Lund University
Department of Political Science

UNDK02, HT23, submitted 2024
Tutor: Tony Ingesson

The unbearable lightness of a medial climate-certainty trough behind scientific-intelligence failure

Sören Floderus

Abstract

Knowledge brokerage and science communication are roles prone to forming "certainty troughs" (MacKenzie, 1990) between scientists and science's downstream consumers. This has been studied as pertaining to in particular the geoscience area of CO2/climate, with an eye for the security domain's use of science's knowledge vertical. As background, the areas of knowledge acquisition, undue politicization and deception theory were overviewed. This identified a link relatively less attended to, between organizational groupthink communicated and deception through unintentional misleading. Method-wise, Hall's (2006) single-case Systematic Process Analysis supplemented with Collier (2011) heuristics was implemented, invoking 15 processes as drawn from the reigning "doubt-merchant" model, or hypothesis (H1), and an all-source analysis provided by this geographer author (H2), respectively, their equifinal outcome being the current near-science communication. Results and analyses revealed, as "trough rhetoric", a clear tendency of H1 to convey half-truths and non-decisive circumstances without regard for underlying forcing, with the use of "interactional expertise" making for the critical difference. With a probing of the areas of investigative science journalism and corporate politicization, for innovative workarounds, the idea surfaced to, e.g., equip investors' Materiality-Assessment reporting for corporate and public knowledge acquisition. It was further suggested that Sociology of Scientific Knowledge, SSK, as part of its Fourth Wave, and Science Communication, may want to (if not done already) pay more attention to a science institution's "rogue" fringe and its co-players, and to end-users' supra-scientific faith.

Key words: certainty trough, climate, science politicization, misleading, deception

Words: 9801

Table of contents

1 Introduction

1.1 Knowledge verticals: security's use of science's

With its intelligence services, security's knowledge "vertical", or domain, may be viewed alongside those of comparable other domains in civic society. Comparing with science's (Agrell & Treverton, 2015), the corporate (Strachan-Morris, 2013) or with knowledge verticals of institutions upholding democracy, education and law (Goldman, 1999) may highlight, e.g., their analysts-buyer divide and dependencies or interactions between domains. If picturing knowledge domains as indeed semi-closed, semi-independent and vertical, able to form knowledge silos or pipes, what will be focused on here is their "upper node" situated right below the level of analysts or knowledge to be acquired. Here, from knowledge collection or production, intelligence possibly relevant to existential threats is passed from science's vertical over to security's, from where – the other way around – its domain is also able to undertake scrutiny involving science's.

And here CO2, or climate, presents a prominent current threat, according to claims,[1] which I covered to some extent at Intelligence Analysis B-level (Floderus, 2022) including a look at science's historic medialization and at the actual climate science.[2] Of relevance then to the above-mentioned focus, the upper node is also where a so-called "certainty trough" may form, meaning a level of actors invested in its knowledge and prone to display excessive certainty over it (Fig. 1). This term, certainty trough, was coined by Donald MacKenzie (1990) in relation to a study of the development of missile guidance systems. He later added (MacKenzie, 1998: 327) that, namely, the climate area suggests another example of such a "trough". Also Shackley and Wynne (1996: 278), and

---

[1] One way of viewing the security domain's situation then is seeing its borders and limits as negotiable through the concept of "securitization" (Buzan et al., 1998). It allows for external claims to have issues added to security's domain, and to the extent its domain is widened accordingly, have it meet the private sector and media in new ways (Trombetta, 2008).

[2] This described how its issue's securitization is most likely not concluded, and, I should add to it two things: (1) that climate science's predicament has also been well popularized, by, e.g., Vahrenholt and Lüning (2013), Koonin (2021), and Curry (2023); still, even then, the most central MSCL-field (medium-term solar-climatic linkage) is not always detailed; (2) how I later found that in the most recent relevant Working Group 1-chapter (Gulev et al., 2021), only 2-3 of the ~20 articles I cited from this field are among its 41 *pages* of references; It seems the Intergovernmental Panel on Climate Change, IPCC, simply gave up on wanting to cover it.

Knaggård in a Swedish thesis (2009), saw its concept as relevant to a climate-uncertainty discussion.

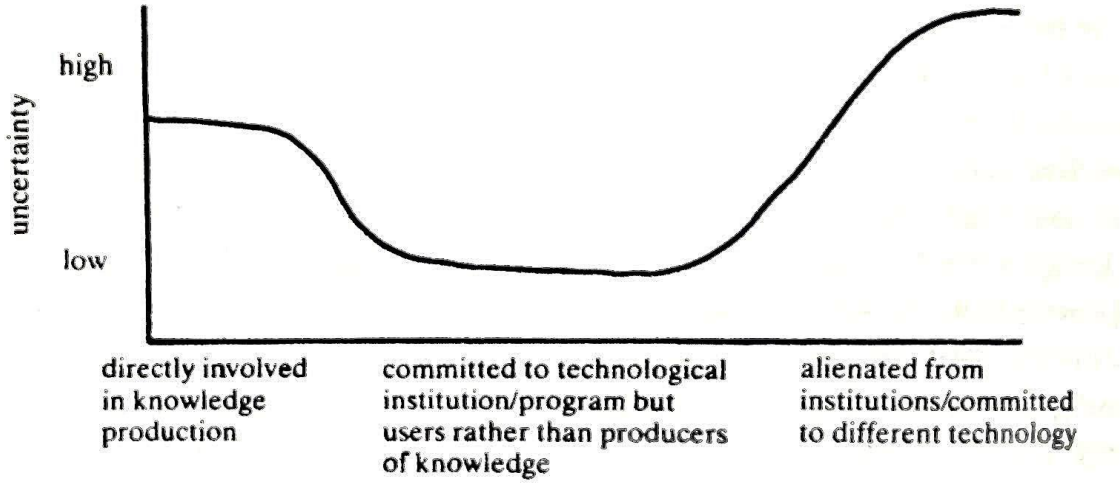

Figure 1. The certainty trough schematically describing how agencies both upstream (the scientists) and downstream (the institutionally alienated) of it tend to display higher knowledge uncertainty about an issue. From MacKenzie (1990: 372).

In fact I will here, in that it enables to maintain a focus on trough workings as such, regard the existence of a "climate trough" as on-beforehand established as at least far from unlikely, or quite likely. If so, it constitutes a knowledge-flow failure originating in science's vertical and exported to security's domain. At any rate, a trough's workings "as if in place" deserve this study of its own, after having first viewed some of its stakeholders in the security domain.

1.1.1 Scientific Intelligence as user

The security domain's relation to science – through, in principle, its policymakers - is exemplified firstly by its capabilities depending on science's wealth of legacy technology and life-science fields. Further and of relevance to the climate area, it undertakes large-scale global assessments, like Global Trends' scenarios (NIC, 2022), and through issues seen as "geopolitical". The latter century-old concept (see Flint, 2022 for an overview) has re-emerged in recent decades, and then in

energy-policy contexts in particular.[3] Its climate- and energy-content is now invoked in international relations as related to regional development, with participation of all major global-scale actors.

What the security domain depends on from science's used to include also Scientific Intelligence, SI. This term is foremost associated with the era of nuclear-physics development during World War II and the Cold War, as recently described by Houghton (2019). SI is generally trained on an adversary's institutional capabilities, but also on actual scientific findings and their potential. A third circumstance is whether findings, involving an adversary or not, are sought ignored or suppressed out of whichever reason or cause – involving, e.g., a certainty trough - so that they would need to be, despite not being classified, at any rate skillfully acquired.

This third scenario is held up here to raise a point: whether today's situation with a certainty trough involving the geosciences warrants perhaps an "SI 2.0"? In this, two takeaways emerge from revisiting Houghton's (2019) SI 1.0: (1) how any such upgrading probably no longer implies covert science-group infiltration, yet (2) how science *expertise* was paramount, and seems to be still.

1.1.2 Accountability Oversight's use

Among further science's "user accounts", one shaping its independent existence behind security policymakers in general is intelligence accountability-oversight functions guarding democracy "from below". Of interest to these are tendencies toward inefficiency and misuse of power, being of the political-policing and "state-within-the-state" kind (Cameron, 2019), both of which include matters around knowledge dependency.

Let's say - again - that while an SI 2.0 is not about covertly infiltrating science communities "1.0-style", a message from SI 1.0 was rather the role of science expertise. Here, Gill (2020) when discussing accountability oversight's need for intelligence-community oversight (IC-oversight), is not too explicit about who should make up overview's expert-oversight bodies,[4] except that they *can* also draw on analyst-level expertise. Cameron too (2019) prefers manning oversight bodies with IC-community participation, only not the most

---

[3] As reviewed by Vakulchuk et al. (2020), its field sees already a classical-critical split, and the European Commission having made a "geopolitical turn" (Siddi, 2022).

[4] Such bodies were exemplified by the UK's Investigatory Powers Commissioners Office, IPSO, Canada's National Security and Intelligence Review Agency, NSIRA, and the Dutch Review Committee on the Intelligence and Security Services, CTIVD.

directly active (paragraph 41). A problem with real such agencies however, including climate science's IPCC, the Intergovernmental Panel on Climate Change, is that these, ever so science-connected, risk getting institutionalized and acting as such regardless of formal independence.

Also this description raises the quality issue: If policy and its agencies would be "in the trough", Accountability Oversight needs convincing ways to acquire and overview all relevant knowledge from the actual scientists.

1.2 Aim of study, questions and caveat

In the above context, the aim of this study is to pick up and build on MacKenzie's certainty-trough observation, as guided by concerns of policymakers, knowledge acquirers, voters and their intelligence-Accountability Oversight functions. To shed light on trough workings, it will explore them by way of adjudication between hypotheses according to developments in political-science methodology given social complexities and social science's overall "historical turn" (George & Bennett, 2005: 224) - still imperfectly and only as circumstances allow. This highlights the role of Science Communication, SC, its enabling or disabling conditions, as science knowledge passes its agent level right below the science domain's analyst level, here termed "the upper node", between knowledge production and use.

A main question is specifically asked then, with some sub-questions:

- How does an upper-node, SC-centered certainty trough work? Then, how can they be avoided, perhaps circumvented, and how do they differ among themselves and in comparison with functional upper nodes?

It should shed light on how "trough rhetoric" might affect the overall assessment of climate science, with this caveat guardedly added: "(trough rhetoric) if and when in place, i.e., wrong".

Realistically, the aim needs to be limited also, to one of at least framing the "landscape" and its nomenclature. Furthermore, the study relies on long-achieved insight, yet unfortunately cannot attempt to collect *much* more data in relation to needs showing up along the way.

Regardless, I am in this intrigued firstly by the way pertinent questions seem to direct the field of Intelligence Analysis to a knowledge domain's more vital yet perhaps underperforming workings and how this might affect discourse, secondly, by how this particular attempt combines two fairly rare accounts:

political science's methodology (its hard-earned case-study framing) and the climate area’s two more “passivist” space-climate- and paleo-communities' knowledge.

2 Background

I will substantiate the questions next through placing them in a theoretical frame, which illustrates a seeming theory-”gap” even. Thus, through a lens of (1) social agency theory, the most pertinent areas close to science's analytics level are walked through, here: (2) knowledge acquisition, (3) undue politicization and (4) misinformation and disinformation, including deception.

2.1 A social agency-theory lens

Agency theory was originally developed for the corporate knowledge domain (Ross, 1973), but its implications for sociology has enabled it to frame other domains' processes too. Its theory's simple, dyadic relationship consists of one autonomous agency, the principal (sometimes: “buyer”), having a second agency acting on its behalf, the agent. Its original dyad was owner-management, after which many more followed: employer-employee, voter-policymaker, etc.

A most central circumstance then is that of asymmetric information: an agent most-often knowing more than the principal, and asymmetries of power, whereby an agent rather than the principal may well assume control, with the principal in an inquiring role. Given how informing corrects such an information imbalance, of critical importance then is which tasks principals need to specify as expected for task fulfillment (Eisenhardt, 1989), e.g., which knowledge to collect, calling for agent scrutiny, and the arm’s-length principle whereby agents can show integrity and experience more or less slack (Majone, 2001).

Indeed, the social sciences adopted and re-made agency theory on their own and also policymakers’ terms. Waterman and Meier (1998) described how agency theory needed this expansion, and Shapiro (2005) explained how it is now part of sociology and of course organization studies. It was to encompass conflicting interests, goal conflicts and multiple principals, with parties sitting in social networks (Granovetter, 1985), knowledge ecosystems and in public bureaucracies (Moe, 1984). Here agents' constructive potential was appreciated by Donaldson (1990) through organizational stewardship theory. Further, policy objectives play a major role of its own for whether principals choose to use, or not use,

knowledge (Daviter, 2015) with, I would add, relevance to how certainty troughs might form generally.

2.2 Knowledge acquisition

The two knowledge domains firstly looked at here, their limits defined as existential (security's domain) and public (science's), share important traits but also differ in relation to knowledge acquisition and organization: science's open and medial vs. security's domain more organized and closed. It turns out, as principals under *all* domains see needs - sometimes valid - to intervene through or circumvent their agents, shaping perhaps its "perfect agent" (effectively, a non-agent), that they may then enhance or compromise a knowledge domain's analyst-level capacity, and sharpen "trough-relevant" questions about the role of agent-level communication.

2.2.1 Security's legacy of politicization and failures

Intelligence failures has become a unifying theme in the security domain's own field of Intelligence Analysis, with the policymaker-analyst relationship featuring prominently among reasons behind (Betts, 1978; Jervis, 2011; Agrell & Treverton, 2015). Steve Marrin (2020) explains how these roles were originally sought (by Sherman Kent, 1949) to be kept separated, to secure objectivity. Uri Bar-Joseph (2013) describes how the security domain's resulting Cold-War history of politicization played out instead. He aptly characterizes politicization, citing Joshua Rovner (2009), as an attempt by the policymaker, given its political opposition and the IC's standing as authoritative arbiter, to muster the support of its IC. He accounts for this tendency's post-war prevalence among democracies, finding that ICs actually most-often stood the ground and "got it right" intelligence-wise, despite politicization attempts from both political sides being commonplace, however especially in the US. Bar-Joseph points out how analysts in this kept their realist, positivist approach. Then occasionally undue agent support also resulted, creating a policymaker's perfect agent, with at least part of the agent community and its buyer eventually pulling in the same direction. Toward the end of the Cold War, and after it, this became more common with the US Republican and "neoconservative" side, so that history has this side mainly responsible for intelligence failures such as Iraq 2002. While in the 1960s those

roles had been opposite, the Republican side ended up distrusting its IC generally, seeing it as its political opponent and as susceptible to being deceived due to harboring "human bias". Indeed, to the extent the Cold War was also this contest between analysts and the politicizing buyer, the more Democratic-leaning analysts-side won this, its "intelligence discipline" then - not too surprising perhaps given their profession. Here, Archetti et al. (2019) acknowledged the security domain – just possibly - harboring echo-chamber tendencies, including being prone to issuing own misinformation.

If this US experience: relationships shifting control, either-or and back-and-forth, may be seen as exemplifying either the Kentian legacy (Kent, 1949; Marrin, 2020) or just more dire conditions more prone to failures and their ensuing "postmortems", it could also be compared with Sweden's. Here the same buyer-agent relationship started out strained too, partly out of Sweden's special awareness of state agents' arm's-length autonomy (Petersson, 2006: 622-23). The same era later saw a game-changing creation however with courses fostering exchange and shared understanding across the same divide (Leijonhjelm, 2020), and unlike main impressions of the US case, with policymakers informing more from their agents.

Relatively less has been written about the cross-domain divide in this respect, i.e., security's relative to science's vertical and undue politicization. Wilhelm Agrell and Greg Treverton (2015) saw security's domain gradually accepting Beck's (1992) "risk-society" concept and its handling of uncertainty. In return security's domain exported what Agrell and Treverton coined as fast-paced "intelligence modes of science" (p 77) characterized by scientists' self-deterrence and *prima facie* closures (p 63), effectively the science domain's own version of undue politicization's workings.

2.2.2 Science's vertical as medialized and near policy

Overall, apt knowledge theory for science's purposes has sprung mostly from social epistemology (social knowledge theory) as a continuation of its classical-philosophical beginnings dealing with individuals' knowledge production. This later social field has seen Alvin I Goldman (1999, 2002) champion a "veritist" (realist-truth) strain, including normative veritism (2002: 199) and "applied" social epistemology (2002: 160). As the whole field split into "critical" vs. "analytic" social epistemology (Collin, 2013), the latter is the closest one gets to one the science's domain's "own" theory of knowledge theory comparable to the organized domains' Intelligence Analysis and corporate Business Intelligence, BI. Its handling of the social aspects of the science vertical's knowledge distribution

leads onward to the fields of media studies, including its principal-agent divide, Sociology of Scientific Knowledge, SSK (Collins & Evans, 2002), and SC (e.g., Roedema et al., 2022).

If undue politicization is not unique to science's less organized domain, its special relationship to media may be. Recalling (from Floderus, 2022) how scientists as a condition prefer to be busy with their science, science communicators tend to "park" right below science's analysts as their principals' near-analyst agent, "instrumentalist" rather than veritist (Collin, 2011).

It is in particular in such a comparison with a more organized and closed domain that science's special relationship with media stands out, with its part-institutional SC in particular. Lashmar (2019) described a security-domain "triangle" of near-analyst collection consisting of analysts (the IC), academia and journalism, which might act as quite independent of institutional SC, and, which is applicable in also science's domain. I will return to this under the science-politicization topic and in the Analysis section.

Further, the history of medialization turned via the Public Understanding of Science program, and SC, into politicization's "upstream push". This often starts out as a policy-side on the lookout for problems, as Åsa Knaggård (2009: 97) cites policy-agenda scientist John Kingdon (2003) for pointing out. Here policymakers meet intermediary knowledge brokers (Litfin, 1994: 37-40) and so "questions of value get reframed as questions of fact" (p 4), which is related by Knaggård too (2014: 24). In this process, the near-science upper node gets populated and is a prime candidate for formation of the born-communicative certainty trough, still, not necessarily misinforming as such.

Media's role then invokes much full-grown media theories, where I instead elect to pursue this study's cross-domain agency-theory description of the security domain's principal and the science vertical's upper-node agent, leading to related fields of science politicization, misinformation, disinformation and deception.

2.3 Politicization

2.3.1 Undue politicization's roots

The relatively new field of Quality of Government offers a from-below view explaining the essence of undue politicization and corruption generally (Rothstein, 2021). It views policymaking as a system meant to deliver impartiality, where political equality is what both enters it, and, should survive there, from power access to power exercise (p 17), as a prerequisite principle. Out of poor understanding however, its system risks getting inside-plastered and stuffed by counteracting content: policy not procedure, private not public, culture and relativism not universalism, empirical not normative, multi-dimensionally "thick" not lean. If such content-tendencies were kept at bay, policy visiting or even running SC could well be in place, since impartiality is what also science rests on. Instead, aberrations, meddlesomeness and susceptibility to misinformation result, from poor attention to, e.g., "procedure, professional knowledge and ethics" (p 14).

2.3.2 Science politicization

With the current climate-SC situation, politicization may well flourish at its most exacerbated anew however, this time actually in science's domain. For framing this I will add, to Bar-Joseph's (2013) security politicization account, Joseph Hanna's (1991) description of science politicization, which in turn invokes Vienna-positivist Rudolf Carnap (1950). Such analysis, it seems, results in a "four-corner framing" of politicization (Fig. 2).

Hanna's analysis is noteworthy also for demonstrating how refutation of "critical" knowledge theory happened fairly early following its overall entry in the preceding decades - where he cites mainly Habermas (1971) - characterized by its self-description as "transcendental" realism, which Hanna coins as "supra-scientific", and its "critique of ideology". From this self-chosen sideline, this science's counterpart focused on, e.g., a "scientization of politics", overlooking what Hanna rather saw as its own politicization of science.

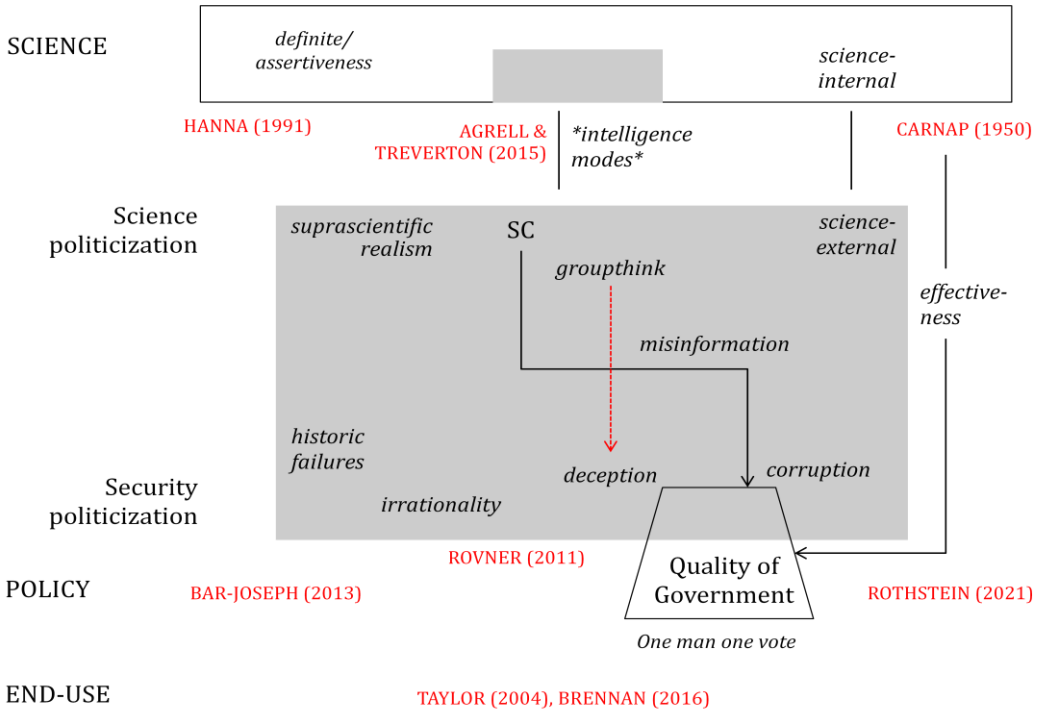

Figure 2. The realm of cross-domain politicization (shaded areas) and its "four corners" of theory as related here: Bar-Joseph's and Rothstein's toward policy and Hanna's and Carnap's toward science.

The latter concept thus joins this study's question targeting a likely certainty-trough having parked as science communication entity right under the science domain's analyst level. It forms a case of policy politicizing science not unlike similar processes in security's domain, except for one detail: In that scientists are only part cooperative in the role of IC-agent, there is instead its likely upper-node entity to relate to. Further, unlike with historic events in security's domain with time featuring mainly Republican-side politicization (Bar-Joseph, 2013), there is rather the Democratic side behind as one enters "the climate war" in science's domain.

Carnap's (1950) positivism distinguishes as science-internal hypotheses which are falsifiable, seeing science-external issues as the "decision" realm of supra-scientific realism (Hanna, 1991: 208-211), including unduly politicized science. It underlines the also intuitive difference between fact and opinion, where policymakers seek undue "factification" for support against perceived political opposition (Rovner's theoretical model, Bar-Joseph, 2013: 349). Meanwhile, with un-politicized science, more genuinely "definitive" (Hanna, 1991: 208 - or assertive) science-internal processes carry the potential to effectivize democracy by way of feeding into, e.g., cases of Rothstein's (2021) quality-of-government system working less corrupted.

To concretize Carnap's view on the decision realm in the context of security's domain, one could here recall and exemplify it with Wheaton and Beerbower's (2006) drawing of a line corresponding to Carnap's science-internal vs. -external. They separated the activities of knowing, understanding, analyzing and synthesizing information (about a foreign entity) - activities largely conducted by government employees - from the conscious act of attempting to influence the same, to be authorized by elected officials. The former is designed to inform policy, while the latter is an act of policy.

2.4 Disinformation, misinformation and deception

2.4.1 A matter of intent

The above four-corner framing of undue politicization in both domains may also be supplemented by contributions offering closer descriptions of psychological processes and belief-systems conducive of (otherwise counter-intuitive) misinformation. While Agrell and Treverton's (2015) self-deterrence and *prima facie* closures have been mentioned, I would add here Jason Brennan's (2016) voter- and politicians-types, motivated reasoning (Kahan, 2013), political psychology, and philosopher Charles Taylor on belief in the perceived good and science's institution (e.g., Taylor, 2004) as influences behind Hanna's (1991) described mindset of the supra-scientific.

With regard to the issues of misinformation, disinformation and deception, the two former concepts are normally explained as a matter of intent or not behind misinformation, which opens for the mainstream Intelligence-Analysis field of adversarial (or own) disinformation (Bjola & Pamment, 2019; Pherson et al., 2021). Beyond that however, if considering also an accepting receiver (still ignorant, deceived or misled), thus, moving from the sole perspective of the sender to this expansion still places intended disinformation's resulting deception in only the lower left corner of the below four-square "matrix of falsities communication" (Fig. 3).

No intent	Misinformation	Misled through unintentional misinformation
Intent	Disinformation (and misinformation)	Deceived through intentional disinformation
	Sender	Accepting receiver

Figure 3. Four-square matrix defining the wider realm of falsities communication

The lower-right square still seems "classical", and, was high-lighted in a recent discussion on deception by Andrew Chadwick and James Stanyer (2022, hereafter: CS22). With stressing their use of the word "deception" as apart from "disinformation", their focus is on processes behind receiver *acceptance* as intended by a sender.

There is however also the upper-right corner: unintended misinformation accepted by the receiver, which might imply CS22-deception, but then counters common language understanding. Granted, CS22 mentions there exists also "mere absence of knowledge" with senders, citing Carson (2010). Carson in turn suggests (p 47) to not use "deception" about the unintentional, with its negative connotations, and rather use "to inadvertently mislead". Levine (2014) would agree with Carson's interpretation too, rather using "honest communication" (p 379-80). Interestingly, the way the latter should include even honest marketing and propaganda (despite targeting and intending to steer audiences) to the extent there is an *intention* of veracity, makes it more likely to be relevant to larger-scale politicization theory.

Here it needs to be added, about honest communication: *and yet it may be misinformation,* i.e., nevertheless just not true, which may in this case mislead an ignorant, largely trusting knowledge collector. Still, unintended misinformation is the main focus of *neither* studies of disinformation (with the sender) *nor* studies of deception (with the accepting receiver). Indeed, it seems CS22, despite their focus on whether deception is actually accomplished, still leave this gap in "deception theory", in that *intended* deception seems *not* the best fit relative to this study's focus in communicating certainty troughs.

2.4.2 From communicated groupthink to deception: a theory gap?

I mentioned in the level-2 paper (Floderus, 2022) how with *unintended* deception the well-known Dunning-Kruger effect rather springs to mind: false yet assertive communication despite sender ignorance, but also that this effect operates at the level of the individual (Kruger & Dunning, 1999). I will therefore expand somewhat on how something similar *does* operate out of also *organizations*, as candidate mechanism behind certainty-trough misinformation, and how it highlights groupthink (Janis, 1982) and its effect on *receivers* of a self-deceived group's communication, which seems relatively unattended to and may suggest its gap in deception theory, a gap between *communicated* groupthink and unintentional or inadvertent misleading in this case. It leads to rationales behind communicated groupthink, where Turner et al. (1992) and Turner and Pratkanis (1998) stress guarding from negative views of the group, which they call social identity maintenance behind groupthink. Kramer (1998) however, when revisiting Janis' (1982) "original" Bay of Pigs-groupthink, found political considerations in fact more important than social psychological processes like protecting group cohesiveness.

Even so and overall, while the existence of unintentional misinformation is accepted, it is little dealt with even when seemingly attended to, as by CS22. Meanwhile, there exists in parallel sizable treatment of the whole in relation to communicated groupthink. Thus the two theories seem ripe for fusion provided a science-domain's certainty trough would exemplify, e.g., social identity or political groupthink. To summarize these background fields in terms of also agency theory: a certainty trough in science's domain resembles a principal's perfect agent more than any extra well-informed agent.

3 Method

This section will explain how it provides ground for analyzing, in the Results and Analysis sections, circumstances surrounding cases of upper knowledge nodes or likely certainty troughs. These will be, as earlier arrived at, missile-guidance accuracy described by MacKenzie (1990), tobacco and climate described by Naomi Oreskes & Erik Conway (2010), and climate as supplemented here and by Floderus (2022).

3.1 Equifinality, multi-causality - and adjudication

Here the qualitative case-study approach to admittedly complex, social political systems presented by George & Bennett (2005, hereafter: GB05) can be said to, at long last, have clarified and solidified its scientific rationale and legitimate standing as positivist science. It has then accepted that it too strives at, e.g. - despite not always arriving there - comparing rival hypotheses each modeling the same system and sharing perhaps only an equifinal outcome. Its type of problem is held up in GB05 for quite thorough treatment: how process-tracing was hard-earned arrived at, and how all necessitated and its school benefitted from the resulting "historical turn". Also multi-causality is clearly appreciated (p 112), including how equifinality does not necessarily or primarily call for a search, in system models, for "similar processes" ostensibly behind their visible outcome.

The task at hand is, namely, a low-*n* (actually, single-case) such study. In this, I note an additional circumstance not explicitly highlighted in GB05's otherwise comprehensive summary, but of special relevance here in that knowledge shifts hands before further distribution, which allows for upper-node assessment. As contestable, it arrives at "adjudication" like in a legal setting[5] and in hypothesis-testing alike. Multi-causes and equifinality lead toward what resembles the

[5] This parallel has been explored in the field of psychotherapy, as "adjudicated case study methods" (Stephen & Elliott, 2011; Bohart et al., 2011), but remains to be fully acknowledged in the judicial realm, despite Epstein and King (2002) having once highlighted it. While courts orchestrate scrutiny of hypotheses, it seems they still stand to be further fertilized by social-science fields having developed its applicable scientific approach to such ends in parallel.

hypothetical-deductive manner of falsification, with the court-system outcome instead being the lawsuit.

So this study's formulation of questions proceeds from GB05's discussion of equifinality. Science's vertical nurtures a system, a communicating upper node interacting with its level of analysts above, the scientists, processes near which result in a visible outcome: SC and media conveying own content.

3.2 Hall's SPA's critical features

Here, Peter Hall's (2006) approach to low-*n* qualitative method (no "weak sister of statistical methods"; p 27), Systematic Process Analysis, SPA, satisfies this situation's demands: historicizing and adjudicative, allowing two rival hypotheses, their narratives and numerous observations, i.e., also for multiple interaction honoring rich still not unrealistically detailed process-tracing. Being flexible about its specifics, it summarizes the approaches of numerous related studies, all the while adhering to GB05's three major study-phases: design, empirical data collection and implications for theory.

3.2.1 Explanation mode

Hall describes three major explanation modes: historical, multivariate and theory-oriented. Among the two qualitative modes (the 1st and the 3rd), the present case is single-case and historical-specific, with a leaning toward also theory. It's about *the one* upper node and its *major* narrative under science's *uniquely* ruling domain for a *fair share* of *global history:* it's just one historical event, albeit interestingly both central and contentious

The theory-part identifies disconnect, related to deception theory, between security and science politicization. It is one of prevalent, likely unintentional misleading as likely caused by communicated groupthink, with undue politicization behind. The process being succinct and weighty enough, such related theory also eases understanding, in describing a very human behavior.

Following Hall's design phase, and GB05's Phase One, Design (p 73), this is where system theories are to be advanced, which is represented here by the Background section. They are to include assumptions on underlying forcing (which I will call *drive*) as well as assumptions on how variables produce the outcome.

3.2.2 Hypotheses and empiricism

Corresponding to GB05's empirical Phase Two (the carrying-out) this setup is challenged by a rival hypothesis, both then adding empiricism drawn from the system to be examined in the form of a diverse, rich set of observed causal theory-related "values". Detailed "short-questions" specifically placed to the case are answered this way.

I here bring Oreskes and Conway (2010) in as reigning hypothesis, H1, regarding the science vertical's upper node: the comprehensive and widely shared tobacco-and-climate doubt-merchant model. For adjudication, it will challenge this geographer's account, H2, best described as an all-source analysis of the same node, overlooking a wider climate-communities history and with less of supra-scientific institution-faith. Then, all we *know* (for this setup stage) is the equifinal outcome: SC and media conveying their narrative, while two "sides" posit that either (H1) no certainty trough obscures, vs. (H2), there is certainty-trough distortion of, science's produce. Thus subsequently, the large and diverse set of observations is to involve this rival, which allows for comparison through a process of judgment.

3.2.3 Comparing the models

Here, with all "dominos" of detailed process tracing not in place, a supplementary method well described by David Collier (2011) is added, drawing on Mahoney (2010) and Van Evera (1997: 30-34). Representing the evaluative Phase Three of within-case study, it suggests a heuristic comparing two rival process-traced system descriptions characterized by being rich only not perfectly fine-grained – also being an "early step" (Mahone, 2010: 123), depending on the researcher's prior knowledge, and not to be taken too "rigidly" (Collier, 2011: 825). Mahoney termed system-process values Causal-Process Observations, CPOs, and categorized such as necessary and/or sufficient, or neither, for affirming causal inference relative to the outcome. This placed them in a four-square matrix designating the resulting test as either:

- most powerful, the CPO being both necessary and sufficient, passing a "doubly decisive" test, eliminating a rival hypothesis (alternatively, when failing the test, substantially strengthening it),

- second most powerful: being sufficient but not necessary, passing a "smoking-gun" test, substantially weakening the rival (alternatively, somewhat strengthening it).

- third most powerful: being necessary but not sufficient, passing a "hoop" test, somewhat weakening the rival (alternatively, somewhat strengthening it), or

- the least powerful: being neither, passing just a "straw-in-the-wind" test, only slightly weakening the rival (alternatively, only slightly strengthening it).

Collier thus supplements GB05, addressing "inferential leverage that is often lacking in quantitative analysis" (Collier, 2011: 823). Calling my observations CPOs, I will list them following an introduction to the reigning H1-hypothesis next.

4 Results

4.1 The doubt-merchant model

The choice of the doubt-merchant model as rival system description is made out of the way it represents a mainstream multi-faceted description of on-goings around “the upper node” right under science, which is also the center of a certainty-trough if and when it forms. It was laid out by Oreskes and Conway (2010), and by Oreskes (2019), but was also adopted by, e.g., Stocking and Holstein (2009) and by Hoggan and Littlemore (2009). In that this school’s H1-system does not produce a certainty trough, it instead harbors proper communicating scientists and SC, much disturbed however by “free market-motivated” opposition as helped by own-side naive, biased media. It describes how this side had mustered the same opposition in relation to issues like the missile crisis, nuclear winter, DDT, acid rain, the ozone hole, passive smoking, and thus finally CO2/climate. In addition to a call to basically “trust science”, lately an appeal to IPCC's consensual process and to science's institution in particular has been added (to also peer review) among science progress' key trust-conducive cues (Oreskes, 2019: 19).

As pointed out initially too, laying out much more extensively the data representing the CPOs has not been possible, for reasons of time and space. Instead a process-tracing approach akin to that held up by also Ikani et al. (2020) is here opted for, i.e., overall referring to - in addition to cited literature - long (4-5 decades) exposure and engagement with the setting: in this case its academia, field, social discourse and environments, as sometimes colleague (in marine organic-matter carbon/CO2 transport), teacher, national climate postgraduate-course initiator-organizer, or consultant, at times more of an interested bystander.

4.2 Climate's upper node-related processes and data

I list below 15 processes emerging out of overview of climate’s upper node, with thus 30 corresponding variables/notions for H1 and H2, respectively, as CPOs, and within parentheses: their necessity and/or sufficiency for causal-inference

outcome (or conduciveness, as judged) and the "test type" pertaining to that combination, then whether necessity is out of communication content and/or other drive, a notion's veracity, and whether tests were passed or failed as a result. The latter hinges on whether the variable is deemed at all outcome-conducive or not, with [pass/fail] meaning: as pertaining to [process], this [H1/H2]-variable, expressed as [notion] (which is [true/false]) [has/has not] been conducive to the system outcome, i.e., SC and media conveying it, or the variable in other ways driving it. Again note the two different aspects of outcome-conduciveness: (1) the *content* as conveyed and (2) more basic causal forcing (Hall, 2006: 27) or *drive* not necessarily conveyed as such.

4.2.1 View on external factors

1. Climate change

H1: Climate change is seen
(necessary/Drive and Content/hoop test, true, pass)

H2: Climate is within "bounds"
(neither/straw-in-the-wind, true, fail)

There remains a possibility to add energy demand and socio-political factors here if these would show drastic future change.

2. Climate surprises

H1: Global cooling is not seen
(necessary/Drive and Content/hoop test, true, pass)

H2: "Runaway" warming is not seen
(neither/straw-in-the-wind, true, fail)

Here, the lack of global cooling has the potential, given longer time, to attain also sufficiency and thus smoking-gun status unlike any other process except perhaps (6) below.

4.2.2 The science-internal

3. Solar-climate contention

H1: Volcanism seen explains Holocene; now for modeling
(neither/straw-in-the-wind, false, pass)

H2: Solar is seen yet dismissed; then little interest
(neither/straw-in-the-wind, true, fail)

This is from developments following the Past Global Changes (PAGES) program mainly (Beer, 2014; Laepple et al., 2023).

4. “Intelligence modes of science”

H1: Science is “toiling on”, in order
(necessary/Content/hoop test, false, pass)

H2: Science is part self-deterrent
(necessary/Drive/hoop test, true, pass)

Characteristically, the H2-notion here is not conveyed, despite being an outcome-driver, while the H1-notion is conveyed as if being this driver and despite being half-true only, given H2-related processes as overviewed by Agrell and Treverton (2015).

5. Science communities' unease

H1: Paleo interests are a real driver
(necessary/Content/hoop test, false, pass)

H2: Modeling acts over-confident
(necessary/Drive/hoop test, true, pass)

Same mechanism as under (4).[6]

6. Consensus

H1: Over 95 % unanimity
(necessary/Content/hoop test, false, pass)

H2: On contention, ~2/3 (or ill-defined)
(neither/straw-in-the-wind, true, fail)

Here, the necessity of H1 is noteworthy the way it has nevertheless, or precisely therefore, produced blatantly substandard bibliometrics, serving, to an H2-side, as "litmus test" bordering on its notion's sufficiency and thus smoking-gun status.

4.2.3 Science Communication

7. Whistle-blowing/"Climategate"

H1: Acquittal, minor corrections, the rest is normal
(necessary/Drive and Content/hoop test, true, pass)

H2: "Climategate" plus institutional response
(neither/straw-in-the-wind, true, fail)

The latter part of the H1-notion is from Harry Collins (2014).

8. Near-science exchange

H1: Science-Public discourse, in order
(necessary/Content/hoop test, false, pass)

---

[6] The field of Sun-climate relations was described by Lockwood (2012: 506) as one with poor reputation and having been "corrupted by unwelcome political and financial interests".

H2: SC acts institutional
(necessary/Drive/hoop test, true, pass)

Same as under (4) and (5); near-science exchange here pertains to not only institutional communication, SC, but also to psychology-sociology-journalism akin to Lashmar's (2019) “triangle” academia-community-journalism (to be returned to).

9. SC and media performance

H1: Fine, provided no false balance
(both/Content/double-decisive, false, pass)

H2: SC is misleading, media is abstaining
(both/Drive/double-decisive, true, pass)

Same mechanism as processes (4), (5) and (8); Oreskes and Conway (2010) deplore false balance (p 215), however so do science *and* this H2-notion.

10. Alternative media

H1: The flawed dissent, all
(necessary/Content/hoop test, false, pass)

H2: A convenient straw-man
(necessary/Drive/hoop test, true, pass)

Same mechanism as in processes (4), (5), (8) and (9).

4.2.4 With policymakers

11. Quality of Government/Politicization

H1: Due concern vs. right-wing politicization
(necessary/Content/hoop test, true, pass)

H2: Policy impartiality is violated
(necessary/Drive/hoop test, true, pass)

12. IPCC's governmental process

H1: “Consensus was reached”
(necessary/Content/hoop test, true, pass)

H2: Policy minority was down-voted
(necessary/Drive/hoop test, true, pass)

13. CO2/energy measures

H1: Measures ”will work”
(neither/straw-in-the-wind, false, pass)

H2: Measures polarize
(neither/straw-in-the-wind, true, fail)

4.2.5 View on end-users

14. Wide movement

H1: Duly science-familiar and -attuned
(neither/straw-in-the-wind, false, pass)

H2: Display of supra-scientific overfaith
(necessary/Drive/hoop test, true, pass)

The concept of the supra-scientific was suggested by Hanna (1991). Its tendency invokes institution-faith (Taylor, 2004), political and voter psychology (Brennan, 2016), all weighing in on the assessment here that its H2-notion is necessary and passes its hoop-test, being outcome-conducive through drive, not content.

15. Contrary opinion

H1: Noisy free market-motivated amateurs
(neither/straw-in-the-wind, true, pass)

H2: Mainly suspicious amateurs
(neither/straw-in-the-wind, true, fail)

Both hypotheses agree to some extent on this final process, except on which epithet to attach to it (and how much to concentrate on it), where it joins process (10). Unlike with H2-notion (14), it would seem the existence of this H2-opinion has not been outright outcome-conducive through drive however.

5 Analysis

5.1 Categorization of process-variable CPOs

Toward drawing conclusions (Hall, 2006: 28), I next overview how the process-variables and their CPOs (Fig. 4) land in categories, here with titles and descriptions added to thus emergent findings.

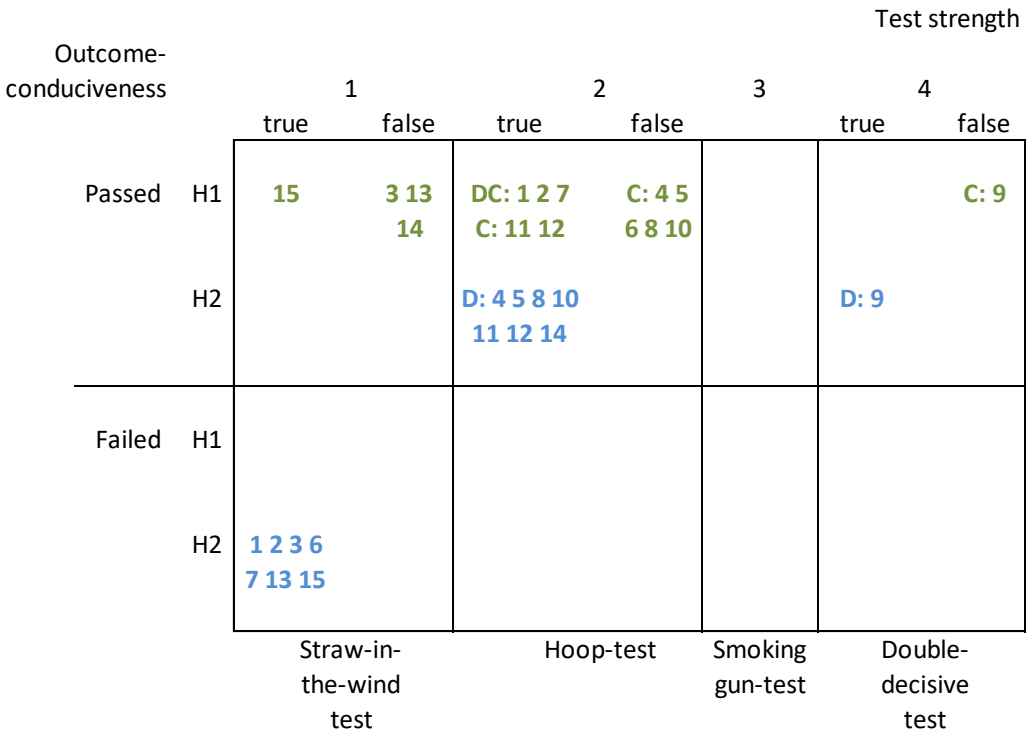

Figure 4. Plotting of the 30 H1/H2-variables related to the 15 processes as a function of test strength, veracity and outcome-conduciveness. D and C denote drive and content, respectively.

5.1.1 I: Conveyed yet unconvincing H1-truths

Passing straw-in-the-wind test:

- Opinion (15): noisy, free-market-motivated amateurs

Passing hoop test:

- Climate change (1): is seen (drive and content)

- Climate surprises (2): global cooling is not seen (drive and content)
- "Climategate" (7): acquittal, minor corrections, the rest is normal (drive and content)
- QoG/Pol (11): due concern vs. right-wing politicization (content)
- IPCC (12): "consensus was reached" (content)

These H1-notions are true, outcome-conducive and conveyed. Their hoop-tests pass without all being convincing as drivers, except the lack of global cooling holding smoking-gun potential.

5.1.2 II: Misleading part-truths, drive unconveyed

Passing straw-in-the-wind test:

- Contention (3): volcanism seen explains Holocene; now for modeling
- Measures (13): "will work"
- Movement (14): duly science-familiar and -attuned

Passing hoop test:

- Science modes (4): science is "toiling on", in order (content)
- Unease (5): Paleo interests are a real driver (content)
- Consensus (6): over 95% unanimity (content)
- Exchange (8): Science-Public discourse, in order (content)
- Alt-media (10): the flawed dissent, all (content)

Passing double-decisive test:

- SC/media (9): fine, provided no false balance (content)

Characteristically, these H1-notions passing hoop-tests are deemed outcome-necessary but are misleadingly conveyed as being drivers. Being only part-truths, their processes are driven by unconveyed, true H2-notions. Indeed, unless untrue, the final one could have double-decisively eliminated H2.

It seems this category II makes for a major mechanism behind the upper node acting as certainty trough.

5.1.3 III: Unhelpful inconveniences

Failing straw-in-the-wind test:

- Climate change (1): is within "bounds"

- Surprises (2): “runaway” warming is not seen
- Contention (3): solar is seen yet dismissed, then little interest
- Consensus (6): on contention, ~2/3 (or ill-defined)
- Whistle-blowing (7): “climategate” plus institutional response
- Measures (13): polarize
- Opinion (15): mainly suspicious amateurs

Unhelpful circumstances here fail straw-in-the-wind tests. Lacking outcome-conduciveness they are merely either “blocked” or just ignored. Notions (3) and (6) are significant the way they suggest further in-science research and inquiry.

5.1.4 IV: Necessary drive unconveyed

Passing hoop test

- Science modes (4): science is part self-deterrent (drive)
- Unease (5): Modeling acts over-confident (drive)
- Exchange (8): SC acts institutional (drive)
- Alt-media (10): convenient straw-man (drive)
- QoG (11): policy impartiality is violated (drive)
- IPCC (12): policy minority was down-voted (drive)
- Movement (14): display of supra-scientific overfaith (drive)

Passing double-decisive test:

- SC/media (9): SC is misleading, media is abstaining (drive)

Necessary true circumstances pass their hoop tests here for being important, yet sometimes merely “acceptable” and generally not conveyed as such, characteristically being H1-problematic quiet drivers. The final dysfunction if true, as strengthened by also CPOs and categorization emerging here, likely eliminates H1 through medial, sufficient outcome-conduciveness.

5.2 Upper-node comparisons

Having delved into climate's certainty trough allows for two more (brief) two-case comparisons, one between missile-guidance's trough as described

by MacKenzie (1990) and climate's, another between tobacco's upper node and climate's certainty trough.

This would contribute (in the Conclusions section) to answering a study sub-question: how an SC-led certainty trough may differ in comparison with missile guidance's real trough and a functional upper node like tobacco's, respectively. The study then explores both "the universe of cases to which the theory applies" (Hall, 2006: 30), being the missile-guidance trough and a groupthink-deception theory on certainty-trough formation, and "cases in which that outcome does not occur" (p 30), being tobacco's upper node. The outcome in question would still be climate's case of a certainty trough's communication through SC and media.

5.2.1 Missile guidance-Climate

I first explain the 1970-80s certainty trough pertaining to missile guidance systems technology. Starting top-down with the scientists-level, this was Draper Laboratories. Its "guidance mafia" championed the "missile revolution" with the army, thus establishing a science-policy liaison. Other policymakers still harbored skepticism about missile accuracy, notably an old-school "bomber faction". Here Draper-liaised policy since Kennedy had "settled" for ballistic missiles - their modernization generally deemed as unavoidable - forming a communicating certainty trough. Still, only one real field test had been made, an imperfect one at that, so policymakers had to "invent accuracy" as needed. In terms of agency theory, a convinced principal, via its army, apparently just put *faith* in its need for counterforce precision being met, with all processes overwhelmingly social and institutional, unlike what most perhaps would have assumed before social sciences launched Science and Technology Studies in earnest.

Draper scientists, despite their "guidance mafia" championing their army liaison, did not communicate their real skepticism much. Similar skepticism downstream of the army trough was represented by technology competitors, not only the bomber faction, but also the navy, and Congress' anti-counterforce lobby.

MacKenzie further suggested giving voice to scientists' uncertainty in order to "incline to caution", all the while acknowledging policymakers' right to decide (MacKenzie, 1990: 420). As it happened, policymakers merely *invented* their sought accuracy, here interpreted as an implementation of Agrell and Treverton's (2015) "intelligence modes of science".

As stated in the Introduction, MacKenzie saw (well after his missile-guidance study) how climate looked like a certainty trough too (MacKenzie, 1998: 327)

and related how this was spotted early by also Fernau et al. (1993) and by STS scholars (Science and Technology Studies; Shackley & Wynne, 1996).

5.2.2 Tobacco-Climate

Tobacco and climate were side-lined by the H1-account, to illustrate tobacco's and the climate area's otherwise functional upper node as equally afflicted by the free-market lobby. Here I suggest to side-line them in order to perhaps identify a way this lobby was wrong about tobacco, but is more right about climate.

A simple "most-different" approach thus sees how an upper-node comparison as performed through the H1-account does not spot this difference. Its upper-nodes' processes happen in the same era, are similarly positioned for adjudication, in the same knowledge domain - science's - with media equally present, and with even some lobbyists being exactly the same.

Such comparison illustrates a difference between *this* study's climate account, H2, and tobacco's upper node however: one about overviewing numerous disparate communities. The latter relies on "interactional expertise" (Collins & Evans, 2002, 2007, 2015), here spelling in-science experience, all-source and multi-communities width and near-science exchange, aspects vital also for an elusive "Scientific Intelligence 2.0".

5.3 Probing for workarounds

As spurred by findings along the way so far, I will finally probe two sub-question areas indicating apparent ways for knowledge users to circumvent a certainty trough.

5.3.1 Near-science journalism challenges

The two additional upper-node practitioner categories considered by Lashmar (2019) as being active in security's vertical: academia's Intelligence Analysis and medial journalism, under science would translate to: social epistemology and investigative science journalism. Thus, if not staffed from the principal, as oversight bodies described by Gill (2020), who instead should play the role of oversight's agent: any of those?

Here, oversight commissions, if exploring convincing near-science exchange in its neighboring knowledge-supplier, science's domain, would need to relate to media's presence and how media's journalistic techniques are what matter. Their deployed agents would collide with media on issues like professional code and informants' (like scientists') expectations – whereby the science domain's "how" of knowledge acquisition seems not so straightforward.

Given how scientists differ, I assume these will need to be approached journalistically, only more knowledgeably, via investigative science journalism. Meanwhile, journalism has its media role and its professional code to handle. Most importantly, with scientists themselves, only journalists both *can* and *may* investigate, as sole "unifiers" of the media-role and investigative skills. Scientists are wary and hesitate about access to all but firstly media, secondly policymakers and paying business. Then there exist numerous legitimate applied roles other than these: colleague, activism, students, public inquiry, and of course SC proper (Koivumäki et al. (2021). Still, media as a category represents what scientists see as a foremost external, non-colleague stakeholder, also in its own way definable as related to informant protection. Science's whistle-blowers turn to journalists, scientists acknowledge a media obligation, and are more confident about being "on top" with media content-wise.

For a journalist, it's still mostly about having success striking honest conversation simply about what is known, which all the while both journalist- and oversight-roles would demand. It is acceptable, and things are not kept secret much either. Indeed, open science is matters whose documentation and publication happen mostly without drama, where any *sensitivity* is *rather* about what should be communicated institutionally, e.g., be conveyed as compiled or not, how and by whom, credibly. Here, the institutional voice, given also the "climate war" and SC's certainty trough in particular, needs to be viewed sometimes more as "propaganda", or marketing, yet likely honest and possibly just unintentionally misleading. Thus with communication uncertainty, an H1-side gets concerned, its institutional and instrumentalist "us-here"-understanding being that no war rages so is raised only from an "outside". An H2-side on the contrary does not find that its role is to uphold institutional facade. As a result, there is mere silence normally. Here, being "in the know", interactional expertise is able to tell and inform, initially at least, where facade would be more important and where less so.

5.3.2 An opening in the corporate domain?

Pondering workarounds and knowing the corporate domain, the second more closed and organized domain and originator of the agency-theory lens, as increasingly politicized too, I will add an overview of also its knowledge acquisition. The corporate domain is more legal- and economy-oriented, and constrained as compared to security's domain. As production-structured, with a front- and a back-end, its umbrella term Business Intelligence, BI, covers multiple intelligence-collection targets subject to subsequent Knowledge Management, KM: competitive, product development, market and strategic, where my impression is that KM enjoys more attention than total BI including knowledge acquisition. For a characterization of its knowledge-acquisition assets, Gold et al. (2001) apply an organizational-capabilities perspective and add that without knowledge acquisition however, among preconditions, KM cannot be expected to work really (p 186).

The dominating take, with time, on corporate knowledge acquisition is one of collaboration leading to mergers and acquisitions (also Leonard, 1995). Before this, corporations more often owned own-bred scientists, at “in-house” campuses even (p 144-145). This was replaced with mere acquisition of expertise, and corporate mere presence at ordinary campuses. In this, now industry clustering, technology sharing, benchmarking (O’Dell & Grayson, 1998), personnel movement, and linkages between organizational and alliance or joint-venture partners assist (also Friedmann & Pedersen, 2006), all the way to buying into the knowledge, as reviewed by Tallman and Phene (2017).

Systematic collection of scientific knowledge may happen also just online, from common, research-driven virtual communities in particular (Herlin & Hedegaard-Knudsen, 2011). In comparison, acquisition from increasingly advanced practices of distributed “open innovation” (Chesbrough, 2019) likely serves innovation, but draws not on science necessarily.

Indeed, the corporate domain has arrived at knowledge acquisition being this matter of inter-firm collaboration, also more than, e.g., an own dedicated intelligence “service”. Strachan-Morris (2013) describes a service-pushing, risk-managing, corporate strategic intelligence analysis (not so much market or competitive intelligence) and finds organizational lines blurred: collection and analysis happening in a “black box”, solutions presented alongside problems, and all more opportunity-driven. In comparison with security's equally closed domain (in the Background section), the corporate seems closer to the later Swedish security model than to the security domain's role-distinctions having fraught Sweden's earlier era and US politicization still.

The opportunity drive also represents the presence of an own bottom-up, internal corporate policymaker principal, one focused on market demand and not necessarily science findings ultimately. Akin to what the security domain's accountability oversight looks after, corporate policymakers' focus represents their own “political policing” stakes then, showing how indeed both organized domains, security’s domain and the corporate, are susceptible to being misinformed by their own perfect agents.

It is here, to the extent principals liaise with the climate area’s certainty trough, an opposite opportunity may be spotted too. As exemplified by the European Union’s recent Corporate Sustainability Reporting Directive, CSRD (e.g., Wollmert & Hobbs, 2022), open-domain policymakers attempt to align with the corporate domain's policymakers. It points at an inherent, recently opening “crevasse” in the mainstream understanding of also corporate knowledge acquisition, namely, such legislation's procedural Materiality Assessment, MA. It allows for wide perspectives (Garst et al., 2022) as part of corporate work with ESG-aspects (Environment-Social-Governance) involving, e.g., investor stakeholders. Thus, opened by external policymakers, may the MA bring with it also its potential, novel knowledge-supply channel?

6 Conclusions

I will below denote three particularly salient short summaries with bullet paragraphs (1), (2) and (3).

6.1 Study findings, and weaknesses

6.1.1 Mechanisms behind misleading

The two groups of notions characterized by being omitted from communication or seeing their drive being unconveyed, categories III-IV, gathered almost all 15 H2-notions. So it seemed a certainty trough is signaled by this and by category-II part-truths, with important trough workings thus elucidated. Fig. 5 indicates the critical importance of all-source analysis behind this. Audiences are in addition misled by category II part-truths, and finally, are allowed to disregard how two opposite notions passing double-decisive tests invoke their actual veracity.

Thus true H2 notions were judged to be necessary drivers (category IV) behind the outcome, only, this is left out (category II) of outcome content, along with much else (category III). H1 instead rested on part-truths (category II), unconvincing (category I) and non-decisive circumstances, thus adjudicating H2 as the more likely system description.

- So (1), when geoscientific overview and the reigning doubt-merchant model are summoned for adjudicative comparison of upper climate-node workings, a "certainty trough" shows a reliance on omissions and half-truths, weakening this node’s climate assessment overall.

Thus, the results and analysis this far answered this study's main question, being how a climate-science upper-node SC-responsible certainty trough may work. This strengthened an overall climate-science assessment toward H2 – more on this below however - and allowed for further comparison and probing addressing sub-questions:

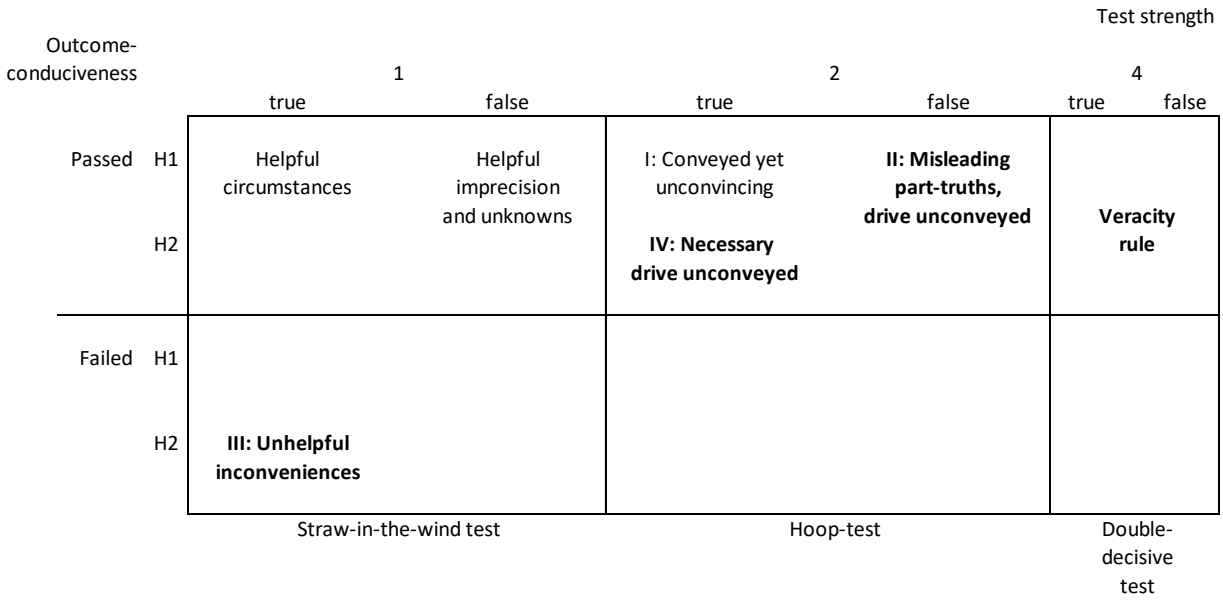

Figure 5. The most important "trough-rhetoric" categories (boldened) as described.

6.1.2 Troughs in general

Here the impression was one of indeed much similarity, with both science troughs[7] hinging on an activist science-"mafia"- (in climate: "the team") - policymaker alliance. Among slight differences: with climate's trough, the presence of communicating media and SC is more pronounced, while its security-domain link is more tenuous. Politically, climate's and MacKenzie's (1990) missile-guidance trough were (and climate's still is) more left-leaning, whereas the security domain's politicization attempts (Bar-Joseph's, 2013) came from both sides, still with time leaning more right.

6.1.3 A theory gap confirmed - others overseen

I here recall politicization and deception theory, the way they deal with communicated groupthink and unintentional misleading, which as suspected should likely be more clearly linked. Still, as also Hall cites: "historians wear

[7] This author's beginnings as physical geographer also spurred an alternative schematic: a lake: a "trough" as well, but also a filter (for particles, nutrients, toxins); what leaves it (knowledge-wise) is perhaps not what enters it.

their theories lightly", which for political science should align with its recommendation of "the cure of history" (George, 1997: 49).

Regardless, the study unfortunately could not delve much into Science Communication theory, rhetoric, media theory or Sociology of Science Knowledge, SSK, theory-wise. Most likely these would have shown similar gaps, probably ready theory too, where this finding could have contributed – as a piece in other unknown puzzles.

It struck me however, when learning of SSK and its three "waves", inspiringly related by Collins and Evans (2002, 2007, 2015) and Collins (2014), where its third and perhaps latest wave is sorting out how to identify interactional and other forms of expertise: Should not a Fourth Wave (I apologize if this has been done since long) see to also entirely insincere "rogue" parts - still very much a minority - as nevertheless parts of science's institution, and then to withhold and nurture further a link to Intelligence Analysis as explored here?

- As *its* challenge (2), Sociology of Scientific Knowledge, but also institutional Science Communication, may want to look at science-internal roguishness and science-external supra-scientific faith in particular.

6.1.4 All boils down to qualifying

Returning to how the precondition about the existence of a climate-certainty trough made for presenting H2 on equal footing with H1, with H2-notions asserted as true even, out of this author's stated claim about representing interactional expertise: This would seem like a study weakness given how H2 could, conceivably, also prove wrong in the end. It was justified here as a technique aimed at demonstrating "trough rhetoric", as an answer meeting the aim of study, now with a somewhat more confident "being in place, i.e., wrong" added. If the analysis seemed to weaken H1, also a sense of circular logic is understandable, yet not critical given how H2-notions rested on their real, independent CPO-empiricism through wide interactional expertise. What the study offered was just its fairer presentation of H2 in accordance with the method's adjudicative setup - just as if it too had, for a change, an appointed and well prepared lawyer at its side.

What the study does, and *in any case* does (if such background and its empiricism would play little role regardless), is to point at better qualifying the climate science (Floderus, 2022, for the climate science, also citing Hirschman, 1991, on qualifying - who landed there too), in that it seems H1 can be right only to the extent H2 can be *shown* to be wrong.

6.1.5 Principals' and users' unbearable-lightness play

This study has looked at the science domain's upper node using late developments in qualitative case-study methodology (its historic turn and provision for imperfect yet rich process-tracing) combined with relatively rare climate-science insight. The combination offered, here, a fascinating journey in itself the way its resulting pattern emerged.

It brings me to the study's title, borrowed from Milan Kundera - and a bit from Archetti (2018) cited earlier too. It seems an "unbearable lightness" would apply to both H1- and H2-sides as they see or discover climate's certainty trough: how carelessly built, and also, how fairly easily dismantled. Probably there will always be one to find, so it calls for seeing a joint medial-principal play, and part of science's institution playing along, as nevertheless responsible for focusing on it unaware (seemingly at least) of what it may be and how it probably works.

This also raises a question of whether certainty troughs are more common than hitherto fully incorporated - as insight to acknowledge - at least in some form or another, certainly of varying severity, with climate's nevertheless sticking out, being so all-pervasive and historic as centred around the all-encompassing carbon-atom and -cycle.

6.2 Mechanisms for an SI 2.0?

A final probing aiming at techniques for orderly trough circumvention, meaning truth-to-power approaches enabling Accountability Oversight's and Scientific Intelligence's understanding and knowledge acquisition, suggested two headings:

6.2.1 Interactional expertise

This would be near-science exchange corresponding to what Lashmar (2019) discussed for security's knowledge domain's agent level, only instead in science's vertical: upper-node exchange for overview of communities through interactional expertise, as journalism resource. This category of intermediaries was described by social epistemologists Harry Collins & Robert Evans (2002, 2007, 2015).

6.2.2 Investors’ Materiality Assessments

Here, the probing suggested a solution, related to the new CSRD legislation (e.g., Wollmert & Hobbs, 2022), making use of policymakers' own invoking of corporate stakeholders in ESG-work reporting. Provided an independent category like investors, with in addition a sobering "skin in the game", would be open for being equipped by Scientific Intelligence, a rather innovative inroad for also journalism is here provided by this process' required Materiality Assessment. The reason why this would work as, ultimately, also Scientific Intelligence-workaround, is that investors’ skin in the game could increase the likelihood of seeing the climate science more-often better qualified, by way of continued improvement resulting in higher-quality, open-source climate-risk analyses for the corporate and other domains alike.

- So for workarounds (3), regular qualifying of the science, including medium-term solar-climate linkage, with the help of interactional expertise and investigative science journalism, could try feeding via investors' risk-management analyses into CSRD-required materiality assessments.

7 References

Agrell, Wilhelm & Gregory F Treverton, *National Intelligence and Science: Beyond the Great Divide in Analysis and Policy*, Oxford, UK: Oxford University Press, 219 pp, 2015.

Archetti, Christina, *The Unbearable Thinness of Strategic Communication*, in (Corneliu Bjola and James Pamment, eds.) Countering Online Propaganda and Extremism: The Dark Side of Digital Diplomacy: 81-95, Abingdon, UK: Taylor & Francis Group, 230 pp, 2018.

Bar-Joseph, Uri, *The Politicization of Intelligence: A Comparative Study*, International Journal of Intelligence and CounterIntelligence 26(2): 347-369, 2013.

Beck, Ulrich, *Towards a new modernity*, Newbury Park, CA: SAGE Publ, 272 pp, 1992.

Beer, Jürg, *Constraining Holocene solar forcing by "detection and attribution"*, Past Global Changes Magazine 22(2): 112, 2014.

Betts, Richard K, *Analysis, War, and Decision. Why Intelligence Failures are Inevitable*, World Politics 31(1): 61-89, 1978.

Bjola, Corneliu & James Pamment, *Introduction: The 'dark side' of digital diplomacy*, In (Corneliu Bjola and James Pamment, eds): Countering Online Propaganda and Extremism. The Dark Side of Digital Diplomacy: 1-10, New York, NY: Routledge, 213 pp, 2019.

Bohart, Arthur C, Karen L Tallman, Gayle Byock & Thomas Mackrill, *The "Research Jury" Method: The application of the jury trial model to evaluating the validity of descriptive and causal statements about psychotherapy process and outcome*, Pragmatic Case Studies in Psychotherapy 7(1): 101-144, 2011.

Brennan, Jason, *Against Democracy*, Princeton, NJ: Princeton University Press, 288 pp, 2016.

Buzan, Barry, Ole Wæver & Jaap de Wilde, *Security: A New Framework for Analysis*, Boulder, CO: Lynne Rienner Publ, 237 pp, 1998.

Cameron, Iain, *The problem of oversight*, In: (Jan-Hendrik Dietrich and Satish Sule, eds) Intelligence Law and Policies in Europe. A Handbook: 388-420, Oxford: Hart Publishing Ltd, 591 pp, 2019.

Carnap, Rudolf, *Empiricism, semantics, and ontology*, Revue Internationale de Philosophie 4: 20-40, 1950.

Carson, Thomas L, *Lying and Deception: Theory and Practice*, New York, NY: Oxford University Press, 280 pp, 2010.

Chadwick, Andrew & James Stanyer, *Deception as a Bridging Concept in the Study of Disinformation, Misinformation, and Misperceptions: Toward a Holistic Framework*, Communication Theory 32: 1-24, 2022.

Chesbrough, Henry W, *Open Innovation Results: Going Beyond the Hype and Getting Down to Business*, Oxford: Oxford University Press, 201 pp, 2019.

Collier, David, *Understanding Process Tracing*, Political Science and Politics 44(4): 823-830, 2011.

Collin, Finn, *Science studies as naturalized philosophy,* Dordrecht: Springer, 247 pp, 2011.
Collin, Finn, *Two Kinds of Social Epistemology,* Social Epistemology Review and Reply Collective 2(8): 79-104, 2013.
Collins, Harry, *Are we all scientific experts now?* Oxford: Polity Press, 144 pp, 2014.
Collins, Harry & Robert Evans, *The Third Wave of Science Studies: Studies of Expertise and Experience,* Social Studies of Science 32(2): 235-296, 2002.
Collins, Harry & Robert Evans, *Rethinking expertise,* Chicago, IL: University of Chicago Press, 176 pp, 2007.
Collins, Harry & Robert Evans, *Expertise revisited, Part I - Interactional expertise,* Studies in History and Philosophy of Science 54: 113-123, 2015.
Curry, Judith A, *Climate Uncertainty and Risk. Rethinking our Response,* New York, NY: Anthem Press, 340 pp, 2023.
Daviter, Falk, *The political use of knowledge in the policy process,* Policy Sciences 48: 491–505, 2015.
Donaldson, Lex, *The Ethereal Hand: Organizational Economics and Management Theory,* The Academy of Management Review 15(3): 369-381, 1990.
Eisenhardt, Kathleen M, *Agency Theory: An Assessment and Review,* The Academy of Management Review 14(1): 57-74, 1989.
Epstein, Lee & Gary King, *The Rules of Inference,* The University of Chicago Law Review 69(1): 1-133, 2002.
Fernau, Mark E, William J Makofske & David W South, *Review and Impacts of Climate Change Uncertainties,* Futures 25(8): 850-63, 1993.
Flint, Colin, *Introduction to geopolitics. 4th Edition.* New York, NY: Routledge; 324 pp, 2022.
Floderus, Sören, *Toward establishing CO2-securitization's warning process and likely non-conclusion,* Lund University, Intelligence Analysis B-level course submission, lup.lub.lu.se/student-papers/search/publication/9081963, 25 pp, 2022.
Friedmann, Jens-Christian & Torben Pedersen, *National innovation policies and knowledge acquisition in international alliances,* Global Strategy Journal 2023: 1-36, 2023.
Garst, Jilde, Karen Maas & Jeroen Suijs, *Materiality Assessment Is an Art, Not a Science: Selecting ESG Topics for Sustainability Reports,* California Management Review 65(1): 64-90, 2022.
George, Alexander L & Andrew Bennett, *Case Studies and Theory Development in the Social Sciences,* Cambridge, MA: The MIT Press, 331 pp, 2005.
George, Alexander L, *Knowledge for Statecraft. The Challenge for Political Science and History,* International Security 22(1): 44-52, 1997.
Gill, Peter, *Of Intelligence Oversight and the Challenge of Surveillance Corporatism,* Intelligence and National Security 35(7): 970-989, 2020.
Gold, Andrew H, Arvind Malhotra & Albert H Segars, *Knowledge management: an organizational capabilities perspective,* Journal of Management Information Systems 18(1): 688-698, 2001.
Goldman, Alvin I, *Knowledge in a social world,* Oxford, UK: Oxford University Press, 407 pp, 1999.
Goldman, Alvin I, *Pathways to knowledge,* Oxford, UK: Oxford University Press, 224 pp, 2002.

Granovetter, Mark, *Economic Action and Social Structure: the Problem of Embeddedness,* American Journal of Sociology 91: 481-510, 1985.
Gulev, Sergey K, PW Thorne, J Ahn, FJ Dentener, CM Domingues, S Gerland, D Gong, DS Kaufman, HC Nnamchi, J Quaas, JA Rivera, S Sathyendranath, SL Smith, B Trewin, K von Schuckmann, and RS Vose, *Changing State of the Climate System.* In (V Masson-Delmotte, P Zhai, A Pirani, SL Connors, C Péan, S Berger, N Caud, Y Chen, L Goldfarb, MI Gomis, M Huang, K Leitzell, E Lonnoy, JBR Matthews, TK Maycock, T Waterfield, O Yelekçi, R Yu, and B Zhou, eds): Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change: 287-422, Cambridge, UK: Cambridge University Press, 2021.
Habermas, Jürgen, *Knowledge and human interests,* Boston: Beacon Press, 356 pp, 1971.
Hall, Peter A, *Systematic process analysis: when and how to use it,* European Management Review 3: 24-31, 2006.
Hanna, Joseph F, *Critical theory and the politicization of science,* Communication Monographs 58: 202-212, 1991.
Herlin, Dan & Benedikta Hedegaard-Knudsen, *Virtual communities as a vehicle for science-based external knowledge sourcing,* Master Thesis, Copenhagen Business School, Management of Innovation and Business Development (MIB), Copenhagen, 161 pp, 2011.
Hirschman, Albert O, *The Rhetoric of Reaction. Perversion, Futility, Jeopardy.* Cambridge, MA: The Belknap Press of Harvard Univ Press, 197 pp, 1991.
Hoggan, James & Richard Littlemore, *Climate Cover-Up: The Crusade to Deny Global Warming.* Vancouver, BC: Greystone Books, 264 pp, 2009.
Houghton, Vince, *The Nuclear Spies. America's Atomic Intelligence Operation against Hitler and Stalin,* Ithaca, NY: Cornell University Press, 239 pp, 2019.
Ikani, Nikki. Aviva Guttman, and Christoph O Meyer, *An Analytical Framework for Postmortems of European Foreign Policy: Should Decision-Makers have been Surprised?* Intelligence and National Security 35(2): 197-215, 2020.
Janis, Irving L, *Groupthink: Psychological Studies of Policy Decisions and Fiascoes,* Boston, MA: Houghton Mifflin, 349 pp, 1982.
Jervis, Robert, *Why Intelligence Fails. Lessons from the Iranian Revolution and the Iraq War,* Ithaca, NY: Cornell University Press, 248 pp, 2010.
Kahan, Dan M, *Ideology, motivated reasoning, and cognitive reflection,* Judgment and Decision Making 8(4): 407-424, 2013.
Kent, Sherman, *Strategic intelligence for American world policy,* Princeton, NJ: Princeton University Press, 226 pp, 1949.
Kingdon, John W, *Agendas, Alternatives, and Public Policies,* New York, NY: Longman, 253 pp, 2003.
Knaggård, Åsa, *Vetenskaplig osäkerhet i policyprocessen. En studie av svensk klimatpolitik,* PhD Thesis, Department of Political Science, Lund University, Lund, 348 pp, 2009.
Knaggård, Åsa, *What do policy-makers do with scientific uncertainty? The incremental character of Swedish climate change policy-making,* Policy Studies 35(1): 22-39, 2014.
Koivumäki, Kaisu, Timo Koivumäki and Erkki Karvonen, *Challenges in the collaboration between researchers and in-house communication professionals in the digital media landscape,* Journal of Science Communication

20(03)(2021)A04: 1-21, 2021.
Koonin, Steven E, *Unsettled: What Climate Science Tells Us, What It Doesn't, and Why It Matters*, Dallas, TX: BenBella Books, 320 pp, 2021.
Kramer, Roderick M, *Revisiting the Bay of Pigs and Vietnam Decisions 25 Years Later: How Well Has the Groupthink Hypothesis Stood the Test of Time?* Organizational Behavior and Human Decision Processes 73(2/3): 236–271, 1998.
Kruger, Justin & David Dunning, *Unskilled and Unaware of It: How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments,* Journal of Personality and Social Psychology. 77(6): 1121–1134, 1999.
Laepple, Thomas, E Ziegler, N Weitzel, R Hébert, B Ellerhoff, P Schoch, B Martrat, O Bothe, E Moreno-Chamarro, M Chevalier, A Herbert, and K Rehfeld, *Regional but not global temperature variability underestimated by climate models at supradecadal timescales,* Nature Geoscience 16: 958-966, 2023.
Lashmar, Paul, *The Ivory Tower and the Fourth Estate*, in (Stephen Coulthart, Michael Landon-Murray and Damien Van Puyvelde, eds): Researching National Security Intelligence: 193-210, Washington, DC: Georgetown University Press, 255 pp, 2019.
Leijonhielm, Jan, *Ett svenskt leijon. Ett liv i underrättelsevärlden,* Stockholm: Medströms Bokförlag, 288 pp, 2022.
Leonard, Dorothy, *Wellsprings of Knowledge. Building and Sustaining the Sources of Innovation*, Boston, MA: Harvard Business School Press, 334 pp, 1998.
Levine, Timothy R, *Truth-Default Theory (TDT): A Theory of Human Deception and Deception Detection*, Journal of Language and Social Psychology 33(4): 378-392, 2014.
Litfin, Karen T, *Ozone Discourses. Science and Politics in Global Environmental Cooperation*, New York, NY: Columbia University Press, 257 pp, 1994.
Lockwood, Mike, *Solar Influence on Global and Regional Climates.* Surveys in Geophysics 33: 503-534, 2012.
MacKenzie, Donald, *Inventing Accuracy. A Historical Sociology of Nuclear Missile Guidance*, Cambridge, MA: The MIT Press, 464 pp, 1990.
MacKenzie, Donald, *The Certainty Trough*, In (Robin Williams, Wendy Faulkner and James Fleck, eds): Exploring Expertise: 325-329, London: MacMillan Press, 340 pp, 1998.
Mahoney, James, *After KKV: The New Methodology of Qualitative Research,* World Politics 62(1): 120-147, 2010.
Majone, Giandomenico, *Two logics of delegation: agency and fiduciary relations in EU governance*, European Union Politics 2: 103-122, 2001.
Marrin, Stephen, *Analytic objectivity and science: evaluating the US Intelligence Community's approach to applied epistemology*, National Intelligence and Security 35(3): 350-366, 2020.
Moe, Terry M, *The New Economics of Organization,* American Journal of Political Science 28(4): 739-777, 1984.
NIC, *Global Trends 2040. A More Contested World,* National Intelligence Council, NIC 2021-02339, 144 pp, 2021.
O'Dell, Carla & C Jackson Grayson, *If Only We Knew What We Know: Identification and Transfer of Internal Best Practices,* California Management Review 40(3): 154-174, 1998.

Oreskes, Naomi, *Why Trust Science?* Princeton, NJ: Princeton University Press, 360 pp, 2019.
Oreskes, Naomi & Erik M Conway, *Merchants of Doubt. How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*, New York, NY: Bloomsbury Press, 355 pp, 2010.
Petersson, Magnus, *The Scandinavian Triangle: Danish-Swedish-Norwegian Military Intelligence Cooperation and Swedish Security Policy during the first part of the Cold War,* The Journal of Strategic Studies 29(4): 607-632, 2006.
Pherson, Randolph H, Penelope Mort Ranta & Casey Cannon, *Strategies for Combating the Scourge of Digital Disinformation,* International Journal of Intelligence and CounterIntelligence 34(2): 316-341, 2020.
Roedema, Tessa, Virgil Rerimassie, JEW Broerse, and JFH Kupper, *Towards the reflective science communication practitioner,* Journal of Science Communication 21(04)(2022)A02: 1-20, 2022.
Ross, Stephen A, *The economic theory of agency: The principal's problem,* American Economic Review 62(2): 134-139, 1973.
Rothstein, Bo, *Quality of Government: Theory and Conceptualization,* In (Andreas Bågenholm, Monika Bauhr, Marcia Grimes, and Bo Rothstein, eds): The Oxford Handbook of the Quality of Government: 3-24, Oxford: Oxford University Press, 896 pp, 2021.
Rovner, Joshua, *Fixing the Facts, National Security and the Politics of Intelligence,* Ithaca, NY: Cornell University Press, 263 pp, 2011.
Shackley, Simon & Brian Wynne, *Representing Uncertainty in Global Climate Change Science and Policy: Boundary-Ordering Devices and Authority,* Science, Technology and Human Values 21(3): 275-302, 1996.
Shapiro, Susan P, *Agency Theory,* Annual Review of Sociology 31: 263-284, 2005.
Siddi, Marco, *Europe's policies for a green transition. The European Commission's geopolitical turn and its pitfalls.* The Finnish Institute of International Affairs, FIIA Working Paper 362 (May). 8 pp, 2022.
Stephen, Susan & Robert Elliott, *Developing the Adjudicated Case Study Method,* Pragmatic Case Studies in Psychotherapy 7(1): 230-241, 2011.
Stocking, S Holly & Lisa W Holstein, *Manufacturing doubt: journalists' roles and the construction of ignorance in a scientific controversy,* Public Understanding of Science 18 (1): 23-42, 2009.
Strachan-Morris, David, *The Intelligence Cycle in the corporate world: bespoke or off-the-shelf?* In (Mark Phytian, ed): Understanding the Intelligence Cycle: 119-133, Routledge, London and New York, 184 pp, 2013.
Tallman, Stephen & Anupama Phene, *Sourcing External Knowledge: Clusters, Alliances and Acquisitions,* In (Michael A Hitt, Susan E Jackson, Salvador Carmona, Leonard Bierman, Christina E Shalley, and Mike Wright, eds): The Oxford Handbook of Strategy Implementation: 21-46, Oxford: Oxford University Press, 552 pp, 2017.
Taylor, Charles, *Sources of the Self. The Making of the Modern Identity,* Cambridge, UK: Cambridge University Press, 601 pp, 2004.
Trombetta, Maria Julia, *Rethinking the securitization of the environment. Old beliefs, new insights,* In (Thierry Balzacq, ed): Securitization Theory. How security problems emerge and dissolve: 135-149, Routledge, Abingdon, UK, 272 pp, 2008.

Turner, Marlene E & Anthony R Pratkanis, *A Social Identity Maintenance Model of Groupthink,* Organizational Behavior and Human Decision Processes 73(2/3): 210–235, 1998.
Turner, Marlene E, Anthony R Pratkanis, Preston Probasco & Craig Leve, *Threat, Cohesion, and Group Effectiveness: Testing a Social Identity Maintenance Perspective on Groupthink,* Journal of Personality and Social Psychology 63(5): 781-796, 1992.
Vahrenholt, Fritz & Sebastian Lüning, *The Neglected Sun. Why the Sun Precludes Climate Catastrophe,* London: Stacey International, 412 pp, 2013.
Vakulchuk, Roman, Indra Overland & Daniel Scholten, *Renewable energy and geopolitics: A review,* Renewable and Sustainable Energy Reviews 122, 109547, 2020.
Van Evera, Stephen, *Guide to Methods for Students of Political Science,* Ithaca, NY: Cornell University Press, 136 pp, 1997.
Waterman, Richard W & Kenneth J Meier, *Principal-Agent Models: An Expansion?* Journal of Public Administration Research and Theory 8(2): 173-202, 1998.
Wheaton, Kristan J & Michael T Beerbower, *Towards a New Definition of Intelligence,* Stanford Law & Policy Review 17(2): 319-330, 2006.
Wollmert, Peter & Andrew Hobbs, *How the EU's new sustainability directive is becoming a game changer,* Ernst & Young Global Ltd., www.ey.com/en_dk/assurance/how-the-eu-s-new-sustainability-directive-is-becoming-a-game-changer (retrieved March 8, 2024), 2022.