 (n = 71)	2023–2025 (n = 91)
First period: education	student, learning	10/71, 10/71	1/91, 1/91
First period: history and Proctor's name	history, Proctor	20/71, 13/71	9/91, 6/91
Recent period: production	produced	5/71	22/91
Recent period: race and harm	race, violence, harm	1/71, 2/71, 2/71	12/91, 10/91, 10/91
Recent period: knowledge and the digital	non-knowledge, digital	2/71, 1/71	10/91, 9/91

A3.3 Citing corpora

Table A4. Citing works, works with abstracts and share containing the word (lower bound; Wilson 95% interval).

Corpus	Period	Citing works	With abstract	Contain the word
B: 2008 volume	2008–2017	334	247	8% [5, 12]
	2018–2022	645	473	10% [7, 12]
	2023–2025	379	334	10% [7, 14]
M: *Merchants of Doubt*	2008–2017	1,117	756	2% [1, 3]
	2018–2022	1,589	1,117	1% [0, 2]
	2023–2025	760	622	2% [1, 3]

Table A5. Share of each topical dictionary among wordless citing works (Wilson 95% interval for "any").

Corpus	Period (n)	Tobacco	Climate	Ozone	Other industries	Doubt and denial	Any
B	2008–2017 (227)	3%	9%	0%	16%	9%	27% [22, 33]
	2018–2022 (428)	1%	7%	0%	15%	9%	26% [22, 30]
	2023–2025 (300)	1%	6%	0%	14%	8%	23% [19, 28]
M	2008–2017 (744)	6%	50%	3%	19%	11%	64% [60, 67]
	2018–2022 (1,107)	4%	32%	0%	20%	12%	50% [47, 53]
	2023–2025 (612)	2%	30%	1%	25%	14%	51% [47, 55]

A4. Anchors, controls and the reading rule

Anchors. The author chose 50 works as anchors, one or more for each line of research that he knows. Two of them are controls: *Golden Holocaust*, as a work that certainly exists, and an invented title that must return "not found". We matched anchors to OpenAlex by title (the first eight words, then the full title) and by the surname of the first author, not by DOI, because the DOIs that language models gave from memory did not agree for one article. For nine anchors that automatic matching did not find (titles with typography or apostrophes that did not match), the author found the OpenAlex ID by hand in a browser and recorded it in the script (ID_OVERRIDE). For each anchor we recorded: the word in the title or abstract; a citation of the volume; a citation of *Merchants of Doubt*; and presence in Corpus A. A question mark means unknowable (OpenAlex lacks the abstract or reference list).

Control result. The invented title was correctly "not found". *Golden Holocaust* matched but has no abstract or reference list, so the control tested only title matching, not detection of the word or of citations.

Selection. Anchors are the author's selection, and 49 of the 50 were found in OpenAlex. Two works could not be classified (the Oreskes and Conway chapter and the Gross and McGoey handbook, 2015), because we could not consult their texts or reference lists. Of the 49, 31 have usable reference lists, and 18 anchors (mostly books) have none. We cannot generalise from them to a population.

The reading rule (D4). We wrote the reading rule for the genealogical question before we ran the analysis.

If most works that cite the 2008 volume contain the word, label and descent coincide, and the "minority" result of Chapter 1 concerns only the word-bearing works.

If many citing works lack the word, and industry and denial vocabulary is frequent among them, the industrial line continues under another label ("unlabelled continuation").

For anchors: "wordless but citing the volume" means linked but unlabelled; "wordless and not citing" means a parallel tradition.

The data fell into neither of the first two cases. After we saw the data we added a third case: most citing works lack the word, and industry and denial vocabulary is clearly less frequent among them ("wordless halo"). This third case is a post-hoc addition and the article says so.

Table A6. Anchors and their status (output of script v3.3, second run). "?" means unknowable in OpenAlex. "Refs" is the number of references recorded in OpenAlex. The analysed groups of the article are marked G1 to G4: G1 word and cites the volume; G2 word and does not cite; G3 no word and cites; G4 no word and does not cite; E: excluded.

Work	Match	Word	Cites volume	Cites *Merchants*	Refs	Group
Bedford (2010)	found	yes	yes	no	28	G1
Legates et al. (2013)	found	yes	yes	no	24	G1
Bedford & Cook (2013)	found	yes	yes	yes	49	G1
Benestad et al. (2013)	found	yes	yes	yes	108	G1

Work	Match	Word	Cites volume	Cites *Merchants*	Refs	Group
Pinto (2015)	found	yes	yes	yes	65	G1
Croissant (2014)	found	yes	yes	yes	104	G1
Dorsey & Ray (2023)	found (manual ID)	yes	yes	no	23	G1
Haider & Rödl (2023)	found	yes	yes	no	52	G1
Cook et al. (2014)	found	yes	no	yes	62	G2
Pinto (2017)	found (manual ID)	yes	no	yes	60	G2
Supran & Oreskes (2017)	found (manual ID)	no	yes	yes	75	G3
Painter (2023, thesis)	found	no	yes	yes	159	G3
Hendlin & Palazzo (2025)	found	no	yes	yes	80	G3
Frickel et al. (2010)	found	no	yes	no	79	G3
McGoey (2012a)	found	no	yes	no	50	G3
McGoey (2012b)	found	no	yes	no	98	G3
Jacques & Dunlap (2025)	found	no	no	no	65	G4
Farrell (2016)	found	no	no	no	38	G4
Supran et al. (2023)	found (manual ID)	no	no	no	39	G4
Goldberg & Vandenberg (2019)	found	no	no	yes	52	G4
Goldberg & Vandenberg (2021)	found	no	no	yes	43	G4
Kearns et al. (2016)	found (manual ID)	no	no	no	51	G4
Rice (2026)	found	no	no	no	76	G4
Hess (2020)	found	no	no	no	40	G4
Rayner (2012)	found	no	no	no	39	G4
Michaels (2020)	found (record is a book review; no usable list)	?	?	?	0	not classified
Jacques et al. (2008)	found	no	no	no	77	E (same year or earlier)
Michaels & Monforton (2005)	found	no	no	no	50	E (same year or earlier)
Michaels (2006)	found (manual ID)	no	no	no	30	E (same year or earlier)
Biddle & Leuschner (2015)	found	?	yes	no	92	not classified (word status unknown)
Brulle (2014)	found	?	no	no	41	not classified (word status unknown)
Franta (2018)	found	?	no	no	5	not classified (word status unknown)
Kourany & Carrier (2020)	found	no	no	no	1 (insuffi cient)	not classified
Oreskes & Conway (2008, chapter)	found (not classified; text not consulted)	no (no abstract)	?	?	0	not classified

Most of the other anchors are books with no abstract or reference list in OpenAlex: Proctor and Schiebinger (2025), Michaels (2005, 2008), Dunlap and McCright (2011), Markowitz and Rosner (2002, 2013), Benedick (1991), Litfin (1994), Parson (2003), Gross and McGoey (2015), McGoey (2019), and *Merchants of Doubt* and *Golden Holocaust* themselves. For these, word status and citations are unknown. The invented control title was not found, as it should be.

A5. The ozone search

We searched OpenAlex for works from 2008 to 2025 whose title or abstract contains ozone or chlorofluorocarbon terms together with a term of doubt, denial, uncertainty, ignorance or scepticism. The search returned 236 works. Of these, 119 have reference lists. One of the 119 cites the 2008 volume (Painter, 2023, a master's thesis with 159 references, which also cites *Merchants of Doubt* and does not contain the word in its title or abstract). Five others cite only *Merchants of Doubt*. The only work that contains the word is a review of that book (Roberts, 2012). It has no reference list, and the word occurs only in the text that OpenAlex recorded in place of an abstract. A filter removed some unrelated records, but the denominator remains contaminated (the most cited works include stellar flares and wastewater treatment), so we report no proportion.

A6. The list of 28 strategies

Why this list. The article needed a list of doubt-making strategies that did not come from our own judgement, because we had rejected subjective coding. We took the list from Goldberg and Vandenberg (2021). Its authors extracted 28 strategies from five cases: tobacco; coal and black lung; sugar and heart disease; Syngenta and atrazine; and scientists at and near the Marshall Institute on climate in the 1980s.

What we took. From the article and its supplementary material (Additional file 1) we took, for each strategy, the name and explanation (given verbatim in Table A7), the cases in which it is recorded, the audience (where the text is explicit), the authors' own cautions with page numbers, and the sources the authors give for each cell. We added no strategy and removed none, and we counted nothing in the word-bearing literature. All 140 cells of the supplementary material (5 cases by 28 strategies) agree with Table 1 of the source article. The authors state that their article is not a systematic review and that no pre-set criterion identified the strategies (p. 3).

Sources of the cells. In the five cases the dominant sources differ: tobacco rests mostly on internal industry documents held in the UCSF Industry Documents Library (21 of 25 cells), coal on three investigative reports (Hamby, 2013; 8 of 10), sugar on a historical analysis of documents (Kearns et al., 2016; 10 of 15), atrazine on the exhibits of a journalistic investigation by 100Reporters (15 of 19), and climate on *Merchants of Doubt* (Oreskes & Conway, 2010; 15 of 17). The source article's supplementary material cites *Merchants of Doubt* in 20 cells (5 tobacco cells and 15 Marshall cells), Michaels (2008) in 4 tobacco cells and Proctor (2011) in 2 tobacco cells.

Cells that rest on planning documents. Of the 86 marked cells, we read 12 as "planned*", because the title of the base document is a proposal, a plan or a request for proposals. Eight of the 12 are atrazine cells that trace to one document, the 2009 proposal of a public relations agency to Syngenta (Exhibit 13). Of the other 74 cells, 2 rest on several sources of which one is a proposal or a plan, and 4 are unclear because the title of a document suggests a plan, and we have not opened the document. We judged from titles only. The authors accept strategies that organisations were "documented to use or planned to use" (Goldberg & Vandenberg, 2021, pp. 2, 5). The supplementary material does not say whether the agency's proposal was carried out.

The authors' cautions. (1) The article is not a systematic review (p. 3). (2) The list is "thorough, but by no means exhaustive" (p. 9). (3) The absence of a strategy in a case may reflect only the absence of documentation (pp. 6, 9). (4) Strategies do not weigh equally, and some have legitimate uses (p. 8). (5) Larger, newer or governmental cases may add other strategies (pp. 8, 10). (6) The five strategies shared by all five cases are the most effective features of manufactured doubt, but the absence of one is not a sign of failure to establish doubt-making (p. 3). (7) Some strategies need money (p. 5). (8) A strategy such as "influence government and laws" shows government as an unwitting carrier in these five cases; examples in which government builds the doubt lie outside them (pp. 7, 8).

The source defines the symbols A and B in its table notes: A is information generated to combat scientific evidence and facts, and B is information generated to promote narratives favourable to the industry. In Table A7, "Planned*" marks a cell that rests on a document whose title is a plan, proposal or request for proposals.

Table A7. The 28 strategies with the explanation from Goldberg and Vandenberg (2021, Table 1), the cases, the status of the evidence and the audience or caution. Cases: T tobacco, C coal, Su sugar, Sy Syngenta (atrazine), M Marshall Institute and others (climate). The audience and caution column gives only what the source states explicitly. For 17 strategies it is empty and must be read from Figure 2 of the source.

#	Strategy and explanation (explanation verbatim from the source)	Cases	Status of the evidence	Audience and caution
1	**Attack Study Design.** To emphasize study design flaws in A that have only minimal effects on outcomes. Flaws include issues related to bias, confounding, or sample size	T C Su Sy M	T: Planned*	Scientific community only (p. 3)
2	**Gain Support from Reputable Individuals.** Recruit experts or influential people in certain fields (politicians, industry, journals, doctors, scientists, health officials) to defend B in order to gain broader support	T C Su Sy M	Documented	All four audiences; fallacy of appeal to authority (Table 2, p. 6)
3	**Misrepresent Data.** Cherry-pick data, design studies to fail, or conduct meta-analyses to dilute the work of A	T C Su Sy M	Documented	All four audiences; "Texas sharpshooter" fallacy (Table 2)
4	**Suppress Incriminating Information.** Hide information that runs counter to B	T C Su Sy	Sy: one source is a proposal	All four audiences; its absence in the Marshall case may only reflect missing documentation (p. 6)
5	**Contribute Misleading Literature.** Use literature published in journals or the media to deliberately misinform, either pro-B, anti-A, or to distract with peripheral topics	T Su Sy M	Documented	Costly, for example hiring ghostwriters (p. 5)
6	**Host Conferences or Seminars.** Organize conferences for scientists or relevant stakeholders to provide a space for dissemination of only pro-B information	T Su Sy	Sy: Planned*	A one-sided conference may carry no intent to deceive; scientific bodies need not invite non-scientific speakers (p. 8). Costly (p. 5)
7	**Avoid/Abuse Peer-Review.** Avoid the peer-review process to publish poor literature, publish without revealing funding sources, use the journal name to add weight to claims, or minimize need for peer-review among lay audiences	T Su M	Documented	
8	**Employ Hyperbolic or Absolutist Language.** Discuss scientific findings in absolutist terms or with hyperbole, use buzzwords to differentiate between "strong" and "poor" science (i.e. sound science, junk science, etc.)	T C Su Sy M	Documented	All four audiences; a defender of health with strong evidence may also exaggerate (p. 8)
9	**Blame Other Causes.** Find related, alternative causes for negative effects that are reported or observed	T C Su M	T: Planned*	All four audiences; its absence in the Syngenta case may only reflect missing documentation (p. 6); fallacy of the suspect cause (Table 2)

#	Strategy and explanation (explanation verbatim from the source)	Cases	Status of the evidence	Audience and caution
10	**Invoke Liberties/Censorship/Overregulation.** Invoke laws to emphasize equality and rights for expression of B, despite differences in evidence quality	T M	T: Planned*	
11	**Define How to Measure Outcome/Exposure.** Attempt to set guidelines for 'proper' measurement of exposures or outcomes, while undermining guidelines used in A	T C Su Sy	T: unclear; Sy: Planned*	Definist fallacy (Table 2)
12	**Take Advantage of Scientific Illiteracy (media/individuals).** Emphasize scientific obscurity to confuse lay audiences, or deliberately disseminate unscientific or false but digestible information	T Su Sy M	Su: Planned; Sy: Planned	Not aimed at the scientific community (p. 3)
13	**Pose as a Defender of Health or Truth.** Represent the goals of B as health-conscious or dedicated to truth	T Su Sy M	Sy: Planned*	Not aimed at the scientific community (p. 3); fallacy of honesty (Table 2)
14	**Obscure involvement.** Ghostwrite, create shell companies, use attorney client privilege to hide association	T Su Sy	Documented	
15	**Develop a PR Strategy.** Devise methods for specifically reaching public audiences to spread B messages	T Su Sy	Documented	Costly, for example professional firms (p. 5)
16	**Appeal to Mass Media.** Appealing to journalistic balance, developing relationships with media personnel, preparing information for media personnel, invoking the Fairness Doctrine	T Sy M	Sy: Planned*	Public only (p. 3)
17	**Take Advantage of Victim's Lack of Money/Influence.** Silence or abuse individuals by out-spending or exploiting a power imbalance	C M	Documented	Needs large resources (p. 5)
18	**Normalize Negative Outcomes.** Normalize the presence of negative effects to reduce importance and make them seem inevitable	T C M	Documented	
19	**Impede Government Regulation.** Overwhelm governmental regulatory agencies to slow or stop their function	T Sy	Sy: Planned*	
20	**Alter Product to Seem Healthier.** Make modifications to harmful product to reduce ostensible negative effects	T	Documented	Recorded in one case only (p. 3)
21	**Influence Government/Laws.** Gain inappropriate proximity to regulatory bodies and encourage pro-B policy	T C Su Sy M	T: unclear; C: one source is a plan; Sy: Planned*	Government was an unwitting carrier here, not a builder (p. 7); an example of government as builder lies outside these five cases (p. 8)
22	**Attack Opponents (scientifically/personally).** Conduct targeted attacks on opponents by undermining their professional or personal reputations	Sy M	Documented	Not effective in a court of law (p. 3); ad hominem fallacy (Table 2)
23	**Appeal to Emotion.** Manipulate an audiences' emotions to draw support for claims in the absence of facts	T Sy	T: unclear; Sy: Planned*	Appeal to emotion fallacy (Table 2)
24	**Inappropriately Question Causality.** Argue that correlation does not equal causation despite the presence of strong evidence	T	Documented	Recorded in one case only (p. 3)
25	**Make Straw Man Arguments.** Publicly refute an argument that was not made by the opposition	M	Documented	Recorded in one case only (p. 3); straw man fallacy (Table 2)
26	**Abuse Credentials.** Use qualifications in one discipline to assume authority in another discipline	T M	Documented	Not effective in a court of law (p. 3); example of Wakefield (p. 6); false authority fallacy (Table 2)
27	**Abuse Data Access Requests.** Requesting access to data in order to misrepresent and attack, employing Shelby Amendment, Freedom of Information Act, etc.	T Sy	T: unclear	
28	**Claim Slippery Slope.** Illogically or falsely claiming that there will be disastrous consequences if B ideology is not supported	T Sy	Documented	Slippery slope fallacy (Table 2)

Count check. The strategies appear in 86 marked cells: tobacco 25, coal 10, sugar 15, Syngenta 19 and Marshall 17. Of the 12 cells marked Planned*, 8 are Syngenta cells (strategies 6, 11, 12, 13, 16, 19, 21 and 23), and 4 are tobacco or sugar cells (strategies 1, 9, 10 and 12). Four tobacco cells are unclear (strategies 11, 21, 23 and 27), and two cells (strategy 4 for Syngenta and strategy 21 for coal) rest on several sources of which one is a plan.

Sources by strategy. The supplementary material lists the source of each cell. We summarise the pattern, because the full list is long. A cell may cite an internal document with an identifier of the UCSF Industry Documents Library, a historical analysis, a journalistic report, or *Merchants of Doubt* with a page number. Where the supplementary material cites a document as quoted in another work, it does so "as discussed in" that work. The supplementary material also contains its own errors, for example it names Aviv (2014) as a *New York Times* article, but it is a *New Yorker* article. We report the sources as they stand and have corrected nothing.

A7. Process and changes

The first version (v3) changed after we saw the result (the list of foundational texts, the exclusion of 2026, the bootstrap and the sensitivity analyses), and we built v3.1. So v3.1 is not pre-registered. We wrote the script v3.2 (descriptive indicators) before we saw its result. For v3.3 (the genealogical test) we wrote the reading rule before the run (section A4). The script changed several times after incomplete runs (quota errors and 504 errors), and the list of anchors grew after the first output, with 9 manual IDs and the anchor Michaels (2006). The changes were technical (save and resume, ozone filter, removal of badly matched records, manual matching), and the reading rule did not change. We added Michaels (2006) and Corpus C after we saw the first result, so their result is exploratory.

A8. Full list of limitations

We see the word only in titles and abstracts. Works that use it in the full text, or that avoid it, do not show. About 28% of the works of the first period have no usable abstract.

Coverage of reference lists is 52% to 61%, and it is lower for books and book chapters, so the share of citations is probably overestimated. Of the 49 anchors we found, only 31 have reference lists, and most books have none. "Does not cite" in the tables means "is not in the OpenAlex list".

The anchors are the author's selection. Of 50 anchors, 49 matched (all except the invented control). Two works (the Oreskes and Conway chapter and the Gross and McGoey handbook, 2015) could not be classified, because we could not consult their texts or reference lists, and 18 anchors (mostly books) have no usable reference list. We cannot generalise the result to "continuation".

OpenAlex holds duplicate records for one work (publisher version, repository, review). This shifts counts, and the record that has a reference list may be another version of the same work.

The word is detected only in the title and abstract, and without an abstract it is "?". So the share of the word in B and M is a lower bound.

Topic, keyword, discipline and subfield labels are OpenAlex's machine labels, and they may be wrong for single works. The topical diversity of Corpus B was not computed with equal-size sampling against A.

The overlap of Corpora A and B (some works are in both) was not computed.

The word lists are exploratory, and we did not correct for multiple comparisons.

The dictionaries are not blind, and we changed them from v3 to v3.1 after we saw the result. We also changed v3.3 twice after incomplete runs, for technical reasons.

The share of the word relative to "ignorance" includes non-theoretical and unrelated senses of "ignorance". The denominator "all works" after 2024 is invalid because the index expanded.

The review in Chapter 3 (section 3.5) is selective, not systematic. Its claims about who cites whom come from OpenAlex reference lists, which are incomplete, especially for books.

The results describe the literature, not the behaviour of industries.

The anchor Michaels (2006) and Corpus C came after the first result, so their figures (48 works with abstracts) are exploratory.

The list of 28 strategies comes from one article and five cases, and it is not a systematic review (p. 3 of the source). We only report it. We added no strategy and removed none.

Of the 86 marked cells, 12 are read as Planned* from the title of the base document, 2 more rest on several sources of which one is a plan, and 4 are unclear. We have not opened the documents.

The audience column of Table A7 is empty for 17 strategies and must be read from Figure 2 of the source article.

The article has no count of the strategies in the word-bearing literature, so we do not know which strategies occur in the titles and abstracts of Corpus A.

A9. Use of AI, materials and correspondence of codes

Use of AI. The use of AI in translating and editing the text is disclosed in the statement on the first page. In addition, the author used Claude, an AI assistant developed by Anthropic, to critique drafts and to help write and revise the analysis scripts. The author formulated the questions, chose the anchors, set the reading rules, and takes responsibility for the interpretation and for every claim. Language models proposed some DOIs and references from memory, and some were wrong, so the author matched references and anchors by title and author name and checked bibliographic details against the sources.

Materials for upload. The analysis scripts (agnotology_v31.py, agnotology_v32.py and agnotology_v33.py) are not included in this deposit. The outputs and the cached OpenAlex records are provided so that the reported figures can be checked against the data. The outputs are summary_v31.txt, summary_v32.txt, summary_v33.txt, results_v31_periods.csv, results_v31_yearly.csv, results_v31_sensitivity.csv, results_v32_lists.csv, results_v32_adoption.csv, results_v33_anchors.csv, results_v33_citers.csv and results_v33_ozone.csv. The data files are data/canon_ids.csv, data/A_meta.csv, data/A_topics.csv, data/v33_cache_W184537900.json, data/v33_cache_W1560889174.json, data/v33_cache_W2138562946.json and data/v33_anchor_cache.json.

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