

ALGORITHMIC IMAGINARIES.
Visions and values in the shaping of search engines

Rahmenschrift for the habilitation

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ALGORITHMIC IMAGINARIES.

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1. Introduction

Search engines have become central actors in providing access to web information. Similar to libraries, having traditionally organized access to knowledge, search engines have become essential gatekeepers to web information in contemporary knowledge societies. Both website providers trying to communicate their content and users trying to filter the mass of information along their needs heavily rely on search engines and their algorithmic logics. Google in particular has become an “obligatory passage point” (Callon 1986, Röhle 2009, Mager 2009) for both actor groups, but also for advertising clients, search engine optimizers, and the digital economy at large that operates with user profiling and targeted advertising. Google, however, not only passively transmits information from content providers to users, but rather actively filters, curates, and ranks websites in its result lists, as has been critiqued from early on.

In 2000, only two years after Google’s initial launch, Introna and Nissenbaum (2000) pointed towards information hierarchies already. Brin and Page (1998), the founders of Google, described the PageRank algorithm as a mathematical way of ranking search results since it uses the number and quality of links a website gets as an indicator of the value of that website. In contrast, Introna and Nissenbaum (2000) argued that Google would systematically privilege big, well-connected, often commercial websites at the expense of smaller ones and would therefore undermine the early democratic ideals of the web (Introna and Nissenbaum 2000, see also Hindman et al. 2003, Rieder 2012). Empirical studies followed that reaffirmed these findings (Nettleton et al. 2005, Seale 2005, Mager 2009, Mager 2012a, Eklöf and Mager 2013). This initial search engine critique developed into a more fundamental criticism of gender and race bias in algorithmic systems. The more dominant Google became, and the more websites, data and images it ingested, the greater the biases grew over time, as Noble (2018) illustrated with devastating examples. My own PhD research contributed to this critique by investigating “sociotechnical practices of communicating medical knowledge via the web” (Mager 2010). Having analyzed practices of content providers and users it showed how Google not only impacts the way web information is provided, hierarchized, and distributed in search engine results, but also crucially influences the way users pick up, evaluate, and integrate web information into their own bodies of knowledge. It therefore concluded that search engines like Google, and their complex ranking algorithms, trigger not only information biases, but also fundamental epistemic implications.

Moreover, Google’s revenue model based on consumer profiling has been critiqued since the 2000s. Van Couvering (2008) discussed the commercialization of search engines, tracing Google’s history from its early roots in academic research at Stanford University towards the introduction of its AdWords and AdSense advertising platforms (see also Ridgway 2023). This lineage has been framed in terms of “informational capitalism” (Fuchs 2010, 2011), “cognitive capitalism” (Pasquinelli 2009) as well as “surveillance capitalism” (Zuboff 2015, 2019). At the heart of this critique is the “service-for-profile” business model (Elmer 2004), where users receive services for free, while paying with their data. User data are translated into user profiles and sold to advertising clients, to put it in a nutshell. Intrusive practices of user profiling have been conceptualized in the field of surveillance studies for some time now (Lyon 1994, 2003, 2007, Pasquinelli 2009, Christl and Spiekermann 2016). More recently, big

tech's means to turn user attention into “assets” through the measurement, governance, and valuation of digital traces and user engagement have been criticized in the tradition of audience commodification and the “attention economy” (Smythe 1977, Fuchs 2012, Birch et al. 2021, Pederson et al. 2021).

Starting from classical search engine critique, this habilitation goes beyond the political economy of search engines by using concepts from Science and Technology Studies (STS) to elaborate how search engines are socially constructed. It shifts the perspective from impacts search engines have on society towards imaginaries, sociotechnical practices, and power relations involved in the construction of search engines in different sociopolitical contexts. In doing so, a particular focus is put on the European context where more and more interventions have taken place over the past years to contain and control big tech companies like Google and their business practices – especially after the so-called “NSA affair”. In 2013, Edward Snowden accused big tech companies such as Google, Facebook, Apple, and others of collaborating with the US National Security Agency (NSA), which pushed corporate surveillance into the spotlight of public debates all over the world (Mager2014a). In the aftermath of the NSA affair, a number of significant court rulings and legislative acts have been passed in the EU. The first important court ruling was “the right to be forgotten case,” which the ECJ passed against Google in 2014. The ECJ forced Google to delete illegal or inappropriate information about a person from the Google index if the person concerned requests it. This judgment has been described as remarkable, since it successfully applied European data protection legislation to a US technology company for the first time. The right to erasure has later been integrated into the EU’s General Data Protection Regulation (GDPR), which is considered an important milestone in the containment of big tech companies; despite growing criticism (Mayer-Schönberger and Padova 2016, Marelli et al. 2020, Prainsack 2020). In 2015, Google was faced with its first antitrust actions when the European Commission accused the company of cheating competitors by privileging its own shopping service in its search results (Lewandowski et al. 2018). Two other cases have resulted in formal charges against the company for privileging the Android operating system as well as Google AdSense. More recently, the EU has adopted a number of legislative acts aimed at controlling big technology companies including the Digital Services Act (DSA) (Regulation (EU), 2022/2065), the Digital Markets Act (DMA) (Regulation (EU), 2022/1925), and the European Data Governance Act (Regulation (EU), 2022/868). A fourth, the Artificial Intelligence Act, is still under negotiation. Against this background, my habilitation understands European policy as an increasingly important arena where hegemonic search engines are shaped, negotiated, and renegotiated. Furthermore, it considers Europe as a place where a number of alternative search engines are growing at the margins of hegemonic search that follow a social cause rather than mere profit maximization.

The central aim of this habilitation is twofold:

Theoretically, it conceptualizes the notion Algorithmic Imaginaries as an analytical tool enabling us to shift the perspective from impacts search engines have on society towards visions, values, and practices involved in the shaping of search engines. More specifically, it allows us to investigate the making and governing of search engines at the nexus of discourse and practice. To theorize Algorithmic Imaginaries, the habilitation draws together and builds upon a bricolage of concepts from STS and Critical New Media Studies useful to grasp how ideologies, imaginaries, and counter-imaginaries co-produce sociotechnical practices of search engine design and governance. Three research projects have been conducted over the past 13 years that provide the groundwork for this theoretical

endeavor. In each of the projects a particular concept has been developed to analyze the shaping of search engines in different geographical, cultural, and sociopolitical contexts, the European context most importantly. These concepts have been derived inductively following a Grounded Theory approach (Glaser and Strauss 1968). The Grounded Theory is a research methodology enabling the researcher to develop a theory “grounded” in empirical fieldwork by cyclically going back and forth between data collection, analysis, and theory-building. Since the in-depth qualitative fieldwork has been conducted over a span of more than 10 years, the cyclical research process has continuously led to a saturation of the overarching theory of Algorithmic Imaginaries.

Empirically, this habilitation investigates Algorithmic Imaginaries in practice by asking how ideologies, social values, and imaginaries form search engines in three different empirical sites: 1) the social construction of hegemonic search engines, 2) European search engine governance, and 3) developments of alternative search engines in Europe. Three central research questions are guiding the overall empirical fieldwork:

- 1) How does the capitalist ideology get embedded in and intertwined with search engines by way of sociotechnical practices?
- 2) How do European values shape the governance of search engines and how is a European identity co-produced in governance practices?
- 3) What counter-imaginaries drive alternative search engines and what notions of Europe are enacted in practices of search engines design?

To answer these questions, I conducted three research projects over the past years all focusing on the making and governing of search engines at the nexus of discourse and practice: 1) The first project investigated how the “new spirit of capitalism” (Boltanski and Chiapello 2007) gets inscribed in hegemonic search engines and how it acts through algorithmic logics. Moreover, it analyzed how corporate dynamics impact the way scientific controversies play out in search engine results compared to classical media. In this project, the notion Algorithmic Ideology has been coined to conceptualize the mutual shaping of search engines and capitalist society. 2) The second project analyzed how European “sociotechnical imaginaries” (Jasanoff and Kim 2009) shape practices of search engine governance and how a European identity is both made and unmade in tough negotiations of the General Data Protection Regulation (GDPR) (Regulation (EU), 2016/679). In this project, the concept Search Engine Imaginary has been developed to theorize how European values are configured and reconfigured in EU policy, Austrian media discourses, and different stakeholder communities. 3) The third project explored visions and values driving alternative search engines in Europe, how they are embedded in technology, and what challenges arise in the European context. In this analysis, a particular focus is put on different notions of Europe that co-emerge with the developers’ narratives and practices. After revisiting the notion Algorithmic Ideology to investigate alternative search engines and their ideological underpinnings, the notion Counter-Imaginaries (Kazansky and Milan 2021) has been employed for an in-depth analysis of three European search engines and their developers’ attempts to counter-imagine and counter-act hegemonic search with their search engine projects.

The three notions conceptualizing visions and values in the shaping of search engines from the three different empirical sites and contexts – Algorithmic Ideology, Search engine Imaginary, and Counter-Imaginaries – jointly feed into the overarching theory of Algorithmic Imaginaries. The notion Algorithmic Imaginaries therefore enables us to analyze, theorize, and potentially intervene in the co-production of search engines and society. Only when understanding how search engines are shaped

and negotiated in different cultural and sociopolitical contexts, can we start thinking about renegotiating search engines and their Algorithmic Imaginaries in the future – especially in Europe where values like privacy, independence, and digital sovereignty are strongly pushed in EU policy, but tend to get lost along the way of creating, implementing, and regulating digital technologies, platforms, and infrastructures.

In the following pages, I will first describe the analytical toolbox out of which the three concepts 1) Algorithmic Ideology, 2) Search Engine Imaginary, and 3) Counter-Imaginaries are built and how they contribute to the theory of Algorithmic Imaginaries. I will then draw on eight articles to discuss the three concepts, and their relation to Algorithmic Imaginaries, in detail. To briefly summarize each of the articles I further provide their abstracts and a cue of how the three concepts emerged from the respective research sites and their specificities. In conclusion, I will discuss the contributions of this habilitation to the fields of STS and Critical New Media Studies and what future research directions may be taken.

2. Algorithmic Imaginaries: A Conceptual Toolbox

The three search engine projects that I conducted to investigate and conceptualize Algorithmic Imaginaries draw on different conceptual tools from Science and Technology Studies (STS) and combines them with insights from Critical New Media Studies most importantly, but also from Critical Theory, Internet Governance Research, and European Studies. This analytical bricolage enabled me to account for the specificities of each empirical case study and develop a larger theory of Algorithmic Imaginaries grounded in rich qualitative and multi-sited fieldwork. In the following, I discuss the conceptual groundwork for each of the notions in turn: 1) Algorithmic Ideology, 2) Search Engine Imaginary, and 3) Counter-Imaginaries by following the order of the three research projects that feed them.



The first project, Opening the Black Box of Search Engines, was conducted as part of my postdoctoral fellowship at “HUMlab”, a digital humanities lab at Umeå University in Sweden (2010-2012, funded by HUMlab). In this project, I coined the notion Algorithmic Ideology to show how search engines and capitalist society are intertwined and how corporate dynamics impact scientific controversies in search engine results and classical media. Building on this groundwork, the second project, Glocal Search, was conducted at the Institute of Technology Assessment (ITA) at the Austrian Academy of Sciences (2012-2015, funded by the Jubilee Fund of the Austrian National Bank/OeNB). In this project, I developed the notion Search Engine Imaginary to describe how practices of European

search engine governance and notions of Europe are co-produced in formal EU policy, in national media discourses, and local stakeholder communities. The third project, Algorithmic Imaginaries, was

hosted by ITA (Austrian Academy of Sciences) and by the Humboldt Institute for Internet and Society (HIIG) during a two-months research stay in Berlin in 2018 (2016-2022, funded by FWF, Elise Richter program). In this project, I revisited and refined both the notions of Algorithmic Ideology and Search Engine Imaginary and brought them in conversation with the notion of Counter-Imaginations. The concept of “counter-imaginaries” (Kazansky and Milan 2021) helped me to conceptualize how alternative search engine providers counter-imagine and counter-act hegemonic search and come up with alternative imaginaries of both search technology and Europe. Altogether, these conceptual tools enabled me to develop the overarching theory of Algorithmic Imaginaries, as will be discussed next by grouping the eight articles along the three projects and conceptual tools.

ALGORITHMIC IDEOLOGY

- 1) Mager A (2012) Algorithmic Ideology. How capitalist society shapes search engines, *Information, Communication & Society* 15(5), 769-787, DOI: <https://doi.org/10.1080/1369118X.2012.676056>
- 2) Eklöf J and A Mager (2013) Technoscientific Promotion and Biofuel Policy. How the Press and Search Engines Stage the Biofuel Controversy, *Media, Culture & Society* 35(4), 454–471, DOI: <https://doi.org/10.1177/0163443713483794>
- 3) Mager A (2014a) Defining Algorithmic Ideology: Using Ideology Critique to Scrutinize Corporate Search Engines, *Triple C. Communication, Capitalism and Critique* 12(1), DOI: <https://doi.org/10.31269/triplec.v12i1.439>

SEARCH ENGINE IMAGINARY

- 4) Mager A (2017) Search engine imaginary. Visions and values in the co-production of search technology and Europe, *Social Studies of Science* 47(2), 240–262, DOI: <https://doi.org/10.1177/0306312716671433>
- 5) Mager A (2018) Internet governance as joint effort: (Re)ordering search engines at the intersection of global and local cultures, *New Media & Society* 20(10), 3657–3677, DOI: <https://doi.org/10.1177/1461444818757204>

COUNTER-IMAGINARIES

- 6) Mager A (2014b) Is small really beautiful? Big search and its alternatives, in: König R and Rasch M (eds) *Society of the Query Reader. Reflections on Web Search*, Amsterdam: Institute of Network Cultures, 59-72, DOI: <https://doi.org/10.25969/mediarep/19289>
- 7) Mager A (2023) European Search? How to counter-imagine and counteract hegemonic search with European search engine projects, *Big Data & Society* 10(1), DOI: <https://doi.org/10.1177/2053951723116317>
- 8) Mager A (forthcoming) Digital Europe from below. Alternative routes to the Digital Decade, in: Hoyweghen IV, Dratwa J, and Verschraegen G (eds) *Project Europe. Remaking European futures through digital innovation*, Edward Elgar Publishing

Moreover, two editorials of special issues that I co-edited during my habilitation research are listed here because they are discussed in the last section: Contributions of the Habilitation and Outlook.

- 9) Mager A, Katzenbach C (2021) Future imaginaries in the making and governing of digital technology: Multiple, contested, commodified, *New Media & Society* 23(2): 223–236: DOI: <https://doi.org/10.1177/1461444820929321>
- 10) Mager A, Norocel OC, and Rogers R (2023) Advancing search engine studies: The evolution of Google critique and intervention, *Big Data & Society* 10(1): DOI: <https://doi.org/10.1177/20539517231191528>

2.1 ALGORITHMIC IDEOLOGY

In the first project, *Opening the Black Box of Search Engines*, I developed the notion Algorithmic Ideology by bringing together concepts from STS, Critical (New) Media Studies, and Critical Theory. I started out with analyzing how the “new spirit of capitalism” (Boltanski and Chiapello 2007) gets embedded in search algorithms by way of social practices following the long-standing STS tradition of the Social Construction of Technology (SCOT). Together with Jenny Eklöf, I then used concepts from STS and Critical (New) Media Studies to investigate how Algorithmic Ideology, and the sociotechnical practices co-producing it, influence the way scientific controversies are staged in search engine results and how these dynamics overlap with classical media. Finally, I drew upon concepts from Ideology Critique to theorize how Algorithmic Ideology gets stabilized through algorithmic logics, search queries, and result lists, but also how search engines could be renegotiated in moments of struggle. The first three publications summarize these arguments and build the groundwork of Algorithmic Imaginaries by showing how hegemonic search engines, Google in particular, are shaped in capitalist society and how this impacts the way controversial knowledge is presented, crafted, and hierarchized in European contexts like the Swedish one. This section will summarize the notion Algorithmic Ideology and discuss how it feeds into Algorithmic Imaginaries.

2.1.1. The Social Construction of Algorithmic Ideology

The concept Algorithmic Ideology was initially developed *in Article 1) Algorithmic Ideology*, published in *Information, Communication & Society* (Mager 2012). In this article, I combined insights from the Social Construction of Technology (SCOT) with Boltanski’s and Chiapello’s (2007) concept of the “new spirit of capitalism” to analyze how the capitalist ideology is practically inscribed in search engines and what actor-networks are at play. In the late 1980s, a number of scholars started to challenge the idea that technology development would follow a simple, linear model explaining a technology’s trajectory from production to usage. They demonstrated that “our technologies mirror our societies. They reproduce and embody the complex interplay of professional, technical, economic, and political factors” (Bijker and Law 1992: 3). The most well-known case study showing how societal values are embedded in technologies is the analysis of the social construction of the bicycle. Having traced the historic development of the bicycle, Pinch and Bijker (1987) exemplified how the bicycle was negotiated and constructed in a complex network of actors and their interests. Focusing on the economic context, Carlson (1992) further argued that the failure and success of a technology should be seen in relation to the “frames of meaning” attributed to a technology and how they correspond to socio-economic cultures present at a particular point in time. Edison’s invention of motion pictures, for example, failed because Edison’s own frame of meaning was deeply anchored in the producer culture of nineteenth-century America, while Edison’s movie audience and competitors were part of the twentieth-century consumer culture.

Drawing on this line of work, I elaborated how search engines are negotiated in a network of actors, interests, and practices within contemporary frames of meaning, the capitalist ideology in particular. According to Boltanski and Chiapello (2007: 3), ideology is “a set of shared beliefs, inscribed in institutions, bound up with actions, and hence anchored in reality”. This definition enables us to go beyond the concept of ideology as a moralizing discourse and argue that ideology is intertwined with and embedded in actual practices. The new capitalist spirit has managed to incorporate the “artistic critique” raised by the generation of 1968 and the emerging left according to Boltanski and Chiapello (2007). The artistic critique framed industrial capitalism as hierarchical, dehumanizing and restricting the individual’s freedom, authenticity, autonomy, mobility and creativity (compared to the “social critique” focusing on inequality and class differences). The integration of values like self-management and flexibility in the workplace helped the new spirit of capitalism to endure. Google’s success, for example, is built on flat hierarchies, a flexible work force and a global scale, illustrating central characteristics of the new form of capitalism. Google, however, also well corresponds to the new mode of exploitation that rose with the new spirit of capitalism: “*A form of exploitation that develops in a connexionist world* – that is to say, a world where the realization of profit occurs through organizing economic operations in networks” (Boltanski and Chiapello 2007: 355; italics in original). Rather than taking over classical business models based on audiences (such as portals that collapsed during the dot-com crash), Google followed a new business model based on the “traffic commodity” (Van Couvering 2008). Contrary to Edison, who failed to understand the economy of the day when developing motion pictures, Google succeeded with aligning its technology with a business model that perfectly fits the “connexionist world” and its “global informational network capitalism” (Fuchs 2010a): “Google thinks in distributed ways” according to Jarvis (2009).

Building on concepts from the Social Construction of Technology (SCOT) and the “new spirit of capitalism” (Boltanski and Chiapello 2007) enabled me to empirically investigate how hegemonic search engines, and their capitalist ideology, are stabilized in social practices. Focusing on “relevant social groups” (Pinch and Bijker 1987) and their interests involved in the construction of search technology allowed me to analyze how Algorithmic Ideology is embedded in and stabilized through sociotechnical practices, as discussed in detail in Mager (2012).

2.1.2. How Algorithmic Ideology Co-Produces Scientific Controversies

Building on this groundwork, I used concepts from Critical (New) Media Studies *in Article 2) Technoscientific Promotion and Biofuel Policy*, published in *Media, Culture & Society*, together with Jenny Eklöf (Eklöf and Mager 2013). In this article, we investigated how Algorithmic Ideology impacts the way scientific controversies figure in search engine results and how strategies of “technoscientific promotion” overlap with classical media and their corporate foundation. To explore how Algorithmic Ideology co-produce scientific controversies we chose the Swedish biofuel controversy as a case study. Conceptually, we drew on STS research having investigated the blurring boundaries between industry, academia, and government in the context of science communication – considered as “new mode of knowledge production” (Gibbons 1994, Nowotny et al. 2001): “The transition from “mode 1” to “mode 2” in the terminology of Gibbons (1994) involves, among other things, that knowledge production is taking place in the “context of application”, as we argued (Eklöf and Mager 2012). We further drew on Critical Media Studies conceptualizing mass media as actively shaping the very conditions under which controversies play out in the public domain. These conditions have to do with the economic interests of media corporations as well as journalistic framing practices, such as what is considered newsworthy (Allan, 2010). Herman and Chomsky (2002) introduced the concept of the “propaganda model” to

exemplify how commercial interests and business models influence the content mass media produce since corporate media have to satisfy not only their audiences, but also their advertising clients. Furthermore, the emergence of public relations has been described as tightly connected to the needs of capitalist democracies (Davis 2000, Herman and Chomsky 2002). Public relation strategies –pushing forward both industrial and governmental interests – have been criticized as constructing “hegemonic discourses” about scientific issues, such as genetic engineering, and undermining public debate (Weaver and Motion 2002: 337). Press releases, in particular, function as highly effective strategies to influence news coverage on science-related controversies from the outside and increase the media presence of public and private institutions. A successful press release mimics journalism in style and content, shortens the time and effort needed to produce news, and maximizes the chances to catch a journalist’s attention.

Similarly, search engines, Google first and foremost, have become important sites of struggle in the attention economy, as we further discussed. While Brin and Page (1998), the founders of Google, initially described the PageRank algorithm as a mathematical way of ranking search results, criticism rose quickly framing search engines as systematically privilege major, well-connected websites at the expense of smaller ones, often those providing counter-cultural viewpoints, as argued earlier (Introna and Nissenbaum 2000). Accordingly, website providers have started to use search engine optimization (SEO) techniques to gain a better position in search results. Furthermore, advertising-based business models such as the “service-for-profile” model (Elmer 2004) contribute to commercialization tendencies of web information. We therefore framed search engines as having incorporated the capitalist ideology in a way mass media had 100 years ago.

Following this body of work, we empirically investigated how the Swedish biofuel controversy played out in search engine results and classical media. In this analysis, we focused on actors and institutions, visibility strategies such as hyperlinking, SEO techniques, advertising, and press releases, and the way strategies of “technoscientific promotion” – a style of communication that hybrid actors use to succeed in the day-to-day struggle for media attention – shaped the controversy in both media arenas, as discussed in detail in Eklöf and Mager (2013).

2.1.3. Defining Algorithmic Ideology with Ideology Critique

In Article 3) Defining Algorithmic Ideology, published in *Triple C. Communication, Capitalism and Critique*, I used concepts from Ideology Critique to conceptualize how Algorithmic Ideology works through algorithmic logics, search queries, and engine results and how power relations could be renegotiated and changed in moments of struggle (Mager 2014a). Althusser’s (1971) notion of ideology as a matter of lived relations, for example, helps us to conceptualize how individual users relate to “transnational informational capitalism” (Fuchs 2011a) as a whole and how the capitalist ideology spreads through search algorithms (see also Eagleton 1991). Google uses websites and links provided by content creators to index the web and rank its search results. It further employs user data to improve its algorithm and, more importantly, to adapt sponsored links to users’ preferences and needs. In Marxist terms Google uses both content providers’ and users’ practices to create surplus value, as has been argued (Pasquinelli 2009, Fuchs 2011a, 2011b). Algorithmic logics, code, external content, link structures, user data, clicking behavior, user-targeted advertising, financial transactions all act together and take effect in a single Google search. Capitalist modes of production are enmeshed with technical features and individual practices. The ideological superstructure and the economic base meet with and feed each other in every singly Google query. Similar to sustaining racist ideology by

sitting on a park bench marked “Whites Only”, conducting a Google search may hence be seen as sustaining capitalist ideology; whether consciously or not. The ideology is in the search engine and acts through algorithmic logics and computational systems. Search engines like Google may hence be seen as perpetuating the capitalist ideology through their supposedly neutral search algorithms, as I argued (Mager 2014a).

To better understand how content providers and users are steeped into Google’s capital accumulation cycle and why they play by the rules I turned to Gramsci’s (2012) notion of hegemony. Google has become an “obligatory passage point” providers and users have to pass to reach their own goals (Callon 1986, Röhle 2009, Mager 2009), as argued above. Also, services like Google AdWords and Google AdSense would not work if people would not advertise with or click on Google ads. This dynamic exemplifies Gramsci’s central moment in winning hegemony over hegemonized groups, the moment “in which one becomes aware that one’s own corporate interests [...] become the interests of other subordinate groups” (Gramsci 2012: 181). It is the moment where “prosumers” start playing by the rules of transnational informational capitalism because Google (and other IT companies) serve their own purposes; a supposedly win-win situation is established. Prosumers are “steeped into” the ruling ideology to speak with Althusser (1971). Gramsci’s concept of hegemony, however, further enables us to identify moments of struggle that open up the view for counter-activity and alternative futures. Röhle (2009) described Google’s strategy of convincing website providers and users to play by the rules as a clever system of “punishments and rewards”. This shows how Google makes both website providers and users play by the rules, but it also exemplifies that Google’s hegemony should not be seen as fixed or stabilized, but rather as constantly negotiated and made. “As a concept, then, hegemony is inseparable from overtones of struggle” (Eagleton 1991: 115). This struggle has the potential to challenge powerful actors like Google and their Algorithmic Ideology. If content providers and users broke out of the network dynamic, the power of Google and its whole business model would fall apart. If the media would feature more critical stories about Google’s data collecting practices, privacy violations and possible collaborations with secret services dissatisfaction and protest would significantly grow in the public domain; as we have seen after Snowden’s revelations. If politics and law took on a stronger role in the regulation of search technology, limits would be set regarding the collection and use of personal data, but also business practices and advertising schemes, as the third article concludes (Mager 2014a).

To sum up, the notion Algorithmic Ideology enables us to shift the focus of attention from impacts search engines have on society towards sociotechnical practices and power dynamics involved in the construction of search engines. It further allows us to understand that search technology, as every other technology, could be otherwise. It could be renegotiated and changed, especially in moments of struggle. Edward Snowden’s revelations of tight entanglements of big tech and governments could be interpreted as such as moment of struggle. It was the moment in time when a European Algorithmic Imaginary started to take shape, but also got challenged due to European multiculturalism and diversity, as my second research project has shown.

2.2. SEARCH ENGINE IMAGINARY

In the research project Glocal Search I coined the notion Search Engine Imaginary to investigate how European search engine politics and a European identity are co-produced in the context of negotiations

of the EU's General Data Protection Regulation (GDPR) (Regulation (EU), 2016/679). In this project, I used the notion "sociotechnical imaginaries" (Jasanoff and Kim 2009) to analyze how European values are constructed and deconstructed in formal EU policy and national media discourses. I further showed how different imaginaries of search engine governance are shaped not only in specific cultural contexts but also within particular stakeholder groups and their situated knowledges. To conclude, I argued that joint efforts are needed to challenge powerful search engines and their governing abilities cutting through different societal arenas and areas of expertise.

2.2.1. Search Engine Imaginary in EU Governance Practices

In Article 4) Search Engine Imaginary, published in *Social Studies of Science*, I used the concept "sociotechnical imaginaries" (Jasanoff and Kim 2009) to analyze and conceptualize the notion European Search Engine Imaginary (Mager 2017). The concept of sociotechnical imaginaries is rooted in research on the co-production of technoscientific developments and society (Latour, 1992; Marcus, 1995, Jasanoff, 2004, 2005). Jasanoff and Kim (2009: 120) initially defined sociotechnical imaginaries as "collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects". Drawing on a growing recognition that the capacity to imagine future is a crucial constitutive element in social and political life (Jasanoff and Kim 2009: 123), they compared imaginaries to discourses, metaphors and cultural meanings out of which actors build their policy preferences. Accordingly, sociotechnical imaginaries not only include tightly bound belief systems, ideologies in a narrow sense, but also policy imaginations containing implicit understandings of what is good or desirable in the social world. In comparison to policy agendas, they were characterized as less explicit, less goal-directed and less politically accountable. The notion "sociotechnical imaginaries" (Jasanoff and Kim 2009) thus serves the purpose of investigating how search engines are imagined in the EU policy context, but also how they are negotiated and shaped in the larger "European technological zone" (Barry, 2001). Barry (2001) argues that the European technological zone is not only made up of classical political institutions and the actions of political parties, interests, networks and lobbies, but also of the political agency of scientific and technical materials. Thus "technical controversies are *forms* of political controversy" (Barry, 2001: 9, italics in original). There is no doubt that classical political actors and bureaucratic processes are a central component of the harmonization of the European Union: "Brussels is above all, for its critics, a bureaucracy" (Barry, 2001: 65). Barry, however, further argues that if we want to understand the cultural policy of the European Union we should not only be looking at culture in a classical sense, but also examining the material culture, the politics of regulation and technology. Following this line of thought, the fourth article (Mager 2017) analyzed the tough negotiations over the EU's General Data Protection Regulation (GDPR) as a political issue drawing together political institutions, technical standards, modes of private ordering, lobby interests, social norms and civil society. The overarching question is how a European identity is imagined in this technopolitical controversy. According to Jasanoff and Kim (2009: 124) political territories like states or nations should not be seen as fixed or immutable either, but rather as "reimagined, or re-performed, in the projection, production, implementation, and uptake of sociotechnical imaginaries". This particularly applies to the political construct of Europe, as Jasanoff (2005: 10) argued in the context of biotechnology:

"Europe in particular is a multiply imagined community in the minds of the many actors who are struggling to institutionalize their particular versions of Europe, and how far national specificities should become submerged in a single European nationhood – economically, politically, ethically – remains far from settled."

Along these lines, I used the concept of “sociotechnical imaginaries” to understand how “Europe itself is *in practice* being allowed to unfold” (Waterton 2002: 198; italics in original). To trace how the European Search Engine Imaginary is translated into national contexts, I analyzed Austrian media discourses related to the EU data protection reform. Each European country has its own technopolitical history that plays into the perception and construction of technoscientific developments. A number of scholars described Austria as following a restrained technology policy (Felt 2015, Felt et al. 2008, Müller and Witjes 2014, Torgersen 2002). Torgersen (2002) argued that Austrians should not be seen as technology-averse in general, but rather as abhorring certain large-scale technological systems that carry menacing images, most importantly nuclear power and agricultural biotechnology. Felt (2015) coins Austria’s restrained technology policy as “keeping (certain) technologies out”. Austria’s strong opposition to nuclear power plants and its rejection of genetically modified food crops serve as important frames of reference when nanotechnology is discussed in Austria. One central component of the Austrian “repertoire of sociotechnical resistance” (Felt, 2015: 6) is the picturing of Austria fighting against mighty economic actors. This imaginary was originally shaped in the context of genetically modified foods that are represented as profiting big, industrial players and threatening local culture (Felt 2015, Torgersen 2002). Felt (2015: 121) concludes that resisting a technological innovation also means resisting a certain mode of politics: “Imposed from outside rather than developed from within, driven by lobbies rather than by the ideal of the public good, imposed from above rather than developed from below, artificial rather than natural.”

These concepts allowed me to analyze how a European Search Engine Imaginary is forming in the EU policy domain conceptualizing fundamental rights as core European values, but also in national media debates, where strong images and metaphors are used to solidify a European identity. They further enabled me to explore how national particularities also contribute to the unmaking of a European identity, when it comes to the translation of the European vision into actual text of the GDPR. Europe is in this context no longer shaped as a coherent whole, but rather as a “multiply imagined community” (Jasanoff 2005) rooted in different historical, cultural, political, and economic traditions, as discussed in detail in Mager (2017).

2.2.2. Search Engine Imaginaries in Stakeholder Communities

In Article 5) Internet Governance as Joint Effort, published in *New Media & Society*, I elaborated how “sociotechnical imaginaries” (Jasanoff and Kim 2009) of search engines are shaped not only in specific cultural and sociopolitical contexts, but also within particular stakeholder communities and their respective experiences and expertise (Mager 2018). Conceptually, this article draws on STS-inspired Internet Governance (IG) literature in the context of search engines, the notion of internet governance as “private ordering” most importantly (Katzenbach 2013). The term IG has been constructed and deconstructed multiple times in recent years. Van Eeten and Mueller (2012) argue that the field labeling itself as IG research only captures a narrow field of study, primarily focusing on transnational institutions like the “Internet Governance Forum” (IGF) or the “Internet Corporation for Assigned Names and Numbers” (ICANN). The authors thus concluded that “There is a remarkable absence of governance in what is commonly called Internet governance” (Van Eeten and Mueller, 2012: 728). To broaden this narrow concept of IG, STS scholars suggested investigating IG in practice. Rather than providing yet another IG definition, they proposed to investigate how IG figures in Internet architecture, sociotechnical practices, and private modes of ordering (DeNardis 2009, 2014, Ziewitz and Pentzold 2014, Musiani 2015; Ziewitz 2016). DeNardis (2009, 2014) has analyzed technical infrastructures as arrangements of power and politics, negotiations over Internet architecture as

conflicts of norms, values, and rights, and IG as increasingly privatized endeavor enacted by corporations and nongovernmental bodies. Katzenbach (2013) argued that technological devices and Internet services should not be seen as external triggers for regulation but as parts of the heterogeneous networks that constitute the social, just like norms or power. He used the notion of “private ordering” to capture how mechanisms of private law, including contracts, licenses, and end-user agreements, increasingly complement, and even undermine, traditional mechanisms of public law, especially concerning copyright and privacy issues (Katzenbach 2013: 402). Compared to governance, the notion of “ordering” focuses on practices and procedures rather than formalized institutions and regulations, which makes it a useful tool for STS-oriented IG research. Ziewitz and Pentzold (2014) referred to Law’s (1994) concept of ordering to analyze how IG is enacted and performed in different contexts. They multiplied the notion of IG by showing that different versions of reality relate to different “modes of ordering” (Ziewitz and Pentzold 2014: 2008). Discussing five versions of the “Twitter Joke Trial,” an Internet-related conflict in Great Britain, they showed how different readings of the “Twitter Joke Trial” invoke different solutions to the problem. This example illustrates the interdependence of different versions of reality and visions of governance, an aspect I further explored in my analysis. Hofmann et al. (2017) suggested grounding IG in mundane practices of coordination. They explain that “grounding governance in coordination means studying ordering processes from the bottom-up rather than proceeding from regulatory structures” (Hofmann et al., 2017: 8). The authors argued that mundane activities of coordination become reflexive when ordinary interactions break down and become problematic. Drawing on Boltanski and Thévenot (2006), they called such moments “critical moments”, which resemble the “moments of struggle” discussed in the first project. In critical moments, they argued, actors begin to redefine the situation in question since routines are challenged, contested, and displaced through acts of articulation and justification. The authors concluded that “‘critical moments’ open temporary windows to the precarious conditions underpinning social coordination, which, more often than not, may be in need of adaptation” (Hofmann et al. 2017: 14) – such as Edward Snowden’s intelligence leaks, as I argued earlier.

Drawing on Critical New Media Studies, I further conceptualized different modes of governing performed by globally operating search engines like Google. First, search engines have been discussed in terms of their central role in ordering web information (Introna and Nissenbaum 2000). Since Google constitutes a powerful source of access in wide parts of the world, the “inherently political qualities” (Musiani 2013a: 5) of Google are particularly discussed. In reference to Wu (2010), Musiani (2013b: 4) argues that Google, “as the ‘master switch’ of the internet (Wu 2010: 279–280), centralises and organises the circulation of information in the network of networks, and for every search interrogation and request, arbitrates on what’s important and relevant.” Second, corporate search engines have been described as governing by shaping users’ behavior. Badouard et al. (2016: 3ff) elaborate how Google governs by “directing” users’ behavior. Drawing on Foucault’s (1982) notion of governmentality and discussing Google’s Webmaster Tools, the authors explain how Google directs publishers’ actions by installing an incentive-oriented governmentality regime and making publishers play by the rules, see above. Moreover, they argue that designing a website, content management system, or social network can be interpreted as an act of making users adopt a certain behavior, while developing a mobile operating system (e.g. Google’s Android) can be seen as an act of framing what can and cannot be done with a mobile phone. Finally, private modes of ordering performed by corporate search engines like Google have been discussed (DeNardis 2009, 2014, Katzenbach 2013). Belli and Venturini (2016) argue that contractual agreements like terms of service can be directly implemented through technical means like algorithms, online platforms, or Internet traffic management techniques. These

agreements may be considered as a kind of private law-making system, because the substantive provisions set in the agreements—which may apply transnationally—regulate the relationships between the parties with a binding force that may be analogue to or even stronger than the one exercised by law. (Shapiro, 1993, quoted in Belli and Venturini, 2016: 2) Given the great number and variety of Google services, its power to govern by private ordering has been discussed in regard to commodification, privacy, and surveillance (Fuchs, 2011). In reference to Hardt and Negri (2000), Google was described as having established a “technological empire” (Pasquinelli, 2009: 158), for example.

Building on this research, I analyzed IG in practice. Having investigated the narratives of four distinct actor groups—policy-makers, legal experts, civil society, and IT professionals—I analyzed how different perceptions of Google’s “governing by algorithms” were coupled with different suggestions regarding the “governing of algorithms” (Musiani 2013b, Saurwein et al. 2015). This analysis shows that the sociotechnical imaginaries of search engines are not only shaped in specific cultural contexts (Mager 2017), but also within particular “communities of practice” (Wenger 1998) and their respective experiences and expertise. It further shows where limits of the various governing modes lie and how to overcome them through joint efforts, as discussed in detail in Mager (2018).

To sum up, the notion Search Engine Imaginary enables us to trace and conceptualize how European Algorithmic Imaginaries take shape in EU policy discourses, how national technopolitical identities contribute to the making and unmaking of Europe, and how larger European imaginaries trickle into, transform, and multiply in different stakeholder communities. It further shows how a European identity is both constructed and deconstructed in governance practices and what conclusions could be drawn in terms of renegotiating search engines through rules and regulations. Building on the notions of both corporate Algorithmic Ideology and European Search Engine Imaginary, the last project focused on emerging Counter-Imaginaries in the context of alternative search engine projects based in Europe.

2.3. COUNTER-IMAGINARIES

Finally, in the most recent project titled Algorithmic Imaginaries, I focused on visions and values driving alternative search engines from Europe, how they are embedded in search technology, and what challenges arise in the particular European context. To start with, I revisited work from my first project in which I used the notion Algorithmic Ideology to lay the groundwork of mapping the landscape of alternative search engines and to outline the spectrum of alternative Algorithmic Ideologies driving them. Zooming into three particular search engines based in Europe, I employed the notion Counter-Imaginaries (Kazansky and Milan 2021) to provide an in-depths analysis of the three search engines and how their developers aim at counter-imagining and counter-acting hegemonic search with their search projects. Finally, I deepened this analysis by focusing on the way search engine providers anchor their counter-imaginaries in larger European search engine imaginaries, but also how they come up with alternative notions of Europe co-produced with their developer practices. Two book chapters and one article contribute to the understanding of Algorithmic Counter-Imaginaries, as I discuss in the following.

2.3.1. Alternative Algorithmic Ideologies

In Article 6) Is Small Really Beautiful?, a book chapter published in the *Society of the Query Reader*, I employed the notion Algorithmic Ideology to pluralize the ideologies driving search engines and the

scholarly understanding of these alternative ideologies (Mager 2014b). Starting from the concept of “ideology in practice” (Boltanski and Chiapello 2007, Mager 2012), I argued that not all search engines are driven by “the new spirit of capitalism” (Boltanski and Chiapello 2007), but that alternative search engines also commit to social values instead of mere profit maximization. To map the landscape of alternative search engines, I focused on search engines that claim to have a particular ideological agenda that clearly distinguishes them from big, corporate search tools. There are a number of so-called alternative search engines that are not as big as Google, Bing, or Yahoo! and that lead their lives at the margins of the search engine market. Of course, Bing could be conceptualized as an alternative to Google too in terms of its index and algorithm. However, Bing may also be considered yet another for-profit search engine that is no true alternative from an ideological viewpoint. Accordingly, all search engines included in this analysis explicitly devoted themselves to a particular ideological framework. Four ideological categories were chosen for the analysis of alternative search engines: Privacy-friendly search engines like StartPage or DuckDuckGo, “green” search engines like Ecosia, peer-to-peer search engines like YaCy, and “knowledge engines”, Wolfram|Alpha in particular. Further, all of them were general-purpose search engines with no particular topical focus, even though Wolfram|Alpha is specialized in answering factual questions rather than cultural, social scientific, or commercial ones.

Following the notion of Algorithmic Ideology (Mager 2012, 2014), the book chapter analyzed what norms, values, and ideologies are driving alternative search engines and how they figure in their actual practices. This analysis showed that when considering alternative search projects in the limelight of ideology, we can see that the capitalist spirit is by far not the only ideology shaping contemporary search engines. Quite on the contrary, there are multiple algorithmic ideologies at work. There are search engines that carry democratic values, those that incorporate the green ideology, some that believe in the commons, and others that subject themselves to the scientific paradigm. This means that we can set an ideological example by choosing one search engine over the other. In daily practice, however, the capitalist ideology appears to be hegemonic since not all ideologies are equal in terms of exercising their power. The majority of users turns to big search engines and hence solidifies the capitalist spirit more than any other ideology. Moreover, most alternative search engines are subordinate to “informational capitalism” (Fuchs 2010, 2011) due to entering alliances with big search engines by using their search results and advertising networks. Their ideological agendas are not deeply embedded in technical layers and algorithmic logics because both the index and the algorithms they use are borrowed from other search engines. This indicates that opting out of big search and its capitalist underpinnings is not as easy as it may seem at first sight. Everyone is free to choose alternatives, but selecting a true alternative, both in terms of technology and ideology, would require not only awareness and a certain amount of technical know-how, but also effort and patience. Building on this analysis of alternative search engines and their ideological roots, I selected three alternative search engines from Europe for a closer analysis.

2.3.2. Algorithmic Counter-Imagaries

In Article 7) European Search, published in *Big Data & Society*, I used the notion Counter-Imagaries to capture and conceptualize visions and values driving alternative search engines from Europe, how they are translated into search technologies, and what challenges arise in the specific European context (Mager 2023). Given the hegemonic position of big tech companies in imagining and shaping digital technologies, “sociotechnical imaginaries” (Jasanoff and Kim 2009) have been described as

increasingly commodified, but also as multiple and contested at the same time (Mager and Katzenbach, 2021). Accordingly, a growing body of research has started to investigate the role imaginaries play in citizen engagement with datafication and data infrastructures (Mansell 2012, Milan and ten Oever 2016, Lehtiniemi and Ruckenstein 2019). Lehtiniemi and Ruckenstein (2019: 3) have used the concept of “alternative social imaginaries” to investigate a data activism initiative aiming to shape a more sustainable citizen-centric data economy. Kazansky and Milan (2021) have introduced the notion “counter-imaginaries” to capture counter-cultural voices and practices of technology development that aim at social change. “These counter-imaginaries make apparent how civil society seeks to respond to the ever-complex technological change and the risks it conceals” (Kazansky and Milan 2021: 366). Like dominant imaginaries, they not only enable us to understand how civil society counter-imagines digital futures, but also to observe practitioners in action as they try to shape their technological present and future (Kazansky and Milan 2021: 366). In the words of Hilgartner (2015), alternative search engine developers may be seen as an “avant-garde” that aims to drive a wave of change. In his research on “sociotechnical vanguards,” the author defines them as “relatively small collectives that formulate and act intentionally to realize particular sociotechnical visions of the future that have yet to be accepted by wider collectives, such as the nation” (Hilgartner 2015: 36). The notion of Counter-Imaginaries is thus well suited to investigating not only how search engine developers counter-imagine hegemonic search, but also how they try to build their search technologies and infrastructures accordingly, as discussed in detail in Mager (2023).

In this article, I further elaborated what strategies developers of alternative search engines follow to grow their projects beyond their own “communities of practice” (Wenger, 1998) and how Counter-Imaginaries can be anchored in larger European imaginaries. The issue of scaling was an important one for all three projects, in very different ways though. Their perceptions of scaling also fundamentally differed from the common understanding of scaling that is strongly shaped by big tech companies and their CEOs. Research on the politics of scaling conceptualizes figures like Mark Zuckerberg, PayPal founder and venture capitalist Peter Thiel, and Tesla CEO Elon Musk as “obsessed” with scaling, while framing it as an indispensable part of contemporary innovation discourses and social, political, and economic life at large (Pfothenauer et al. 2022: 4). Against this background, Tsing (2012) argues for a nonscalability theory that pays attention to the “mounting pile of ruins that scalability leaves behind” (Tsing 2012: 506). Not because nonscalability is necessarily better, but because it opens up the view on “diversity-in-the-making.” Nonscalability hence enables us to analyze how diversity, local specificities, and moral values—the “situatedness” of my case studies—contribute to developer practices. The term “situatedness,” which has a long tradition in STS (Haraway 1988; see also Butler 1990, Thompson 2001), allows for considering differences in social, cultural, political, economic, and institutional positionality, but also for a “normative critique of hegemonic power structures and colonial tendencies that threaten to erase epistemic and political diversity” (Pfothenauer et al. 2022: 6).

Despite crucial differences, all three search engines chosen in my research situated themselves in the larger European context whereby constructing different notions of Europe tightly intertwined with their practices and experiences, as I analyzed in detail (Mager 2023). This analysis shows that alternative search providers collectively build out counter-imaginaries to hegemonic search that are devoted to privacy, independence, and openness. Moreover, European values, and broader notions of Europe, turned out to be context-dependent and co-produced with sociotechnical developer practices and search infrastructures. This corresponds to research having shown how European values are

differently constructed and co-produced with data practices, governance of digital technology, and large-scale research infrastructures (Ruppert and Scheel 2021, Mager 2017, Mahfoud 2021, Mobach and Felt 2022). All this research complicates clear-cut notions of Europe by showing how “Europeanness” (Mobach and Felt 2022) is co-produced with practices of shaping digital technologies and infrastructures.

2.3.3. Counter-Imaginarities Co-Producing Notions of Europe

In Article 8) Digital Europe From Below, a book chapter soon to be published in the book *Project Europe*, I extended this research by combining STS literature with European Studies to zoom into different notions of Europe the three search engine providers enacted and co-produced with their developer practices, the divergent notions of Europe as “unified or pluralistic” (Mahfoud 2021) most importantly (Mager forthcoming). In this contribution, I drew on the growing body of work investigating “sociotechnical imaginaries” (Jasanoff and Kim 2009) in the European policy context, often by comparing it to the US-American and Chinese context (Mager 2017, Guay and Birch 2022, Aho and Duffield 2022, Krarup and Horst 2023). More specifically, I used research pointing us towards the fragility and multiplicity of European imaginaries relevant for my study. Having analyzed EU policy discourses on Artificial Intelligence (AI), Ulnicane (2021) identified a crucial tension running through EU policy that she captured with the notions of Normative Power Europe and Market Power Europe. More specifically, the author referred to competing narratives between the “human-centred approach” towards digital innovations and the rhetoric of the EU’s economic interests widely captured with the notion of the Digital Single Market. Ulnicane (2021) concluded that the EU strongly emphasizes Normative Power Europe, while at the same time repeating its competition discourse inherent in Market Power Europe. In the context of European infrastructure projects, yet another long-standing tension within Europe has been observed: the tension between a unified and pluralized Europe. The European Organization for Nuclear Research (CERN), one of the oldest and largest European research infrastructure projects has not only been praised for its scientific success, but also as “manifest evidence of European unity” (Mobach and Felt 2022). Similar ambitions were expressed with the launch of the European Human Brain Project (HBP): “The EC’s vision for the flagships brought up quite a few European techno-scientific tropes – competition with the United States, and the role of science and technology in unifying Europe” (Mahfoud 2021: 331). European attempts to build digital technologies and infrastructures with flagship initiatives were accompanied by big announcements of a similar kind. The recent initiative GAIA-X, a project to build a European cloud ecosystem, was framed as “Europe’s moon shot”, but also in terms of a geopolitical fight for “European sovereignty” in the IT sector (Baur 2023).

In the context of search engines, the notion of European sovereignty was mobilized when announcing Quaero in 2005, which was promoted as an attempt to build a European search engine. Quaero was presented as a joint German/French search engine project meant “to rival Google and Yahoo”, which were interpreted as a “threat of Anglo-Saxon cultural imperialism” at the time¹ (see also Lewandowski 2014). The aim of strengthening Europe’s sovereignty by developing its own search engine failed, however, due to “misguided and unnecessary nationalism”, as critics put it bluntly.² This rhetoric evokes a tension between attempts to unify Europe through digital means and the notion of a

¹ <https://www.telegraph.co.uk/finance/2921407/Chirac-backs-eurocentric-search-engine.html> (accessed January 2023)

² <https://en.wikipedia.org/wiki/Quaero> (accessed January 2023)

pluralized Europe standing in the way of coordinated digitalization efforts. Tensions between a unified and pluralized Europe were also identified in regard to large-scale infrastructure projects such as the European Human Brain Project (Mahfoud 2021). In the course of building this large research infrastructure, tensions between the EC's singular, top-down vision of doing "big science in a European way" and the need to represent the diversity and plurality of neuroscientific efforts in different European countries and research communities were expressed. Mahfoud (2021: 338) therefore concluded: "And through these narratives, Europe itself is posited as a problem – the tension between unification and pluralism serving as both metaphor and backdrop to contestations over how scientific communities should be bringing data together in European 'big science' projects". This corresponds to Mobach and Felt's (2022) analysis of 60 years of CERNs narratives of organizational identity, which showed how different notions of "Europeanness" were enacted and co-produced with the building of such large-scale research infrastructure over time – relating to European values such as unity, cohesion, collaboration, and geography. Investigating counter-imaginaries (Kazansky and Milan 2021) and their role in shaping both alternative search engines and different notions of Europe, this book chapter deepened the analysis of alternative notions of Europe that are co-produced with sociotechnical developer practices.

To sum up, the notion of Counter-Imaginaries allows us to understand not only the visions, values, and ideologies driving alternative search engines, but also how different notions of Europe are co-produced with sociotechnical developer practices. It contributes to research having shown that European technology politics and infrastructure projects not only contribute to the making of Europe, but also to the unmaking of Europe due to the crucial differences at stake. Moreover, it shows how Algorithmic Imaginaries take shape in particular "communities of practice" (Wenger 1998) and their respective experiences and expertise (Mager 2018, Barker 2015, Lehtiniemi and Ruckenstein 2019). Together with the conceptual tools of Algorithmic Ideology and Search Engine Imaginary the notion Counter-Imaginaries feeds into the overarching theory of Algorithmic Imaginaries enabling us to understand how search technology and society co-emerge in different sociopolitical contexts, the European context most importantly.

3. Summaries of articles

In this section, I collected the abstracts of the articles to give a very brief overview of their individual foci and how they contribute to the conceptual work that I have discussed above.

ALGORITHMIC IDEOLOGY

- 1) **Mager A (2012) Algorithmic Ideology. How capitalist society shapes search engines, *Information, Communication & Society* 15(5), 769-787.**

Abstract: This article investigates how the new spirit of capitalism gets inscribed in the fabric of search algorithms by way of social practices. Drawing on the tradition of the social construction of technology (SCOT) and 17 qualitative expert interviews it discusses how search engines and their revenue models are negotiated and stabilized in a network of actors and interests, website providers and users first and foremost. It further shows how corporate search engines and their capitalist ideology are solidified in a socio-political context characterized by a techno-euphoric climate of innovation and a politics of

privatization. This analysis provides a valuable contribution to contemporary search engine critique mainly focusing on search engines' business models and societal implications. It shows that a shift of perspective is needed from impacts search engines have on society towards social practices and power relations involved in the construction of search engines to renegotiate search engines and their algorithmic ideology in the future.

Contribution to Algorithmic Imaginaries: It outlines the notion Algorithmic Ideology to investigate the practices and actor-networks involved in the shaping of hegemonic search engines.

2) **Eklöf J and Mager A (2013) Technoscientific Promotion and Biofuel Policy. How the Press and Search Engines Stage the Biofuel Controversy, *Media, Culture & Society* 35(4), 454–471.**

Abstract: What are the conditions for the public understanding of biofuels and how do the media shape these conditions under the influence of a new production of knowledge? This article investigates how the biofuel controversy plays out in the Swedish press and Google search engine results and analyses winners and losers in the tight attention economy of contemporary media. It describes different visibility strategies biofuel stakeholders employ in both media arenas, and identifies a form of technoscientific promotion that hybrid actors use to succeed in the day-to-day struggle for media attention. To conclude, it raises broader societal questions of the contemporary blurring of knowledge boundaries and the emergence of new information hierarchies and their biases. By understanding how contemporary media shape controversies, we can address the democratic potential of both mass media and science.

Contribution to Algorithmic Imaginaries: It puts Algorithmic Ideology into practice by investigating how it contributes to scientific controversies in search engine results compared to classical media.

3) **Mager A (2014) Defining Algorithmic Ideology: Using Ideology Critique to Scrutinize Corporate Search Engines, *Triple C. Communication, Capitalism and Critique* 12(1).**

Abstract: This article conceptualizes “algorithmic ideology” as a valuable tool to understand and critique corporate search engines in the context of wider socio-political developments. Drawing on critical theory it shows how capitalist value-systems manifest in search technology, how they spread through algorithmic logics and how they are stabilized in society. Following philosophers like Althusser, Marx and Gramsci it elaborates how content providers and users contribute to Google’s capital accumulation cycle and exploitation schemes that come along with it. In line with contemporary mass media and neoliberal politics they appear to be fostering capitalism and its “commodity fetishism” (Marx). It further reveals that the capitalist hegemony has to be constantly negotiated and renewed. This dynamic notion of ideology opens up the view for moments of struggle and counter-actions. “Organic intellectuals” (Gramsci) can play a central role in challenging powerful actors like Google and their algorithmic ideology. To pave the way towards more democratic information technology, however, requires more than single organic intellectuals. Additional obstacles need to be conquered, as I finally discuss.

Contribution to Algorithmic Imaginaries: It further defines Algorithmic Ideology by drawing on Critical Theory, Ideology Critique most importantly.

SEARCH ENGINE IMAGINARY

- 4) **Mager A (2017) Search engine imaginary. Visions and values in the co-production of search technology and Europe, *Social Studies of Science* 47(2), 240–262.**

Abstract: This article discusses the co-production of search technology and a European identity in the context of the EU data protection reform. The negotiations of the EU data protection legislation ran from 2012 until 2015 and resulted in a unified data protection legislation directly binding for all European member states. I employ a discourse analysis to examine EU policy documents and Austrian media materials related to the reform process. Using the concept ‘sociotechnical imaginary’, I show how a European imaginary of search engines is forming in the EU policy domain, how a European identity is constructed in the envisioned politics of control, and how national specificities contribute to the making and unmaking of a European identity. I discuss the roles that national technopolitical identities play in shaping both search technology and Europe, taking as an example Austria, a small country with a long history in data protection and a tradition of restrained technology politics.

Contribution to Algorithmic Imaginaries: It develops the notion Search Engine Imaginary to analyze how EU search engine politics and a European identity co-emerge in the context of the GDPR.

- 5) **Mager A (2018) Internet governance as joint effort: (Re)ordering search engines at the intersection of global and local cultures, *New Media & Society* 20(10).**

Abstract: In this article, I investigate internet governance in practice by focusing on search engines, Google in particular. Building on STS-grounded internet governance research, I ask how different stakeholders interpret governing by algorithms, the governing of algorithms, and the limits of various governing modes when considering local specificities. To answer these questions, I conducted 18 qualitative interviews with key experts involved in search engine governance from four distinct societal domains: policy, law, civil society and the IT sector (from Austria and/ or the European level). In this analysis, I show that perceptions of search engine governance are shaped in specific cultural contexts, but also within particular social groups and their situated knowledges. I further elaborate how joint efforts are imagined as a means to challenge powerful search engines and their governing abilities cutting through different societal arenas and areas of expertise. Finally, I discuss implications of this analysis regarding the complex relationship between global technology and local cultures.

Contribution to Algorithmic Imaginaries: It analyzes how European Search Engine Imaginaries are co-produced with governance practices of different stakeholder communities and their situated knowledges.

COUNTER-IMAGINARIES

- 6) **Mager A (2014) Is small really beautiful? Big search and its alternatives, in: König R and Rasch M (eds) *Society of the Query Reader. Reflections on Web Search*, Amsterdam: Institute of Network Cultures: 59-72.**

Abstract: Google is a flourishing company, and its algorithm incorporates and strengthens the capitalist ideology. Rather than blaming Google for doing evil, however, this book chapter suggests thinking of Google as being shaped by society. Google shows us the face of capitalism because it was born and raised in a capitalist society. Accordingly, Google is not the only actor to blame. Quite on the contrary, actors such as policy makers, jurists, journalists, search engine optimizers, website providers, and, last but not least, users are part of the game too. If users would turn away from Google, the whole business

model, including its sophisticated algorithm and database of personal data, would fall apart. But where can people turn to? Are there true alternatives to Google and their algorithmic ideology? The goal of this article is to examine and discuss critically a selection of so-called alternative search engines and their ideological underpinnings. If Google embodies the capitalist ideology, what ideology do alternative search engines incorporate? What values do privacy-concerned search tools such as DuckDuckGo carry? What is green about green search engines? Can peer-to-peer search engines such as YaCy be interpreted as communist search engines? Could search be seen as a scientific endeavor as Wolfram|Alpha suggests?

Contribution to Algorithmic Imaginaries: It revisits the notion Algorithmic Ideology to map the landscape of alternative search engines and their ideological underpinnings.

7) **Mager A (2023) European Search? How to counter-imagine and counteract hegemonic search with European search engine projects, *Big Data & Society* 10(1).**

Abstract: This article investigates how developers of alternative search engines challenge increasingly corporate imaginaries of digital futures by building out counter-imaginaries of search engines devoted to social values instead of mere profit maximization. Drawing on three in-depth case studies of European search engines, it analyzes how search engine developers counter-imagine hegemonic search, what social values support their imaginaries, and how they are intertwined with their sociotechnical practices. This analysis shows that notions like privacy, independence, and openness appear to be fluid, context-dependent, and changing over time, leading to a certain “value pragmatics” that allows the projects to scale beyond their own communities of practice. It further shows how European values, and broader notions of Europe as “unified or pluralistic,” are constructed and co-produced with developers’ attempts to counter-imagine and counteract hegemonic search. To conclude, I suggest three points of intervention that may help alternative search engine projects, and digital technologies more generally, to not only make their counter-imaginaries more powerful, but also acquire the necessary resources to build their technologies and infrastructures accordingly. I finally discuss how “European values,” in all their richness and diversity, can contribute to this undertaking.

Contribution to Algorithmic Imaginaries: It conceptualizes the notion Counter-Imaginaries to analyze visions and values driving alternative search engines from Europe.

8) **Mager A (forthcoming) Digital Europe from below. Alternative routes to the Digital Decade, in: Van Hoyweghen I, Dratwa J, Verschraegen G, Marelli L (eds) *Project Europe. Remaking European futures through digital innovation*, Edward Elgar Publishing.**

Abstract: This book chapter investigates how developers of alternative technology projects imagine “digital Europe” from below. More specifically, it sheds light on three alternative search engines from Europe that follow a social cause: the privacy-friendly search engine Startpage, the peer-to-peer search engine YaCy, and the Open Web Index initiative. Drawing on literature from Science and Technology Studies (STS) and European studies, this analysis shows how search engine developers draw on “European values” to situate and promote their projects, but also how alternative notions of Europe are enacted that make it possible to see the challenges and constraints that search engine developers experience in the particular European context, as well as opportunities for change that are worth pursuing. To conclude, it will discuss what we can learn from bringing marginal voices to the table of

European technology politics to embrace European pluralism and diversity, but also to bring Project Europe closer to public concerns.

Contribution to Algorithmic Imaginaries: It deepens the analysis of Counter-Imaginaries by focusing on different notions of Europe co-produced with practices of alternative search engine design.

4. Contributions of the Habilitation and Outlook

This habilitation has developed the notion Algorithmic Imaginaries to theorize, investigate, and potentially intervene in the shaping of search engines at the nexus of discourse and practice. The overall theory Algorithmic Imaginaries is fed by three conceptual tools that are deeply grounded in in-depth, multi-sited fieldwork: 1) Algorithmic Ideology, 2) Search Engine Imaginary, and 3) Counter-Imaginaries. These notions help us understand how search engines are shaped and stabilized in society and what possible interventions could be made to renegotiate search technology – especially in Europe where the “human-centred approach” to digital technology is strongly pushed in EU policy, but seems to get lost along the way of practically developing, implementing, and governing digital technologies, platforms, and infrastructures.

This habilitation therefore provides a valuable groundwork for future research agendas and policy initiatives. *Theoretically*, it makes important contributions to the fields of STS, the growing body of research on future imaginaries, and counter-imaginaries, in the making and governing of digital technology, most importantly – closely connected to the special issue “Future Imaginaries” that I co-edited together with Christian Katzenbach for *New Media & Society*. *Empirically*, it contributes to Critical New Media Studies, the field of Search Engine Studies more specifically – related to the special issue “The State of Google Critique and Intervention” that I co-edited together with Ov Cristian Norocel and Richard Rogers for *Big Data & Society*. *Socio-politically*, it formulates three points of intervention that may help to pave the way towards a more sustainable “Digital Europe” rooted in multiculturalism and technological diversity, as I finally discuss.

Theoretically, this habilitation contributes to the field of STS by showing how search engines are socially constructed in corporate contexts, European governance, and communities of practice. More specifically, it feeds into the growing body of research on future imaginaries by complicating and complementing clear-cut notions of “sociotechnical imaginaries” (Jasanoff and Kim 2009) in the context of digital technology, search engines most importantly. In the editorial of the special issue “Future Imaginaries” (*New Media & Society*) we argued that “sociotechnical imaginaries” are increasingly commodified, but also contested and multiple (Mager and Katzenbach 2021). In the process of negotiating digital futures, it is often no longer state actors or governmental institutions that act as primary agents of powerful imaginaries, as originally held in the concept of “sociotechnical imaginaries” (Jasanoff and Kim 2009), but corporate actors: “Especially in the context of digital technologies, this discursive embedding of technological developments and commercial products is pervasive. Entrepreneurs routinely attire their products and services in utopian visions of the future, narratives of community-building, and the promise of technological fixes for social problems (Turner 2006, Katzenbach 2019).” (Mager and Katzenbach 2021: 227) The notion Algorithmic Ideology has contributed to the understanding of search engines as tightly intertwined with capitalist ideology from early on.

The notion Search Engine Imaginary further helps us understand how corporate Algorithmic Imaginaries are increasingly challenged by European imaginaries rooted in “European values”, the fundamental right to data protection most importantly. It shows how a coherent European Search Engine Imaginary is formed in EU policy discourses, but also how it travels into, transforms, and multiplies in national sociopolitical contexts and local stakeholder communities (Mager 2017, 2018). It therefore underlines that “sociotechnical imaginaries” (Jasanoff and Kim 2009) should not be seen as “monolithic or stabilized, but rather as multifaceted and dynamic” (Katzenbach and Mager 2021). Finally, the notion algorithmic Counter-Imaginaries elaborates how alternative imaginaries of search engines take shape in the context of practices of search engine design and how these Counter-Imaginaries are both anchored in larger sociotechnical imaginaries rooted in “European values”, but also challenge them by envisioning alternative notions of Europe co-emerging with search engine developer practices. These insights exemplify the multiplicity of “sociotechnical imaginaries” (Jasanoff and Kim 2009) once again and adds to research on “alternative imaginaries” (Mansell 2012, Milan and ten Oever 2016, Lehtiniemi and Ruckenstein 2019) by showing how particular communities of practice not only counter-imagine hegemonic search engines and their intrusive data and business practices, but also try to build their technologies accordingly. Further research is needed on alternative Algorithmic Imaginaries growing at the margins of dominant sociotechnical imaginaries, which tend to hide “diversity-in-the-making” (Tsing 2012) and its potential for change.

Empirically, my habilitation advances classical search engine critique by focusing on imaginaries, practices, and power relations involved in the shaping of search engines – a necessary prerequisite for practically rethinking and renegotiating hegemonic search and coming up with more diverse digital technologies in the future. In the editorial of the special issue “The State of Google Critique and Intervention” (*Big Data & Society*) we traced the evolution of Google critique and European interventions. In conclusion, we made a plea for putting long-standing Google critique into practice and for providing “frameworks and imaginations for critical intervention” (Mager, Norocel and Rogers 2023). My habilitation provides the groundwork for such interventions by going beyond the political economy of search engines (Elmer 2004, Van Couvering 2008, Pasquinelli 2009, Fuchs 2011) and showing how search engines are socially constructed at the nexus of discourse and practice. Such an analysis makes us understand how capitalist ideology gets inscribed and anchored in hegemonic search engines and how change can be reached through critical interventions in the complex sociotechnical practices and actor-networks at play. It further adds to STS-oriented Internet Governance research (Katzenbach 2013, Ziewitz and Pentzold 2014, Musiani 2015, Ziewitz 2016) and European Policy/ Infrastructure Studies (Marelli et al. 2020, Mahfoud 2021, Ulicane 2021, Mobach and Felt 2022, Guay and Birch 2022, Baur 2023, Krarup and Horst 2023) by showing how Europe tries to participate in the shaping of search engines through rules and regulations, but also how hard it is to reach a common understanding due to Europe’s multiculturalism and diversity. Finally, my habilitation feeds into the growing body of research on alternative digital technologies, practices, and imaginaries (Mansell 2012, Milan and ten Oever 2016, Lehtiniemi and Ruckenstein 2019, Kazansky and Milan 2021) by elaborating how particular communities of practice envision not only alternative technologies, but also alternative notions of Europe helping us to embrace multiculturalism, federalism, and diversity in technology design rather than trying to mimic big tech companies and their intrusive data practices. Further research is needed on alternative Algorithmic Imaginaries helping to pave the way towards a more sustainable “Digital Europe” better suited to European values – in all their richness and diversity – than empty notions of “catching up” with the US, and increasingly China.

Socio-politically, my habilitation contributes to European innovation politics and technology developments. It offers a repertoire of possible interventions to not only rethink, but also rebuild search engines, and digital technologies more broadly, in specific European contexts. Three possible interventions are discussed: 1) “Long-term funding and slow scalability” are needed as important preconditions for developing open search infrastructures – such as an open web index that could become an important backbone to search engine diversity. Moreover, 2) the “opening up of data” is a necessary prerequisite for developing alternative digital technologies and infrastructures and for training algorithms and machine learning models. How to open up commercial data, to share public data, and to create collective data pools that go beyond individual responsibility and ownership of data are thus central questions that need to be tackled in the future. The 3) intervention, “continuous auditing and advice”, calls for the establishment of new processes and institutions with enough resources and interdisciplinary expertise to provide guidance in the creation and implementation of algorithmic systems: “Especially in the phase of developing digital tools and infrastructures, constant advice and public scrutiny are needed with regard to legal requirements, ethical and governance issues, as well as social implications.” (Mager 2023) This repertoire of interventions applies to the corporate sector, but even more so to the public sector where more and more algorithmic systems are developed nowadays to “profile” citizens and provide scarce resources efficiently, as our work in the context of public employment has shown (see Allhutter et al. 2020).

Accordingly, future research is invited to extend the notion of Algorithmic Imaginaries to the public sector where larger political trends such as the ongoing austerity politics in many European countries translate into and are made effective through profiling algorithms, digital technologies, and data infrastructures. Insights from this habilitation can help to better understand the envisioning and shaping of algorithmic systems in the context of larger sociopolitical contexts, but also the making and unmaking of Europe through digital technologies and infrastructures. In our current research project Automating Welfare (FWF I 6075) first steps towards this important research endeavor are made by investigating (semi-)automated decision-making systems and data infrastructures in eight European countries and their different welfare regimes. More studies will have to follow both in Europe and beyond. The globalized nature of digitalization attempts calls for studies on a broader scale including geographical regions and political regimes where authoritarian leaders increasingly try to use data and digital technologies to control populations without any public scrutiny like in Israel or Brazil, for example. Also, data bias, discrimination, and surveillance tie into social inequalities in countries of the global South that need to be considered in future studies – especially in the age of the “transboundary crisis” (Boin 2019) where datafication can become a matter of life and death, as both the disruptive event of the COVID-19 pandemic and the “slow disaster” (Knowles 2014) of the climate crisis show.

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6. Appendix: 10 Articles