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Standardization in science: effects and issues of guidelines for biomedical reporting

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Chapter 2

Perspectives, purposes, and the project

I discovered that the medical literature was full of studies with data crying to be put together to make more sense of an issue than each article could as a stand-alone.

Motivation of a clinical researcher for doing a meta-analysis during the 1970s (Hunt, 1999, p. 82)

2.1 <>

In the previous chapter, we encountered the many facets of writing, publishing, and communicating medical science and have seen how these shaped the biomedical research sector. Instead of providing yet another history of medical research, I interconnected and discussed different histories from biomedical research, medical practice, and wider academia in general. I must admit that this recombination of historical traits has been extensive. However, it offered the essential context to examine the present state of scholarly communication in biomedical research with minimal assumptions and a fresh perspective. The historical traits suggest that much is at stake if the culture of writing and publishing in medical research changes. From this point, we can understand why some experts in the community have become so alarmed and speak of a credibility crisis, and we also get a sense of the momentum behind developments such as reporting guidelines.

But how do we go on? One particular challenge in my research is the multidimensionality of the phenomenon I want to study, which we have already gotten a glimpse of. However, there is even more to it. We are not only able to approach the standardization of writing science from different theoretical and historical angles but rather face a dynamic, timely, and ongoing phenomenon. The transparency crisis happens now, and it calls for attention and engagement. My research will undeniably become part of the crisis discourse and its solution. Therefore, I cannot simply take a step back, observe,

analyze, and interpret, as sociologists typically do. Rather, I have to carefully configure the different social and intellectual relationships of my research project, which I will do in this chapter.

Over the next sections, I will explain and discuss the different methodological, not to speak of epistemological, modes of my research. But instead of describing research techniques in minute detail, which will be done in the empirical chapters anyways, I will lay out some wider principles. These not only guided my intellectual viewpoints and methodological frameworks but also the more social aspects of my journey through a discourse that already spills into my own academic disciplines, the institute I am working for, and, with the Covid-19 pandemic, private life too.

Practically, I will introduce some epistemic, methodological, and theoretical backgrounds during the next pages. First, I will explain how the Science and Technology Studies (STS) provide the basis from which my investigation starts. Second, I provide an overview of the other methodological and epistemological strands that influenced my research, namely the sociology of science, philosophy of science, and particularly scientometrics. STS and more quantitative, or positivistic-oriented, perspectives are commonly understood as contradictory or incommensurable, which is the reason why I will outline and discuss overarching epistemic principles, rather than specific research techniques. Third, I will provide the full set of research questions that will be answered throughout chapters 3-7 and finish the chapter with some editorial notes.

2.2 STS AND BEYOND

Modes and consequences of producing and consuming medical knowledge are a traditional topic of science and technology studies (STS). In combination with other methodological and theoretical paradigms, we can build a rich toolbox to illuminate the role of reporting standards in medical research in both a horizontal and vertical way. I will draw extensively on three central strands. First, practice-theoretical approach enables us to capture different moments of creating, discussing, and using reporting guidelines as form of doing science. Second, the PRISMA guidelines can be used as a case to study reporting guidelines in particular and standardizations in general. Third, scientometric methods expand the scope of the case and add some level of generalizability. Next, I will describe and discuss these strands in brief.

The development and application of theories and conceptualizations of scientific practice have been central and formative moments for the science and technology studies. Classical epistemology and early philosophy of science have been described as general antecedents of a scholarly reflection on scientific practice. But such strands have

also been criticized for focusing too much on a normative perspective on science. Although norms and values do play a crucial role in research, they shouldn't be analyzed in isolation. We have seen in the introduction how epistemic values such as validity and rigor shaped the history of biomedical research. However, the background has also shown how the expectations of doctors, healthcare policymakers, industrial interests, or science evaluators can easily bend trajectories that are considered purely intellectual. For this reason, scholars have argued that we must be open to a multiplicity of motivations and goals to understand the paths and direction of modern research (K. C. Elliott, 2017; Kourany, 2020).

In that sense, sociologists like David Bloor pointed at the paradoxical situation that historical accounts of science attributed successes to epistemic norms while they attributed the failure of scientific projects to the presence of social and non-scientific motivations (Bloor, 1991). Likewise, it has been argued how traditional accounts of standardization overfocused on the successful projects while neglecting failed accounts (Bowker & Star, 1999). Thus, a balanced analytical approach towards science and its standardization must be independent from the project outcome, for example, by focusing on the internal processes of science and the day-to-day practices of researchers. Moreover, judging failure or success itself is of lesser interest to the STS scholar. For this reason, I will neither judge reporting guidelines as successes or failures in my own terms nor consider their emergence as a trend towards more transparent, more rigorous, or better science.

With the practice turn, many scholars in the science studies started to understand science as a human activity and not just as a symbolic representation of natural phenomena (Keller, 2011; Kontopodis et al., 2011; Law, 2017; Thévenot, 1999). This perspective helped to overcome idealizations of science in which truth is the inevitable outcome of a rational process and falsity the result of violating that process. Instead, it provides scholars with a language to explain how wrong theories can be successful or how true theories stay unnoticed and unrecognized (Bloor, 1991; see also Galassi, 2019). These capabilities turned the idea of epistemic practices into a highly successful "object of knowledge" (Vann & Bowker, 2001, p. 248). I conceptualize formal scholarly communication as a form of practice throughout this research. I will approach particularly the development and usage of reporting guidelines, or how guidelines influence the composition of a systematic review article, from these perspectives. In chapter 7, I will unveil the moments when these practices meet.

But perspectives on scientific practices can also be understood as formative aspects of fields, communities, or professions. By conceptualizing how "the social is a field of

embodied, materially interwoven practices centrally organized around shared practical understandings” (Schatzki, 1999, p. 12), practice theoretical approaches can explain how researchers develop and experience social cohesion. For example, practices play a role in social learning and the enculturation of researchers, as much as they do when deviations from the textbook procedures become common (e.g., Woodgate, 2006). For this reason, some social accounts of science have put particular emphasis on practices and have conceptualized science as communities of practice (Wenger-Trayner & Wenger-Trayner, 2015). However, if we want to understand the emergence of reporting guidelines and their relationship to the credibility crisis, focusing solely on the daily practices of biomedical researchers and metascientists has its own shortcomings.

A first shortcoming is that practice theories seem to neglect the homogeneity of the social function of scientific publishing in relationship to the heterogeneity of their modes of production. In that sense, practice theories focus on the social phenomena and embeddings that play out in the production or reception of scientific reports on the individual level. Although such analyses involve the influence of expectations of disciplinary homogeneity, they tend to emphasize the nuances, peculiarities, and deviations from standard practices (Timmermans & Berg, 1997). For example, social accounts of science traditionally contrasted individually observed laboratory practices against depictions of any uniform sense of scientific methods (Knorr-Cetina, 1981; Latour & Woolgar, 1979). As a result, the focus on practice-theoretical accounts meant that less attention was paid to the written and published record of science (Soler et al., 2017).

Although standard depictions and textbook descriptions are essential for learning skills and communicating with others, many practices are not verbalizable (Woodgate, 2006). With regard to the role of professional guidelines and standard procedures, sociologists of medicine argued for a “reflexive standardization” (Hedgecoe et al., 2023, p. 358) in which authority and trust in standards are mostly functions that emerge during the use of the standard (see also Van Loon, 2015). Against this background, homogenizations are used to describe how researchers can manifest epistemic norms or quality goals in research, or how research is a practice domain in which reactions by readers and consumers are similar and foreseeable (K. C. Elliott & Steel, 2017; see also Hosseini et al., 2022).

But as explained above, many social practices in and around the role and reception of research outputs have become ubiquitous, for example, the performative power of genres (Bazerman, 1994) or reading and reviewing research outputs (Hartstein & Blümel, 2021; see also Kaltenbrunner et al., 2022). Likewise, technical infrastructures,

which have become pervasive in modern biomedical research, come with predefined forms of interactions that homogenize a big palette of scientific practices, for example, (online) forms of communication or the analysis and visualization of data (Barjak et al., 2013; Bowker & Star, 1999; Leonelli, 2023; Star & Ruhleder, 1994). Against this background, we must remain open for moments when biomedical researchers and metascientists derive their perceptions, expectations, and even particular actions from homogenized forms of reception or beliefs about the homogeneity of a scholarly communication system and its materials and symbols. In other words, perceived homogeneity, e.g., stories from the community, shape individual practices in a downstream manner. A first glimpse into the biomedical transparency crisis suggests that there is a perceived imbalance between writing and reading that gave rise to the critical discourse and the idea of a publication crisis. Thus, an analysis of the (re-)standardization of scientific writing cannot neglect the discursive effects that emerge from shared modes of scholarly reception or narratives of a publication crisis. Rather, “we got to see the Janus face of science as both constructed and realist.” (Bowker & Star, 1999, p. 48).

A sole recursion to scientific practices and sociological theories thereof also bears a second shortcoming. In general, practice-centered theories tend to overemphasize micro-level interactions and can establish links to general trends and macro-patterns only in a patchy way (see also Keller, 2011). While this is no shortcoming of the theories themselves, it would limit the analysis of PRISMA against the background of the reporting crisis and the overall metascientific movement. The critical and interventional discourse by the metascientific experts regularly formulates universal claims. For instance, metascientific studies scrutinize the “masses” or “most” of research outputs (e.g., Ioannidis, 2005; Page & Moher, 2016). They are convinced of a community-wide crisis that exceeds any subdisciplinary issues or struggles for epistemic re-standardization (Penders, 2022; Peterson & Panofsky, 2023).

Admittedly, the size of the crisis and the metascientific movement remains unknown at this point, and the existence of a substantial fraction of scholars who reject any universal claims of crisis seems likely. However, a neutral social analysis then requires remaining open to the potential of a macro-level crisis or movement. Further, it must be methodologically and technologically able to capture global phenomena. For example, narratives about crisis and reform become part of scholarly communication as a global phenomenon and thereby unfold performative effects that go far beyond micro and meso levels (Penders, 2024). Similarly, traditional discourse analysis reduces the performativity of discourse phenomena to causal relationships but often falls short of showing how quantitative logics and shared impressions thereof can unfold discursive

power, too (Keller, 2011). Second, some of the actors, like the Cochrane Collaboration or the International Committee of Medical Journal Editors (see above), already exist and affect research on a macro level. Thus, focusing on sociological theories that mostly take micro-level practices into account can turn out to be insufficient.

Taken together, my research starts from a standpoint that is similar to the central tenets of discourse analysis. On the one hand, the phenomenal structure, or *Aspektstruktur*, of the medical research discourse and the reform discourse are considered as performative (Keller, 2006). Individual researchers and other actors react to the developments around medical reporting and the reform thereof, and the socio-cognitive devices of the discourse—the concepts, stories, accusations, and so on—play an important role in shaping interpretative schemes, expectations, and behaviors. On the other hand, however, individual practices and materials in scientific publishing are not neglected. First, practices illuminate the relationships between macro and micro levels of the medical discourse. Second, analyzing literature requires a consideration of material dimensions, which, in addition, have performative capabilities too, as illustrated by any bibliometric perspective on literature.

In addition to moving beyond practice-theoretical perspectives on PRISMA, I will examine the phenomena by selecting a specific case. By focusing on the PRISMA guidelines for systematic reviews rather than attempting to systematize and conceptualize what all guidelines may have in common, a vertical approach or *following the object* strategy is chosen (see also Latour, 1987). This does not result in the construction of associative laws that are statistically provable and represent what we call statistical generalizability. Instead, by examining and clarifying the social context of a specific reporting guideline, we may identify mechanisms and structural relationships that are also present in other contexts. Although abstractions thereof allow for some form of theoretical generalization, we must be aware that a theory and the data it is based on cannot be separated. Instead, understanding reporting guidelines or standards in general is done with reference to PRISMA, e.g., in a case-by-case manner (Law, 2017). Thus, my research benefits from a case-study perspective in several ways, which shall be elaborated on in brief.

The lack of generalizability of case study results has become a powerful and generalizable story. Basically, cases in STS allow us to deconstruct claims of universality and “de-essentialize” (Beaulieu et al., 2007, p. 675) the phenomenon we encounter. This approach provides a deep focus while simultaneously emphasizing various phenomena, which often do not maintain the order of their actual significance. As a result, bystanders may perceive case studies to be overemphasizing some aspects while neglecting others,

which results in them disregarding the method as subjective and biased. But such reservations can even come to the benefit of the careful case study investigator! From a general epistemology standpoint, any doubts about case studies' methodological power can remind us to be careful about our claims. Furthermore, we can view it as a call to debate and discuss the proposed ideas (Morgan, 2020). In addition, by making individual perspectives, (pre-)assumptions, and the stance of the investigator transparent, their impacts becomes assessable and retraceable to some extent. In this regard, qualitative researchers have encountered the accusation of subjectivity with sensibleness and self-reflection about the investigator's stance in the research project (Malterud, 2001; Yardley, 2000).

In that sense, a case study about reporting guidelines may offer us knowledge about the standardization of science, which does not require axiomatic conclusions about stabilities or patterns, which, as a side note, haven't been found even after decades of studying standardization (see Timmermans & Epstein, 2010). A comprehensive, in-depth assessment of the phenomenon must involve a praxeological understanding of lab practices and behaviors of scientists, which is common in the sociology of science. But on the other hand, PRISMA-based standardization is not marginal but rather affects thousands of writing processes in biomedicine. This practical impact is paralleled by its epistemic impact as a justification for standard resort stories about crisis and resolution in science, which are expressed and narrated in more general ways. Therefore, approaching standardization in this way allows us to focus not only on the changing discourse of scientific production (Keller, 2011) but also on the micro-effects of rhetoric and reception in scientific texts (Golinski, 1998). So, rather than focusing on how individual practice is derived from the discourse or vice versa, both are understood as entangled and mutually affecting phenomena. Taken together, a valuable middle ground becomes visible that emerges from these and other perspectives on the standardization of medical writing. This middle ground is especially well-addressed by the case study methodology (Beaulieu et al., 2007).

Besides practice-theoretical considerations and the selection of a case, I will use scientometrics as a third major methodological and conceptual strand. We have already illuminated some backgrounds and foundational principles of the field. Formal scholarly communication is the main research object of my research, and it is also central to how scientometrics understands the ontology of science. This ontology can help us to overcome some of the limitations of the previous two approaches. Traditional sociological approaches often neglect the discursive dominance of the published record in the daily life of a researcher, as mentioned above. Journal publications are not a technical pleasantness or byproduct of the *actual craft* of science, or a form of credit

coin that keeps the lab running. Rather, as shown in the historical background to this dissertation, scientific publications have performative powers that shape research practices, scientific collaborations, and influence future practices.

In addition, scientometrics can enhance traditional discourse analysis, which often relies on the identification of core manifestations or artifacts for identifying causal relationships (see also Keller, 2011). However, against the background of the information overload, we must also assume a deflation of the meaning of individual artifacts, which introduces causal uncertainty to traditional discourse analysis. Since scientometric analyses internalize the inflation of individual documents, they can be used to address this uncertainty. Thus, for those who accept this epistemic reduction, the scientometric approach comes in handy, as it provides a rich set of tools and accepted indicators and arguments.

However, we must remain critical of the epistemic reduction associated with using scientometric methods and data. It is surely a common fallacy to confuse the record of published articles with scientific knowledge in a more abstract sense or with the aims and doings of science more generally. Such fallacies lurk just around the corner when we speak of scientometrics as the “science of science” (e.g., Barabási & Wang, 2021) or analyze innovativeness and disruption solely based on scientific papers and their references to each other (Leibel et al., 2024). Similarly, it is reasonable to consider it as coarse when metascientists and science reformers proclaimed an epistemic or scientific crisis only due to the issues they identified in the published record. In this regard, especially the integration of scientometric methods into more traditional forms of science studies has been described as fruitful and less error-prone (Garfield, 1998; Gläser & Laudel, 2001; S. Wyatt et al., 2017).

The combination of scientometrics with traditional approaches from the science studies helps to deconstruct and contextualize the ontologies on which scientometrics is based. These ontologies cannot simply be changed, as they are inscribed in the data and the methods of the field. When presenting scientometric analyses for the sake of conveniently persuading our audience, we often go along with these ontologies and neglect to discuss and contextualize their meanings and shortcomings (see also Rafols, 2025). This issue is fundamental to scientometric research and may have contributed to problems and misunderstandings that arose from the use of bibliometric data for research evaluation. Further, using indicators such as h-indices or Journal Impact Factors to make statements about careers or the social configurations of scientific fields involves a double-translation or double-derivation. Such indicators are often derived from publications and citations, which serve as proxies for actual practices, behaviors, or

epistemic motives. This double-derivation introduces a substantial level of uncertainty, which is ignored in most bibliometric studies. For example, there is no uniform theory to account for the disciplinary and practical varieties that shape science in general and publishing and citation behaviors in particular. Rather, it is provisionally assumed that the sheer wealth of bibliometric data averages out the biases or synthesizes some form of true value (Aksnes et al., 2019).

Analyzing PRISMA as a case study and considering practice-theoretical as well as scientometric aspects provides a holistic and highly contextual approach. The different perspectives are roughly represented by the individual chapters 3-7, which I have developed individually and somewhat independently. Consequently, my dissertation is a collection of articles, or a *cumulative dissertation*, as it is sometimes described. But I do not attempt to combine the different approaches in a procedural or rationalist manner, as, for example, the rich literature on mixed methods from the social sciences suggests. Established approaches such as triangulation or complementarity often imply a more formal and technical negotiation of the strengths and weaknesses of each account (Greene et al., 1989; Johnson & Onwuegbuzie, 2004; Kelle, 2017). For example, scholars concerned with the use of social science for decision-making have argued for triangulation because document analysis alone does not capture the uncoded and tacit knowledge, while qualitative interviews face limitations such as recall bias and desirable responding (Gitomer & Crouse, 2019). Or they have voiced for a deeper collaboration between quantitative and qualitative approaches, for example, to make the former benefit from the latter's rich theoretical background (Gläser & Laudel, 2001), or vice versa, to use scientometrics to find new evidence for validating or refuting established theories (S. Wyatt et al., 2017; see also Leydesdorff et al., 2020).

However, I approach the methodological strengths and weaknesses of its parts in a technically less commensurable way. Using different methods is understood in the sense of "intersecting searchlights" (Galison, 2010, p. 31). These brighten the overall scenery and illuminate dark angles but without the strict expectation to reveal previously unknown qualities (see also Silvast & Virtanen, 2023). Lighting the right things and asking the right questions about what the cone of light reveals remains fundamental. However, the individual approaches do reveal some more straightforward interconnections between the various approaches. Generally, I use quantitative data to study aspects of standardization, which is a rather traditional topic in STS (see also S. Wyatt et al., 2017). Other examples come from basic translations, such as reusing concepts, perspectives, and results from one domain for informing other domains. But there are also more technical couplings, for example the sampling of interview participants in chapter 7, which was informed by a previous consultation of bibliometric indicators. This was a

doable task only because the practices and data have already been acquired for the bibliometric analyses performed previously.

The methodological intersections in my research are based on central epistemic tenets instead of strict adherence to a predefined research protocol. Thus, rather than speaking of a mixed-method approach that strives for goals such as triangulation, I want to draw loosely from the concept of a trading zone, as developed by Peter Galison (1997, 2010). This framework looks at the interaction between diverse trade partners who establish tertiary forms of communication and coordination to exchange goods or knowledge. The concept highlights the emergence and transformation of trade partners' characteristics and cultures during a trade moment. Here, the concept serves as a canvas to develop the central epistemic tenets that connect the different approaches. A trading zone, however, involves traders. In this regard, the social and communicative function of the relationships between these approaches is important too and will be elaborated next.

2.3 AN EXPERIMENTAL TRADING ZONE

My research is based on a case study that is analyzed from a practice theoretical, as well as a scientometric perspective. These are combined with reference to an epistemic mode or way of thinking, rather than a more formal script of mixed-methods studies, as explained in the previously. The concept of the trading zone can be utilized to guide the comprehension of the central epistemic tenets of this work which I will elaborate further.

Using multiple methodological approaches that stem from different scientific communities is not just an intellectual act to serve the aesthetics of epistemic virtuosity. Attentive readers of the historical and theoretical background section are aware that research practices create social links to intellectual communities in a more active and communicative way. To some extent, we think, read, and write as scientometricians when doing a scientometric analysis, and we do differently during interview studies or document analyses. This involves what concepts and types of descriptions we use. But I have submitted the chapters also to journals of different disciplines and discussed their contents at conferences of different domains. Thus, my envisioned readers and listeners surely influenced my writing, too. As such, this dissertation must be considered as a communicative act of trading between different disciplines such as sociology of science, STS, scientometrics, and even the metasciences. Such attempts for more active interdisciplinary connections have gained recent attention and can be understood from different angles.

The investigator who studies the inception, development, and dissemination of a reporting guideline acquires knowledge and interactional expertise. This goes beyond factual insights and rationalist interpretations of the transparency crisis. Moreover, we get immersed in the social, political, and epistemic sentiment behind the science reform movement that spearheaded the development and dissemination of reporting guidelines. Therefore, the contextual knowledge about guideline-based re-standardizations of scientific practices that I have acquired throughout my research also allows to contribute to the reform discourse more directly and advance the overall field of scientific publishing (Collins, 2013; Collins & Evans, 2004). While the practical implications of this relationship will be elaborated further down below, we must respect that such forms of contributions mean to take a position between different expertise, viewpoints, and knowledge backgrounds (see also Field & Derksen, 2021; Igelsböck, 2020). In such a setting, a multifaceted approach comprised of case study, practice theory, and scientometrics equips the investigator with more than just background knowledge. Rather, acquiring technical expertise and communicative idiosyncrasies enables us to connect and interfere in more interactive ways.

A more interactive and service-oriented approach to interdisciplinarity understandings has been described as the “third space” between the production of academic knowledge and its use. As such, it transcends the dichotomous and binary conceptions of one field versus another and promotes a more reflexive and dynamic interaction (Zuiderent-Jerak, 2021), e.g., such as acts of trade within epistemic trading zones. We must actively construct social and epistemic interfaces to enable such interactions, because each discipline comes with its conjectures and idiosyncrasies that can be incommensurable or conflicting. In that sense, the epistemic culture of STS provides the space for diverging and experimenting and to intellectually and practically engage with other spheres, e.g., by utilizing the field’s “nomadic nature and elasticity” (Zuiderent-Jerak, 2021, p. 212). As such, I will make use of STS concepts and theories without binding the analysis too strictly under their conjectures and implications. Similarly, I will utilize rationalist modes of reasoning for the scientometric analyses and consider realist conceptions of epistemic values that dominate the science reform movement without acquiring them as my own epistemic norms. I will elaborate on these epistemic stances and elasticities in the next paragraphs.

The first principle shall be called a humble or *modest epistemology* with a loose relation to the philosophical concept, research humility, or modest hermeneutics (Boffetta et al., 2008; Dorst, 2020; Keller, 2006). As already explained, this modest epistemology involves remaining open for a diverse set of methods and approaches and keeping an open ear for any critical perspectives on these approaches (Silvast & Virtanen, 2023). It

is a confession to instrumentalism that provides access to a wide array of conceptual and methodological toolboxes. However, this also entails taking responsibility for the opportunistic and systematic pursuit of advantages (Law & Ruppert, 2013).

Modest epistemology involves taking the risk that chosen methods and approaches might not fuel actual understanding and remain without connection to the wider discourse in STS and the science studies. The freedom to choose an untypical combination of methods and tinkering with epistemic principles comes at the cost of socially established epistemologies and the persuasive power of any “epistemic sovereignty” (Rouse, 1996, p. 398; see also Igelsböck, 2020). In other words, I do not attempt to take cover behind the epistemic power of any disciplinary *standard method* or *common theory* but must take epistemic responsibility in its own regard. This can be done by remaining self-reflective and asking for the consequences of knowledge communicated, the actions taken, and the overall position of the scholar (Downey & Zuiderent-Jerak, 2017; Field & Derksen, 2021).

Being epistemologically modest and taking responsibility for methods and conclusions means “thinking with care” about the assets and prospects of my research (De La Bellacasa, 2012, p. 197). Thinking with care also means remaining curious, attentive to the unknown, and welcoming the unexpected, rather than aiming for closure and sorting out difficulties. Against the background of this research, I attempt to not just black-box the different epistemic perspectives and decisions that constitute the “universe of uncertainty” (Breznau et al., 2022), which is inevitable and integral to social research. Rather, I try to appropriately emphasize the inherent assumptions, values, and moral commitments, thus interpreting and presenting data in a socially accountable way (Breznau et al., 2022; Mutch, 2009). For example, when negotiating qualitative interview results, case study knowledge, and results of bibliometric analysis with and within different communities that have established methodological and theoretical idiosyncrasies. In such cases, I am aware that metascientists will provide a better audience for my bibliometric analyses, while STS scholars are more attentive to case studies and qualitative knowledge. While I will certainly exploit such relationships, inverting them can be valuable, as it challenges both my audience and me as an investigator.

A practical and illustrative example for modest epistemology is the way scientometric methods and interpretations can be gauged. The analysis in my research focuses more on the *quantitative* as a quality per se than on its actual numbers and sizes. This involves the use of percentile indicators, which are non-linear methods that prohibit any conclusions beyond rankings (Bornmann & Williams, 2020; Donner, 2022; X. Wang,

2024). Similarly, median-based approaches such as non-parametric statistics and ranking based tests have been preferred. Using ordinal and non-parametric statistics can be understood as a too careful interpretation or underselling of the bibliometric analysis and a chafing of the sharpest sword of quantitative research in general. But it also illustrates the inherent uncertainties of these methods,³⁸ and let us reflect on whether it should be used as a sword at all. In addition, we must remind ourselves that the role of scientometric methods in this research is the identification (and validation) of majorities, general trends and their directions, without paying too much attention on the exact sizes of correlations.³⁹

The second principle shall be called *reflexive neutrality* and means to remain neutral, agnostic, or independent of uttering critique and thereby ensures some independence of STS. It can be compared to the idea of hermeneutic suspension in which critique is held back or aborted to remain attentive and sustain fruitful dialogue (Xie, 2018). In other words, my research takes a step away from science and technology studies by not acquiring one of its main epistemic modes, which is the critique of the issues it uncovers (Latour, 2005). As has been described above, criticizing hierarchies and power relations has always been a traditional mode in STS scholarship. STS scholars do well to point out the inequalities and marginalizations that emerge from the configuration of socio-technical networks and powers exerted by knowledge. These range from the many instances where medical treatments might be granted or denied by acts of classification or standardization (Bowker & Star, 1999; Epstein, 2007; Timmermans & Berg, 2003) up to the recent attention to non-pharmaceutical interventions, artificial intelligence, and digital health, which reconfigure medical practices and bear new forms of power hierarchies and marginalizations (see Henwood & Marent, 2019).

Likewise, an STS perspective that approaches the metascientific reform movement will identify and criticize acts of epistemic homogenization and *cleansing* as moments of reestablishing epistemic control (Igelsböck, 2020), or utter “epistemic imperialism”

³⁸ Exact counts of PRISMA citations are impossible to calculate. Data sources, e.g., Web of Science, Scopus, PubMed, GoogleScholar, or OpenAlex, provide wildly different numbers, albeit all exceed the tens of thousands. Such numbers leverage differences in scope and indexing, as well as any measurement inaccuracies. The different guideline versions and documents bear high similarities in their metadata records, from titles to authors or else. Some versions are identified as duplicates by some automatic indexing and matching procedures but not by others.

³⁹ For example, effect sizes or estimates of coefficients in statistical models are usually interpreted in this way. They express the precise magnitude of the impact a continuous or discrete change in the coefficient has on an independent variable.

(Penders, 2024, p. 5; see also Peterson & Panofsky, 2023). But on the other hand, STS investigations also revealed how the social configurations that lead to critical problems also construct the legitimacies of the disciplines and underlying epistemic cultures. Critique itself has also become an object of study in STS because critique can happen anywhere and so in the discourses and debates that are studied by STS scholars (e.g., Briscoe et al., 2022). Therefore, I do not intend to draw clear boundaries against those principles we have become accustomed to criticizing. Instead, manifestations of reductionism, interventionism, and positivism are not simply rejected from the standpoint of a pluralist and democratic epistemology. Rather, I attempt to uncover any moments in which such standpoints leave the curtain of tacitly and subconsciously held values and become tangible parts of the discourse itself, for example when publicly discussing transparency as a principle (see also Collins, 2012; e.g., Moher et al., 2020).

Scholars from STS have approached standardization in medical practice in a similar vein. By provoking a symmetrical perspective on the material and social phenomena that constitute, dissolve, or reshuffle hierarchies and marginalizations, such studies try to “bypass sociological work that criticizes the reductionism of standardization by reifying complexity... and help situate standardization attempts” (Zuiderent-Jerak, 2021, p. 198). Thus, the second principle implies an attitude that remains sensitive to the dynamics of power while refraining from channeling every observation through this lens.

The two positions, modest epistemology and independence from any obligation to criticize, offer several social and epistemic opportunities and methodological pathways to travel but also provide some limitations or risks. Modest epistemology and reflexive neutrality will be discussed in brief.

First, modest epistemology and reflexive neutrality help us understand the transparency crisis as a performative diagnosis that informs the reform movement and is meaningful to its actors and constituents. This understanding is an action in rejecting any epistemic sovereignty of the observer. Thus, it is not the science studies scholar who provides the ultimately correct and true interpretation of events (Collins, 2012; De La Bellacasa, 2012). Rather, it is an attempt to start with a neutral relationship to the different poles of action in scholarly communication, namely readers and writers of scientific articles. For instance, metascientists and science reformers have focused on the perspective of the former when developing their interventions on the latter (e.g., Vazire, 2017). The

science studies, however, have traditionally emphasized the life and doings of the latter, as the rich literature on laboratory studies, or technical writing, suggests.⁴⁰

However, one might legitimately question the value of STS as a trading partner if it comes without its critical attitude. So, while reflexive neutrality opens up some collaborative pathways, it may close others where STS became a valuable trade partner, particularly because of the field's mode of uttering critique. For example, critical assessments have been employed in bibliometric studies of gender inequalities in science (Akbaritabar & Squazzoni, 2021; e.g., Sugimoto et al., 2019) or the marginalization of scholars from the global south with regard to research assessments and funding decisions (Tijssen & Winnink, 2022). Likewise, it has been asked how reform movements such as Open Science may reshuffle elites and established hierarchies in academia (S. Fuller, 2000; Mirowski, 2018). In such moments, STS has become a trade partner without the need for an interlanguage. However, it remains open if they were trades on equal terms or if STS has become a service and its "critical barbarians" (Latour, 2004, p. 240) became mercenaries in a critical mode that permeates contemporary cultural discourse.

Second, the position enables my research to employ modes of positivist and reductionist reasoning, as already suggested. Pragmatically combining such reasonings with a hermeneutical and interpretative approach that considers the nuances and contingencies of scientific practices, it is the attempt to establish a third space between STS and the metasciences (Zuiderent-Jerak, 2021; see also Mutch, 2009). In creating an "interlanguage" that borrows from both fields, it is tried to arrive at a standpoint that is neither initially identified as a sociological nor a metascientific one.

This openness also poses some risks, because combining strands that are not seldomly understood as epistemically opposing can look fuzzy. Guided by principles rather than explicit strategies such as rationalist versions of mixed-method research, this way of doing research might fuel remembrance of "method slurring" (Kahlke, 2014, p. 44) or muddling through (see Mutch, 2009).⁴¹ However, it must be noted that substantial

⁴⁰ In fact, many of the works about literary technologies speak of effects and persuasion as if there was some linear effect of literary technologies which is inevitable by readers. Yet at the same time, STS has traditionally rejected ideas of directness and linearity (Kontopodis et al., 2011).

⁴¹ The concept is taken from political science, where it refers to a situation of independent interactions between organizational bodies that can be characterized by a more seamless form of organization rather than a predefined or formalized process of

idiosyncratic uncertainty is fundamental to (social) research and that any sense of the possibility for formulaic research procedures might be misleading or distracting (e.g., Breznau et al., 2022; Collins et al., 2010).

Therefore, I take a more creative and welcoming stance towards epistemic uncertainty to amplify any potential for fruitful communication and mutual exchange between STS and the metasciences.

Practically, the employment of positivist reasoning manifests mostly in the usage of scientometric methods. Besides going along with scientometric ontologies (see Rafols, 2025), the selection of PRISMA as a case was co-informed by its massive number of citations. Such numbers are not observable for other reporting guidelines. For example, CONSORT is older and more formative for the entire movement, so an orthodox STS approach would probably have chosen it as a case study (Bothwell et al., 2016; Cartwright, 2007). Scientometric logic has further been used to steer and inform qualitative research. I brought scientometric knowledge to the interviews themselves, in addition to sampling candidates based on their bibliometric profiles and those of their systematic reviews. Since scientometric dimensions have become performative devices in the day-to-day life of researchers, as explained above, they can be used to guide reflexivity and narration during interview setups. Together with other literary technologies that come with the reporting guidelines, they can provide solid grounds for critical and reflective thinking (Bogner et al., 2009; Gläser & Laudel, 2001).

Third, creating a trading zone by maintaining rather delicate epistemic interfaces appears to be necessary if we consider what is at stake. Although the metasciences have called for a credibility revolution as an ethical duty to reduce harm to ill-advised patients, we cannot assume that information in a digital era can be controlled or cleansed. Knowledge users cannot be relieved from the responsibilities when it comes to finding, consuming, and believing in (published) scientific statements. Likewise, any analysis of reformulating scientific reporting from the perspective of STS can (and should) be debated, contested, and rejected, rather than taken at face value. Given the multitude of aspects and voices in the broader science reform, one can find many voices that may challenge what is considered as established knowledge in STS.⁴² In addition,

decision-making (Lindblom, 1959). In this regard, the lack of a central epistemology or analytical plan can make a mixed-method project look fuzzy.

⁴² If anything, the science studies have indicated that publications do not represent true knowledge but that the latter emerges in a process of communication and interaction between different actors and publications. Therefore, the knowledge holder has a responsibility when using sources. However, this might be different in medical research.

the role that reporting guidelines might have in ruining people's lives might be limited. So far, the sole victim of standardized and formal writing that has been found is creativity (see Rennie, 1995). Thus, we must analyze what (future) role guidelines play in research evaluation (Logullo et al., 2020; Vandenbroucke, 2009).

The metascientific reform movement benefits from the diverse perspectives that come from the shores of STS knowledge and respective intentions to mingle and interact. These perspectives provide additional attention from outside the field and testify to the importance and severity of the crisis—not by proving its essence but by describing its discourse. Such perspectives also serve as connective points between the inner discourses of scientific strands and wider society. What is an ordinary epistemic quarrel between disciplines, and what is a full-fledged epistemic crisis? Without disrespecting the former, perspectives from the science studies help to estimate the latter or even help to pave the way for the required reforms on a broader scale (Gläser & Laudel, 2021; Laudel & Gläser, 2014). Likewise, a perspective from science studies can estimate the phenomena of the publication crisis against what is known about the tacit, contingent, and unwritten knowledge of scientists. Thus, estimating the crisis can also mean asking what society loses if many scholars see publishing as being fundamentally broken.⁴³

Similar arguments have been made with regard to the history of science. Historians have helped to paint less rationalist and less teleological pictures of the history of science than natural scientists did (Golinski, 1998; Shapin & Schaffer, 1985/2011). They have not only added a description of science that resonates with so many more actors in society. They might have also brought back some confidence and self-esteem to those who believed in the always forward progression of science and to whom the scientific crises are surprising or in support of a defeatist view of science (Breznau et al., 2022; Daston & Harrison, Greenwood, 2024). Likewise, some proponents of science reform have

This has been illustrated during the Covid-19 pandemic when the reliability of preprints became a public debate. Preprints can promote and circulate unfounded claims, which has a high potential for harm in the case of medical research, while it is less of an issue in physics, where a preprint culture has existed since the 1990s (Simons & Schniedermann, 2023).

⁴³ This question plays an even bigger role for more procedural understandings of Evidence-based policy and practice or translational healthcare (Hendriks et al., 2019; Simons & Schniedermann, 2021; Timmins et al., 2016) which imply a stricter role of documents and reports for public policy and practice. Under those paradigms, a crisis of documents would easily translate into a crisis in decision making.

expressed substantial unease with the strong convictions and almost religious enthusiasm within the metascientific community (e.g., Holmes, 2025).

The epistemic principles outlined above guide and safeguard the interaction between STS and metascience in my research. Traditionally, anthropologists and science studies scholars have tried to avoid “going native,” where they lose the grip on their stance as outsiders and fail to keep a distance with the help of strict methodologies (Gorman, 2010, p. 292; see also Collins, 2013). But inside and outside become less accentuated in this research because disciplines engaging in a reflective analysis of science overlap substantially in their research questions, research objects, or methodologies (Hardwicke et al., 2020). However, the metasciences, with their strong normative convictions and prerequisites, allow for the successful drawing of boundaries along these lines.

So much for epistemology, but what about the practical aspects of such interactions? During the course of my research, I have sought after contact with the metascientific community and engagement with interventionist modes of reasoning. This went from the presentations and exchanges at reform-oriented conferences, over participation in BIH’s metascience summer school in 2023 (Weissgerber et al., 2023), to collaborations over position papers (Kohrs et al., 2026). Finally, I took part in an effort to introduce reporting guidelines into the bibliometric research community, a project that is still ongoing (Ng et al., 2023).

Lastly, we might ask, what is the systemic benefit of trading altogether? What emerges if metascientists and scholars from other science studies band together? So far, both shores have been depicted as distant and of substantial difference. However, from a critical perspective, both remain intellectual endeavors, constrained by their academic habits, established procedures, and cultural norms. A decades-old question has been whether science can be creative or sufficiently radical to reform itself. If it cannot, any problems might prevail and spur intervention from outside of the profession. But if science can reform itself, for instance by establishing an effective professional jurisdiction that signals agency and preserves autonomy against outside intervention, then science reform is a conservative project (see Abbott, 1988). As such, it does not only render any outside intervention unnecessary but may also not require trading partners and interlanguages with the science studies (see Rouse, 1999). Rather, the field’s absorptive capacity might be sufficient to arrive at new understandings, successfully implement reforms, and evolve into the future. While this question cannot be solved for now, it will be taken up again when discussing the overall conclusions and implications of this research project.

To this point, I have described the main methodological building blocks and the epistemic stance of this research. I discussed the methodological and epistemic aspects of practice theory, case studies, and scientometrics for the former. I also introduced the epistemic stance of my research by utilizing the concept of trading zones, i.e., describing the *tricks of the trade*, as a chapter in an earlier version of this book was titled. Taken together, I attempt to experiment with epistemic and practical modes from different disciplines and research communities. In that sense, I sketch a fictional collective of trade partners that gave up on ideas of epistemic control, as Judith Igelsböck put it illustratively:

Not 'being in', or 'having' epistemic control, but 'playing' with it, and also embracing 'being played' with, is not to be equalized with irresponsibility for the research that is pursued and the realities that are brought into being. Rather, it comes with the certainty that whatever 'methods for knowing and handling the world' are deployed, they have their own 'social life' (Law and Ruppert, 2013). They 'establish' and 'format relations', but they are also formatted by the nets in which they are actualized. Most definitely, they are 'used opportunistically by social actors in the systematic pursuit of political, economic and cultural advantage.' (239) Manipulating and knowing the world are not rendered mutually exclusive.

(Igelsböck, 2020, p. 8)

Having sketched out the epistemological aspects and some of their methodological consequences, the next subsections will report some of its editorial aspects. The next section provides a comprehensive list of the research questions pursued in chapters 3-7. After that I will address this book being a cumulative dissertation and provide an overview of its external links and relationships. Finally, I end this chapter with a note on the usage of AI tools.

2.4 RESEARCH QUESTIONS AND OVERVIEW

So far, we have learned how reporting standards emerged as promising socio-technical solutions to improve scholarly communication, which became overwhelmed with expectations and entered a crisis mode. I have also explained why these developments are worth studying and how combining different approaches and perspectives can help us to draw more general lessons about the standardization of science. Throughout chapters 3-7 of this book, we will focus on the PRISMA guidelines and work through

different stages of their development and dissemination. The individual foci are introduced and contextualized in each chapter, respectively. However, the following section collects the individual research questions.

In **chapter 3**, we will examine the guideline document itself and the circumstances of its creation to understand its social functions and contexts. To do so, we will address the following research questions: *What is PRISMA, and what are its main characteristics? How was PRISMA developed? For example, how was the process organized, and what roles did the different actors play? What were their motivations and backgrounds? Why has the biomedical community adopted PRISMA so widely and openly?*

This approach is explored in more depth in **chapter 4**, albeit from a different perspective. Here, the details and nuances of PRISMA's intellectual function are examined. The following questions are addressed: *What does increased transparency mean for biomedical research, and what role does transparency play in the normative configuration of science? What is the relationship between the characteristics of PRISMA and transparency as a normative goal? What type of transparency is created by reporting guidelines?*

Chapter 5 leaves behind the social and intellectual cradle of PRISMA to take a closer look at its dissemination. The research questions are: *In which countries and biomedical fields is PRISMA referenced, and how does its usage compare to that of other forms of systematic reviews? Do reviews that cite the guideline receive more citations? What implications does the relationship between PRISMA compliance and citation impact have for perceptions of scientific quality?*

Chapter 6 provides a more profound look at the academic careers of biomedical authors through another bibliometric analysis. The chapter examines how standardization relates to the experience or age of users of standards, addressing the following questions: *How experienced are authors of different review genres in biomedicine, and how experienced are users of the PRISMA guideline in particular? Which biomedical subfields have the highest PRISMA adoption among inexperienced scholars? At what point in their careers do highly experienced authors stop citing PRISMA, and how does this depend on their authorship position?*

Lastly, in **chapter 7**, we return to the micro level, not by investigating the development of the guideline itself, but rather its incorporation into the day-to-day academic practice of systematic reviewers. In particular, we ask: *How do systematic review authors use the PRISMA guideline, and how have they integrated it into their scientific writing practice? We also consider how different preconditions, such as individual background and*

perceptions, as well as contextual factors, such as project characteristics and organizational settings, shape the types and intensity of guideline usage. And how does applying the standard reshape systematic reviewing as a genre and its communicative role within the medical research community?

2.5 EDITORIAL NOTES

2.5.1 NOTES ON THE PUBLICATION OF INDIVIDUAL CHAPTERS

Chapter 3 was originally published in an edited volume that was based on the conference “Practicing Evidence - Evidencing Practice” in Munich from 19th-20th February 2020.⁴⁴ It is co-authored with Dr. Arno Simons and Dr. Clemens Blümel, my first collaborators and mentors. I created the data collection, analysis, and the first version of the manuscript, while my co-authors provided substantial comments and feedback. This chapter is one of the more heavily edited texts in this book because the original publication used the Chicago reference style, which is more common in the humanities. In addition, tables were added to list the interview partners and the different PRISMA versions. The original citation of the chapter is as follows:

- Schniedermann, A., Blümel, C., & Simons, A. (2022). On Top of the Hierarchy: How Guidelines Shape Systematic Reviewing in Biomedicine. In S. Ehlers & S. Esselborn (Eds.), *Evidence in Action between Science and Society: Constructing, Validating and Contesting Knowledge* (pp. 102–126). Routledge. [10.4324/9781003188612-8](https://doi.org/10.4324/9781003188612-8).

Chapter 4 was published in a special issue on research evaluation, edited by Aliakbar Akbaritabar. The chapter is based on the same data as chapter 1, so the supplementary material on the interviews and document analysis can be found in the same OSF storage (<https://osf.io/kgcmj/>). In contrast to chapter 1, this publication was completely drafted and edited by me. The original citation of the chapter is as follows:

- Schniedermann, A. (2022). Shaping the Qualities, Values and Standards of Science. How Reporting Guidelines Improve the Transparency of Biomedical Research. *Frontiers in Research Metrics and Analytics*, 7, 846822. <https://doi.org/10.3389/frma.2022.846822>

⁴⁴ Information about the DFG project can be retrieved from <https://web.archive.org/web/20250623060618/https://www.evidenzpraktiken-dfg.tum.de/en/> [as of 23.06.2025].

Chapter 5 contains the first bibliometric analysis of this research. Analysis and writing were carried out by me. The chapter was originally published in *Scientometrics*. The version provided here contains some edits, ranging from small word changes to some additional sentences that provide clarifications and further explanations. In addition, the conclusion has been completely revised, because the original version was a mere summary of the article.

- Schniedermann, A. (2021). A comparison of systematic reviews and guideline-based systematic reviews in medical studies. *Scientometrics*, 126(12), 9829–9846. <https://doi.org/10.1007/s11192-021-04199-0>
 - **Data:** Schniedermann, A. (2024). Fields, Countries, and Citation impact of PRISMA-citing Systematic Reviews (1.0.0) [Data set]. Zenodo. <https://doi.org/10.5281/zenodo.14277542>
 - **Data retrieval Tool:** Schniedermann, A. (2024). PubMedParser - A tool to download and store metadata from PubMed (v1.0). Zenodo. <https://doi.org/10.5281/zenodo.14015254>
 - **Analysis Code:** Schniedermann, A. (2024). Analysis Code for "A comparison of systematic reviews and guideline-based systematic reviews in medical studies" (v1.0.1). Zenodo. <https://doi.org/10.5281/zenodo.14283189>

Chapter 6 provides a second bibliometric analysis, which, in contrast to the first one, focuses on the authors of systematic reviews rather than the papers themselves. It was originally drafted and published as a preprint in advance of the 27th International Conference on Science, Technology and Innovation Indicators (STI 2023). A more advanced version was submitted to *Systematic Reviews* in September 2025 to address systematic review experts as audience but got rejected by the journal. Afterwards, the paper was submitted to *Quantitative Science Studies*. Together with the submission, a publication package with data and code was uploaded to Zenodo.

- Schniedermann, A. (2023). *Who writes what? The academic age patterns of review genres in biomedicine.* orvium.io. <https://doi.org/10.55835/6441b6d076bb0bb2c9ff4c15>
 - **Publication package:** Schniedermann, A. (2025). Computational notebook for "Who are the cooks of cookbook science? A bibliometric analysis of review authors". Zenodo. <https://doi.org/10.5281/zenodo.16910840>

Chapter 7 is based on interviews with authors of systematic reviews. The chapter was published as a preprint in June 2024. After a first round of reviews in *Social Studies of Science*, which resulted in a rejection after peer review, additional interviews were done in early 2025 to expand the analysis. Afterwards, the paper was submitted to MetaROR where it was reviewed by two guideline experts. After another round of review issued by *Science as Culture*, I am currently revising the paper. The preprint can be accessed via:

- Schniedermann, A. (2025). *From Form to Formation. Biomedical Reporting Standards in Practice.* MetaArXiv Preprints. https://doi.org/10.31222/osf.io/b8439_v2.

2.5.2 NOTES ON THE USAGE OF GENERATIVE AI

In late 2022, in the midst of my research, the US-based software company OpenAI introduced ChatGPT-3, a large language model that generates natural language output based on previous language input. Although advanced transformer models have existed before, ChatGPT provided a culmination point of this innovation. Because of its ability to generate natural text that is hard to discern from human output, the tool is commonly characterized as highly disruptive. The following surge in AI/GPT-based tools not only reduced the efforts of creating text but also impacted practices such as data analysis, interpretation of coding. However, generative AI challenged especially societal dimensions in which the production of text is a valuable act, for instance journalism and commercial publishing, but also schooling, higher education, and, of course, scholarly communication. For this reason, the usage of AI tools involved in this work will be elaborated briefly.

Reading and researching. Reading and researching was supported by ChatGPT, MistralAI, and Microsoft's Copilot. The tools were used to summarize books or synthesize the main arguments. In addition, tools helped to identify relevant aspects and dimensions from theoretical frameworks and more extensive corpora, e.g., if there are several books on the same concept. However, this was limited to getting an overview or entry point to these corpora on which a more in-depth reading could be based.

Writing. I drafted every sentence and section in this book without using any large language model (LLM). Proofreading was supported by the spell-checking function of MS Word and the premium version of QuillBot. Occasionally, deepl.com was used for increasing readability. Although these tools helped me a lot, they should not be used unguided, as their tendency towards readability can distort or completely twist the

meaning of a sentence. The icons in the picture on the cover page were created with ChatGPT 4.

Interview transcription. Some interviews were transcribed with the inbuilt transcription function of the institutional MS Teams instance. If there were quality issues, interviews have been transcribed with OpenAI's WhisperX, which I ran in a local instance to ensure data protection. Translations of German interviews were created by deepl.com and manually edited afterwards.

Scientometrics. The impact of AI tools on the scientometric data used for this research can only be estimated. Data providers use AI models for the field classifications of journal articles. Likewise, the disambiguation of authors that leads to Scopus' AuthorID is supported by AI models. Even the document type classifications employed in MEDLINE's indexing practices are susceptible to a substantial AI impact. In most cases, no clear documentation or explanation of the AI tools are given. As a user of this data, I cannot tell what data entries are created by which method and some analyses indicate that methods have changed a lot over time. However, the epistemic and ethic risks stemming from these practices remain limited because the analysis focuses solely on aggregated levels and macro perspectives.