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Regulating emerging technology in times of crisis: Digital contact tracing in Norway during the COVID-19 pandemic

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Abstract
In times of crisis, emerging technology can pose major challenges for regulators. They must deal with great uncertainty and urgency related to both the crisis and the technology. To understand such situations, this article studies the revelatory case of privacy regulation of a contact-tracing application called Smittestopp, created in Norway during the COVID-19 crisis. Based on public and organizational documents and 48 interviews, the analysis shows that the Norwegian Data Protection Authority faced several options for regulatory intervention throughout the crisis, and adapted its approach based on intra-crisis experience, regulatees' responses, and different levels of uncertainty and urgency. Building on these findings, the study formulates propositions regarding the regulation of emerging technology during a crisis and regulatory agencies' use of rule-based, idea-based, and norm-based interventions. This study provides insight into how these three types of intervention relate to different aspects of a crisis situation. Furthermore, it stresses the importance of idea-based intervention as a key site of analysis in studying technology that emerges during a crisis.

1 | INTRODUCTION

Research on crises has shown that technologies and innovations can emerge rapidly to overcome the crises in question (Mbunge et al., 2021; Meijer et al., 2019). At the same time, emerging technologies bring about uncertainty, both related to their technological specifics and their

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broader societal impacts. During the COVID-19 pandemic, a global mega-crisis with high uncertainty and complexity, digital contact tracing applications (apps) were quickly developed across the world to assist in infection tracking (Ferretti et al., 2020; Whitelaw et al., 2020). Differing views on how to manage and use such technology constitute a highly polarized debate (Abbot, 2012; Mandel, 2009). In times of crisis such as a pandemic, proponents argue for the potential of new technologies to protect human lives, while opponents emphasize uncertainties related to ethics, government surveillance, and long-term privacy implications (Boustead, 2021; Budd et al., 2020; Morley et al., 2020).

This dilemma of technological potential and uncertainty represented a key challenge for the Norwegian Data Protection Authority (DPA) during the pandemic. This regulatory agency had to rapidly evaluate the potential of the contact-tracing app created by the Norwegian Institute for Public Health (NIPH), called Smittestopp ("Infection Stop" in Norwegian), while at the same time considering possible detrimental outcomes related to mass surveillance. The DPA thus had to regulate a new technology under conditions of great uncertainty and time pressure, which is a little-researched context in regulation studies.

Previous research on regulation in non-crisis situations has elaborated on how regulators define non-compliance and analyze moves by regulated entities (e.g., Ayres & Braithwaite, 1992; Gunningham et al., 1998; Kagan & Scholz, 1984), as well as how regulated entities themselves respond to acts by regulators (e.g., Fairman & Yapp, 2005; Gunningham & Kagan, 2005; Winter & May, 2001). These studies, however, are not explicit as to what options regulators face *during* a crisis, or how *emerging technology* is regulated during a crisis. A crisis is a special situation in which regulators are expected to welcome initiatives that can assist in combating the crisis, and thus to apply their interventions differently than they would in more stable circumstances. A crisis also represents an opportunity for regulators to attempt to change the sets of underlying ideas and beliefs that constitute a regulatory field (Black, 2002; Boin et al., 2009; Fligstein, 2001). Using this as a point of departure, this article asks the following questions: which interventions do regulators use to regulate emerging technology in times of crisis? What are the conditions under which regulators adapt their choice of interventions for emerging technologies in crisis?

To answer these questions, this article documents and analyzes the Norwegian DPA's choice of different interventions to regulate the Smittestopp app in 2020–2021. This app, and corresponding ones in other countries, are examples of technology created in a short time frame during a crisis, with uncertainty related to function, data collection, data storage, and long-term privacy implications.

At the outset of the crisis when uncertainty was high, the regulator (the Norwegian DPA) initially utilized what is labeled an *idea-based* intervention to not limit technological innovation of the regulated entities (the NIPH and its assisting app developers, Simula and Netcompany). Due to time pressure and lack of response from the regulated entities, *rule-based* and *norm-based* interventions were embraced in phase two. Thereafter, with reduced uncertainty regarding the technology in question, the coronavirus itself, and the effects of lockdown, the DPA pursued a strictly rule-based approach with the ban of the contact-tracing app in phase three. This forced the regulated entities to create a modified second version, Smittestopp 2. In the final phase, the DPA controlled the new technology with rule-based interventions, but supported these interventions with norm-based elements.

Building on these findings, this study formulates propositions regarding the regulation of emerging technology in crisis and regulatory agencies' use of rule-based, idea-based, and norm-based regulatory interventions. This study provides insight into how these three intervention types relate to different aspects of a crisis. Furthermore, it stresses the importance of idea-based interventions as a key site of analysis in studying technology that emerges during a crisis.

The remainder of the article is structured as follows: First, I define relevant concepts and review the relevant literature in order to provide initial analytical direction for the study.

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Second, I present the study's methods and data, which rely on a total of 48 expert interviews and document analysis. Third, I thoroughly describe the COVID-19 crisis and the evolution of privacy regulation throughout it. Finally, I summarize the empirical findings, form propositions, and discuss the study's limitations and its implications for further research into the regulation of technologies that emerge during a crisis.

2 | THEORETICAL APPROACH

2.1 | Crisis and uncertainty

An important premise of this study is the concept of crisis. I follow Boin et al. (2005, p. 5), who define a crisis as "a serious threat to the basic structures and the fundamental values and norms of a system which under time pressure and highly uncertain circumstances necessitates making vital decisions" (p. 5). This means that crises inherently involve dynamic and unpredictable circumstances, complicating decision making and the building of governance (regulatory) capacity (Christensen et al., 2016). Crises include wars, famines, epidemics, large financial downturns, and cyber-attacks, and the effects of crises can be both immediate and long-term (Ansell et al., 2010). Crises can both facilitate and destroy technological innovations (Archibugi et al., 2013; Schumpeter, 1934; Sechser et al., 2019; Talmadge, 2019). For instance, Meijer et al. (2019) show that during a range of different crises, new technologies, applications, and digital networks have been used to create and share information and reduce transaction costs for collaboration. The work of regulators in such situations is characterized by uncertainty regarding social structures, uncertainty regarding technology, and limited time to act (Baekkeskov, 2016; Rosenthal et al., 1989), but with the opportunity to facilitate the use of technology. Uncertain situations are characterized by unknown probabilities (Knight, 1921), where past experiences and strategies can only be applied to a small extent (Ansell et al., 2010); in addition, perceived solutions may be ambiguous, meaning they are incongruent, incoherent, or open to interpretation (Hatch & Erhlich, 1993). The onset of the COVID-19 pandemic had all of these features. Before elaborating on how technology in such circumstances is regulated, it is necessary to state what is meant by emerging technology and how it relates to uncertainty.

2.2 | Emerging technology

The concept of "emerging technology" is broad and potentially ambiguous (Abbot, 2012). Based on an extensive literature review, Rotolo et al. (2015) highlighted five attributes that characterize emerging technology: (1) radical novelty; (2) relatively fast growth; (3) coherence; (4) prominent impact; and (5) uncertainty and ambiguity. In essence, emerging technology involves the application of knowledge in new ways, having a relatively high impact in a short amount of time (Rotolo et al., 2015). One may observe all these characteristics in technologies emerging during crisis, during which uncertainty is even higher than in more stable times. Technologies from completely different sectors may share these characteristics (Perrow, 1984), including technologies that have a physical impact, like nanotechnology, vaccines, and military technology, as well as non-physical technologies such as smart applications, 5G, deep learning, social media, and blockchain. The latter are of particular relevance for the study at hand, as it deals with a digital mobile tracing application.

There is arguably a difference in technological uncertainty during times of crisis compared with more stable times. Due to time pressure, a crisis demands openness to solutions that can combat it, but the high level of uncertainty simultaneously provides an opportunity for regulators to impose ideas and preferences and to create interpretations of ambiguous situations

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(Black, 2002; Boin et al., 2009). Technological uncertainty in more stable times is characterized by less demand for immediate solutions and a longer time allowance for regulators to consider alternatives on how to deal with the technology, given the greater degree of contextual certainty.

2.3 | Analytical direction: Three regulatory interventions for crisis

Scholars of regulation emphasize that dealing with the introduction of new products and technologies is a primary objective of regulation (Black, 2010; Mandel, 2009). New technologies generate new difficulties, augmenting the presumed gap between existing statutes and regulations and what is regulated. As a consequence, both regulators and regulated entities can be uncertain about how emerging technology fits with existing rules and legislation (Lewallen, 2020). This is especially relevant in times of crisis (Ansell et al., 2010), where common regulatory approaches (e.g., Ayres & Braithwaite, 1992; Baldwin & Black, 2008; Coglianese et al., 2003; Gunningham et al., 1998) are generally not designed for situations of high uncertainty and urgency (Baekkeskov, 2016). This means that situations like the COVID-19 pandemic may call for other regulatory approaches beyond the more common ones.

One way to view different forms of regulatory approaches and how they deal with emerging technology in uncertain circumstances is through the lens of what are here called *rule-based*, *idea-based*, and *norm-based* regulatory interventions. This differentiation derives from neo-institutional theory, where Scott (2014) introduced a broad framework involving three pillars that describe how institutional elements impact social behavior. Inspired by Scott, the present study's point of departure is that regulatory agencies take on different roles and act as "agents" that attempt to influence and guide the behavior of regulatees through various interventions (Fligstein, 2001; Scott, 2003, 2008). These interventions involve different ways for how rules, ideas, and norms can formally and informally be sustained and imposed (Scott, 2008).

2.3.1 | Rule-based intervention

Rule-based intervention entails explicit investigation and control by regulatory agencies. Derived from the core idea of "command and control," rule-based intervention involves the use of formal instruments such as rule-setting, monitoring, and sanctioning activities to manage technology (Scott, 2014), (Baldwin, 1997). Regulatory agencies that make use of rule-based intervention are clear regarding what regulatee behaviors andwhat attributes of technology they expect. In essence, they sustain "the rules of the game" through the underlying mechanism of coercion (DiMaggio & Powell, 1983). Studies investigating what happens when regulators embrace formal control have been conducted in the areas of environmental regulation (Gray & Deily, 1996), labor regulation (Almeida & Carneiro, 2012), and food regulation (Fortin, 2016).

The main argument for a rule-based approach is that the introduction of laws, regulations, or rules is an act of the state using the force of the law, which helps to reduce uncertainty in two ways (Lodge & Wegrich, 2012): first, by clarifying expectations for all players of the game, and second, by enabling information gathering about regulatee behavior. Clear expectations can create higher levels of accountability, transparency, and consistency in obeying the law. Information gathering can enhance the basis for decision-making related to the monitoring of activities, sanctioning, or incentivizing. This perspective employs the idea that without adequate information, enforcing these rules will not achieve or could possibly undermine their intended objectives.

There are several limitations to this approach, which are amplified in crisis situations. One is the rigidity of rules, which can curb innovation (Lodge & Wegrich, 2012). In this study, this

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is a vital point, as regulators arguably should support emerging technology that can help combat a crisis. However, when time is limited, adequate information is difficult to obtain. Additionally, the cost of sustaining ubiquitous bureaucratic monitoring systems with potentially ambiguous rules is high. Sanctioning without sufficient information can also be risky, leading to unintended consequences. The adversarial approach represented by rule-based interventions is generally unwanted by regulators, and is often used as a last resort (Ayres & Braithwaite, 1992).

2.3.2 | Idea-based intervention

Regulation with the idea-based approach derives from what Black (2002) labels "regulatory conversations." These conversations work at the constitutive level of social reality, where regulatory agencies attempt to establish shared understandings through taken-for-granted beliefs (Cornelissen et al., 2015; Phillips et al., 2004). They frame what solutions and problems are conceivable (Gilad, 2014; Goffman, 1974) while also establishing definitions of situations (e.g., "market failure," "compliance," and "privacy violation"; Black, 2002, p. 165). Accordingly, regulatory agencies convey what they deem to be fundamental ideas and beliefs that underlie the interpretations of rules, norms, and target technology in the domain in which regulatees operate and technology emerges.

This type of approach has been used to understand international taxation and compliance (Picciotto, 2015), the regulatory evolution of financial markets in Europe (Thiemann & Lepoutre, 2017), and how the media industry is largely regulated by communication (Ali & Puppis, 2018). Outside the area of regulation, Fligstein (2001) sought to understand how different actors made strategic use of cognitive frames to modify the preferences of state actors in the European Union's (EU) Single Market Programs in the 1980s.

The advantages of idea-based regulation become clear in situations in which constantly keeping track of every actor and new technology becomes overwhelming and costly. When information is scarce, situations uncertain, and rules ambiguous (Black, 2002; Gilad, 2014), an idea-based approach can create certainty and inceptively influence the behavior of regulatees and the properties of technology. This approach differs from ordinary "dialogue," such as restorative justice dialogue (Braithwaite, 2017), in that it has a clear focus on the dissemination of fundamental values, rather than warnings of future inspections or harsher sanctions. It also differs from persuasion or education in that it entails shaping and constructing a specific view of orthodox conduct for technological development (Black, 2002; Picciotto, 2007).

One limitation of the idea-based approach is the fact that altering fundamental beliefs and ideas does not come easy (Barley & Tolbert, 1997), especially in relatively stable situations. Beliefs and ideas may be contested, and regulatees can have enough resources to sustain their existing ideas of technology, making the framing and belief-changing work by regulators more difficult. Changes in beliefs may occur mainly through windows of opportunity (Fligstein, 2001), meaning a crisis must be big enough that existing structures of ideas and beliefs are threatened.

2.3.3 | Norm-based intervention

A third possible style of regulatory intervention occurs through normative appeal (Burby & Paterson, 1993; Tyler, 2021; Winter & May, 2001). This norm-based approach focuses on moral duty and reasonableness (Bardach & Kagan, 2017). Regulators attempt to influence regulatees' behavior by emphasizing the rationale and appropriateness of specific laws and regulations, and by reinforcing norms (Gezelius & Hauck, 2011). This intervention is based on social values

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and focuses on shaming and praising regulatees. Shaming and praising come about when regulators convey information about expected conduct, establishing what constitutes "good" or "bad" behavior and thereby influencing regulatees' reputations (Bach et al., 2021) and perceived legitimacy (Rorie et al., 2018). Studies of regulators working through appeals to moral duty, appropriateness, and reasonableness have reported increased compliance, for instance in the context of environmental regulation (Winter & May, 2001) and tax regulation (Schwartz & Orleans, 1967).

One advantage of the norm-based approach is its distinct focus on regulatees' duties with respect to specific rules and laws, which creates social expectations. Praising and shaming provide clear signals to regulatees about how they should continue their work. By being less specific beginning at the formative stage regarding what technological attributes are expected, this approach remains open to new technologies (Hagemann et al., 2018).

One challenge with this approach is the difficulty of evaluating which social values are more or less important during a crisis (Boin et al., 2005). For instance, one can expect that determining the tradeoff between ensuring people's privacy and saving human lives involves a complex calculation (Akinsanmi & Salami, 2021). Additionally, emphasizing the reasonableness of rules and shaming or praising behavior can be difficult when some rules are only ambiguously applicable to a given emerging technology.

2.3.4 | The interplay between the regulatory interventions in crisis

The essentials of each intervention are summed up in Table 1. The table describes the three regulatory interventions and their relation to the two key features of crisis situations discussed above: uncertainty and urgency (Boin et al., 2005). Both features are expected to play a role when regulators make decisions about interventions during a crisis. The indicators in Table 1 provide direction for what I will look for in the empirical analysis to observe the different types of regulatory intervention.

All three intervention types involve influencing the behavior of regulatees, particularly with respect to emerging technology. They move along a spectrum from enforcing rules to shaping taken-for-granted ideas, and can potentially reinforce, complement, or interfere with each other (Scott, 2014). For instance, sanctioning can lead to public shaming, and the content of idea-based regulatory conversations can at times appeal to moral duties. Similarly, shaming and sanctioning can cause regulatees to change taken-for-granted ideas, which is more in line with idea-based regulation. However, rule-based interventions can also lead to an adversarial relationship between the regulator and regulatees, which can interfere with idea-based regulation (Black & Baldwin, 2010).

Overall, regulation in crisis situations is complex. Uncertainty concerning the crisis and technology, as well as how the levels of uncertainty change over time, creates a dynamic and unpredictable setting for regulatory agencies. The above discussion provides some initial direction as to how the regulatory interventions may relate to levels of uncertainty, time pressure, and regulators' experience with regulatees' responses. The empirical section of this study seeks to explore how these aspects may relate to one another.

3 | METHODS AND DATA

This is a single case study of privacy regulation concerning a specific technology, Smittestopp, operating within the context of public health control during a crisis. This can be considered a revelatory case (Yin, 2014), meaning that it is illustrative of technology regulation during a crisis, a hitherto relatively unexplored phenomenon. The case was selected with the goal of

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TABLE 1 Overview of regulatory interventions in crisis situations

Regulatory intervention	Definition	Indicators	Relation to uncertainty	Relation to urgency
Rule-based intervention	Regulation using formal instruments in line with command and control.	Enforcement, control, sanctions, incentives.	Rigid rules may curb the innovation and technological development needed to combat a crisis. Needs clear rules to enforce.	May take too long to be applied when rules are ambiguous. Used as a last resort if uncertainty is too high over an extended time-period.
Idea-based intervention	Regulation through communication of fundamental beliefs and ideas.	Informal conversations and framing of fundamental beliefs and ideas (general and context specific).	Suitable in situations of high uncertainty.	The communication of ideas and beliefs can be accomplished quickly, even with ambiguous rules. Long-term impact may be unclear.
Norm-based intervention	Regulation that emphasizes moral duty and reasonableness.	Communication of duty, reasonableness, and shaming/praising.	Requires some knowledge about regulatees' activities and technology. Needs somewhat clear rules to know which reactions are relevant.	Can work faster than rule-based intervention as formal case processing is not required.

Note: Own compilation, drawing on Lodge and Wegrich (2012), Black (2002), and Bardach and Kagan (2017).

depicting key aspects of the regulation of emerging technology and understanding how and under what conditions regulation in such special situations occurs. To do this, I provide rich empirical descriptions of how regulation evolved over time and consider perspectives from both regulators and regulatees. This provides the basis for the general propositions concerning the regulation of technology in times of crisis presented in the concluding section of the article.

Documents and interviews constitute the main sources of data for this study. The documents depict the formal communication between the regulator and the regulated entities and are publicly available, reflecting a context with high transparency regarding public sector decision-making. Moreover, the organizations provided additional information through evaluation reports and press releases about their reasoning concerning their regulatory decisions (DPA) and technological development (NIPH and Simula). To clarify, Simula is a public research organization in Norway that provided technical assistance to NIPH as it developed Smittestopp 1. For Smittestopp 2, NIPH received assistance from a private firm called Netcompany.

Government statements and reports provide information about the coronavirus crisis in general, the apps' role in the overall management of the crisis, and relevant laws and regulations. One particularly rich source of information is the first official evaluation report by the Norwegian Corona Commission, which is 456 pages long (see Kvinnsland et al., 2021).

Additionally, the data comprise 48 interviews with actors in various organizations involved in the management of the COVID-19 pandemic in Norway. Sixteen semi-structured interviews were conducted by the author with central actors involved in the regulation process from DPA, NIPH, and Simula. The main criterion for selecting informants was the actors' direct involvement in the regulation process, either as a regulating party or a regulated party. A second

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criterion was that informants should have a range of roles in their respective organizations in order to provide different perspectives on the pandemic and the regulation process.

The informants from the DPA were specifically selected because they played a central role in regulating the Smittestopp app (through conversations with regulated entities, in the formal case processing, and in the sanctioning of the app). The informants were first identified through the formal documents, which are publicly available on the websites of DPA and NIPH. Furthermore, I used snowball sampling to find other actors who were involved or who could provide interesting insights into the regulation process but who were not explicitly mentioned in the publicly available documents. Within the DPA, interviewees included legal advisers, information officers, and directors. Interviewees from Simula were computer programmers and managers responsible for developing the app, while interviewees from NIPH included legal advisers and managers involved in or responsible for the development of Smittestopp 1 and 2. Overall, seven interviews were conducted at the DPA, four at Simula, and five at NIPH. The interviews lasted between 30 and 90 minutes, and were recorded and transcribed. Due to the nature of the crisis itself, all interviews took place via Zoom between September 2020 and August 2021. This time-period provided an opportunity to follow the regulatory development with special proximity, and to see the changes that occurred in the transition from Smittestopp 1 to Smittestopp 2.

In the semi-structured interviews conducted by the author, the interviewees were asked to describe how they understood the crisis situation, relevant legislation, the role of technology and privacy in the pandemic, and how they experienced uncertainty and ambiguity throughout the crisis. They were also asked what lessons could be learned from the process of developing or regulating both the first and the second Smittestopp apps. The interviews provided valuable insight into the regulatory conversations that took place prior to the formal communication and the written documents, as well as into other phases of the regulation process.

In addition, the independent official Corona Commission in Norway conducted 32 interviews as part of its evaluation of the Norwegian government's overall management of the COVID-19 pandemic. These interviews offer very rare insight into the overall crisis management approach of the government and the role that technology played in dealing with the pandemic. The interviews were conducted with political and administrative leaders who were key decision-makers during the pandemic, and the transcripts are available to the public (in Norwegian) on the Corona Commission's website (see Corona Commission, 2021). Examples of actors who were interviewed include the head of NIPH, the Minister of Health, the Prime Minister, and leaders in other prominent public health organizations. These interviews lasted between 60 and 120 minutes and provide an understanding of the overall management of the crisis, as well as considerations, goals, and evaluations related to digital contact tracing.

Lastly, I attended public digital conferences and meetings with the Norwegian DPA, NIPH, Simula, and other experts in the field (see NBT, 2020; PrivacyRules, 2020; Simula, 2020a; Tekna, 2020). This allowed me to observe how some of the actors and experts talked to each other about the crisis and about Smittestopp.

The data as a whole cover the government's general crisis management approach as well as information exchanges between the DPA and NIPH (or the assisting developers) that took place between March and December 2020. Appendix A provides an overview of the data sources used in the study.

The documents and the transcriptions were initially analyzed with an open coding process looking for recurrent themes. Early on, it became clear that the different types of regulatory intervention could be organized into various phases. From there on, relevant evidence and statements were categorized into different phases. By specifically looking for the indicators derived from the three types of regulation that gave initial direction to the analysis, I was able to observe the dynamics between the different types of intervention.

The different indicators were found partially in different types of data. The rule-based aspects were found predominantly in written documents, as they are formal interventions, but

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the interviews also provided a better understanding of these decisions. As expected, the idea-based aspects occurred during conversations between the different actors, as revealed by the interviews. The norm-based aspects appeared in written documents as explicitly mentioned values around shaming and praising behavior.

I analyzed my own interviews in conjunction with the documents from the DPA and NIPH by comparing and tracking the different perspectives on regulation, uncertainty, technology, and privacy in the different phases. These perspectives were considered in relation to the regulatory interventions decided upon by the DPA. Furthermore, I analyzed the data from the Corona Commission (report and interviews) to gain an informed understanding of how central actors in the government and NIPH perceived uncertainty with regard to the overall management of the crisis and which measures were considered and prioritized in dealing with the pandemic. I then analyzed the role that the Smittestopp app played during the pandemic, as well as the role it could have potentially played, as perceived by the central actors in the government. This was essential for understanding what pressure the DPA experienced while making decisions, what evaluations they had to make, and whether their regulatory efforts were successful.

Overall, the data analysis enabled me to gain a comprehensive understanding of the different perspectives on regulation during the crisis held by both the regulating agency, the DPA, and the regulated entities, with NIPH at the forefront, as well as what assessments were made under these circumstances.

4 | EVOLUTION OF PRIVACY REGULATION THROUGHOUT THE COVID-19 CRISIS

COVID-19 was first detected in China in December 2019. It quickly developed into a highly complex mega-crisis involving the entire world, with governments facing difficult trade-offs between health, economics, and human rights. In Norway, the first confirmed case of infection was registered on February 26, 2020. On March 12, the Norwegian government introduced intrusive control measures, and NIPH began development of Smittestopp 1. The government declared the situation under control on April 6 (Kvinnsland et al., 2021). Table 2 summarizes the course of events in Norway.

Before going into more detail on the different phases of the crisis, I will first provide some background information about the general mission of DPAs and about the development of Smittestopp 1 and 2 in Norway. DPAs were created in many European countries throughout the 1970s, 1980s, and 1990s along with the diffusion of data protection legislation, although several non-European countries now also have similar regulatory agencies (Bennett & Raab, 2020). These agencies go under various names, and in some countries, such as the United States, there is no single authority on privacy or data protection.

The Norwegian DPA shares its formal mission with all EU DPAs, which is to regulate data privacy through the EU General Data Protection Regulation (GDPR). The GDPR was implemented in 2018 and aims to strengthen and harmonize privacy regulation in the processing of personal data across the European Union. It intends to give citizens more control of their own personal digital information and strengthens financial sanctions for cases of non-compliance. DPAs often take on various roles in their task of regulating data privacy, playing at various times the role of consultant, policy adviser, educator, or enforcer (Bennett & Raab, 2020).

The Smittestopp app was developed in two versions, Smittestopp 1 and 2. NIPH had assistance from Simula in developing the first version, and from Netcompany in developing the second. Both apps' primary function was to assist human contact-tracing by tracking the movement patterns of citizens in order to limit the transmission of COVID-19 (Simula, 2020b).

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TABLE 2 Overview of 2020 events and regulatory action taken during the COVID-19 pandemic in Norway

Date	Action
March 12	Initiation of extensive infection control measures in Norway and the start of Smittestopp 1
March 27	Regulations issued on digital infection detection
April 4	Expert group announced
April 6	Virus transmission considered under control by Norwegian government
April 9	Expert group preliminary report
April 16	Launch of Smittestopp 1
April 27	Formal inspection by DPA
May 8	First formal letter from DPA to NIPH
May 18	Expert group delivers final report
May 19	DPA formally demands answers from NIPH
June 1	Initial answer from NIPH
June 8	NIPH sends missing information
June 12	Notification of coming ban
June 16	Deactivation of Smittestopp 1 by NIPH
July 6	Official ban of Smittestopp 1 by DPA
September 28	Project start for Smittestopp 2
October 15	DPA formally investigates Smittestopp 2
December 21	Launch of Smittestopp 2

After citizens downloaded the app on their smartphones, the app would notify them once they had been in close contact with someone who reported having been infected by the coronavirus.

Smittestopp 1 worked using both Bluetooth and GPS to track the virus and detect other users (NIPH, 2020a). The information collected by the app was stored centrally at the NIPH for 30 days for research purposes (Simula, 2020b). In Smittestopp 2, GPS tracking was removed, and data was decentralized, being stored only on users' phones. Additionally, open-source code was used in the development of Smittestopp 2; Smittestopp 1 had been closed source.

The significance of open-source code is that the source code of the technology is publicly available for anyone to review and suggest improvements (Fitzgerald, 2006). However, this does not mean that anyone can change the code itself. Closed source, on the other hand, means that the code cannot be accessed by anyone other than the developers themselves. In general, there are advantages and disadvantages to both modalities. However, one can imagine that if a technology is controversial, having open-source code could contribute to transparency, which might be needed to legitimize such an intrusive measure.

4.1 | Phase 1: Development of the crisis and the emergence of new technology

NIPH was not the only actor in the world creating such apps. Computer developers across the world were experimenting with a variety of alternative technologies (Grekousis & Liu, 2021). As these types of technologies were entirely new, at least in a Western context, neither the public, computer developers, nor regulators knew exactly how they would work. This meant that there was no blueprint for how regulators should respond to such technology and no experience on which to base decisions. During the introduction of Smittestopp at the beginning of the crisis, the head of the DPA emphasized the agency's initial communicative approach: "we had a

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dialogue with the Norwegian Institute of Public Health and the app developers about privacy impact assessments, about risk and vulnerability analysis, but we only gave verbal input." At this early stage, the DPA also stressed to NIPH and Simula the importance of "privacy by design" (Interviewee 6), meaning that any privacy measures should be built into the technology from the start and integrated throughout the entire technological development process, rather than simply implemented post-development. This was seen as a proactive measure, necessary to ensure privacy and to allow citizens to gain control over information about themselves. In these conversations, NIPH replied that they wanted more understanding from the DPA regarding the urgency of the situation and the overall infection control assessments (Interviewees 29, 30). For instance, a central actor at NIPH said that "we were not able to convince the DPA that we would eventually introduce the necessary privacy measures, but we had them on our list" (Interviewee 12). These included data minimization, reducing data storage time, and assessments of technology change, meaning privacy by design. This indicates that the DPA attempted to impose its ideas upon NIPH/Simula, and that NIPH/Simula resisted by trying to defend their own choices.

The DPA emphasized the importance of transparency, showing all stakeholders that whatever technology was to be involved must be available for outside expert review (Interviewees 6, 9). In a press release on the DPA's website in March (DPA, 2020a), the head of the DPA stated two essential ideas they had communicated:

> In order for citizens to download the app, there must be full transparency from the authorities. Openness builds trust, and only then will more people use the solution. But it is an intrusive measure that the state is now taking in this very special situation. This type of legislation is only legal if it constitutes a necessary, suitable, and proportionate measure in a democratic society.

These are general encouragements, reminding regulated entities and society at large about what fundamental values are at stake. Transparency is seen as a precondition for trust in political institutions and for a democratic society. Additionally, in the same press release, the DPA strongly emphasizes voluntary usage of the app, as well as information about how citizens can withdraw consent (DPA, 2020a).

4.2 | Information in the early stages of the pandemic

In March and the start of April, information was scarce about both the app and the virus. The first written source for understanding Smittestopp was found in the specific regulation mandating its creation (RDI, 2020). The text of the regulation text is relatively short and was issued by the Ministry of Health and Care Services (MH) on March 27. It states that the app's purpose is to surveil citizens in order to monitor the spread of infection and to assess the effect of infection control measures (Kvinnsland et al., 2021). The regulation further declares which data are relevant in monitoring infection spread, and who has access to these data (RDI, 2020). The text of the regulation has very little information about the actual technology, meaning it did not contribute significantly to enhancing the DPA's knowledge.

Recollecting past events, a director at Simula stated in an interview that this regulation was specifically written for Smittestopp by the MH (Interviewee 3). In hindsight, this appears to give a false sense of unambiguous rules. According to informants in the DPA, as the MH had not significantly involved the DPA in this process, the regulation conflicted with existing privacy laws (Interviewees 5, 7). Further illustrating the ambiguity of rules at the start of the crisis, in an online debate with the DPA in June 2020, the director at Simula declared, "the DPA focuses

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on laws, we focus on realities" (NBT, 2020). This suggests that the regulatees found the privacy laws in general to be somewhat ambiguous—even rules that were tailored for themselves. This is also in accordance with the perceptions of all tracking apps, where the ethical and legal boundaries are generally unclear (Gasser et al., 2020).

Eight days after the institution of the regulation, the MH assembled an expert group to assess privacy and security issues related to personal information on the app, which had yet to be launched (Expert-Group, 2020a). Due to lack of time, the expert group focused only on security and not privacy in its preliminary report, which was delivered just 5 days after the groups' formation. Thus, the group's findings did not help to reduce uncertainty for the DPA. The group claimed that privacy would be easier to analyze once larger parts of the system were finished (Expert-Group, 2020a). This evaluation made the DPA more suspicious, as the agency could not know whether any privacy measures were included at this early stage. Without any assessments of potential privacy concerns, Smittestopp was launched to the public on April 16. At this point, neither the DPA nor the public had access to risk analyses, privacy assessments, or the protocol documenting the developmental stages of the app.

4.3 | Phase 2: No change in technology

Eventually, the DPA realized that it had not been successful in changing the behavior of the app developers or the trajectory of the technology, as far as it knew. According to the head of the DPA, the agency saw that its way of employing informal communication had not adequately achieved its goals (Interviewee 6). This convinced it to change interventions. Too much time had passed without the DPA knowing what the app developers were up to (Interviewee 6).

On April 27, the DPA announced that it would initiate formal inspections of Smittestopp (DPA, 2020b). By this point, approximately 1.5 million (out of 5.4 million) Norwegians had downloaded the app (NRK, 2020a). The DPA retrieved three types of documents from the developer: privacy impact assessments, risk and vulnerability analyses, and the processing protocols. These documents were examined closely because they show precisely what considerations were taken regarding privacy by NIPH. The DPA found that there were clear shortcomings in the risk and vulnerability analyses, and that the processing protocol was not explicit about what personal data were processed by the application and for what purposes (DPA, 2020c).

After the start of the formal inspection, communication between DPA and NIPH became formal and written, and informal conversations ceased (Interviewees 9, 12). In a letter on May 8, the DPA told NIPH that it would instruct them more thoroughly, in different stages (DPA, 2020d). With this letter, the DPA went through the relevant general laws and privacy laws in detail, specifying their basic principles and appropriate applications. By initiating the investigation, the DPA displayed its skepticism, and the decision received media attention (NRK, 2020b). The DPA was active in media debates around privacy and provided justifications for the investigation, which can partly be interpreted as public shaming of the app. A central actor in Simula said in an interview that some personnel felt that this project was lost due to the negative media attention (Interviewee 3).

Eleven days later, on May 19, the DPA formally requested answers from NIPH with a deadline of June 1. The questions the agency demanded answers to concerned the specific purposes of the personal data collected in the app, current results, the justification for using GPS data and not just Bluetooth data, the justification for central storage of data rather than decentralized storage on citizens' phones, and the usefulness of the application in its current state and at that point in the COVID-19 pandemic (DPA, 2020d, pp. 8–10).

Meanwhile, the expert group completed its report on May 18. Its conclusions were that privacy was not properly ensured on the app, and that data minimization could be achieved. The

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group was clear in recommending the use of open-source code in order to allow citizens to know what type of information was collected and as a measure to ensure the protection of private information (Expert-Group, 2020b). This gave the Norwegian DPA some idea about what type of technology it was dealing with. Additionally, the expert group proposed changes to the original government regulation for the app, confirming the uncertainty that the DPA experienced and the ambiguity that NIPH/Simula experienced.

4.4 | Phase 3: answers and action

On June 1, the DPA received answers to some of its questions from NIPH. However, the DPA demanded more documentation on June 8, as the initial documents were not considered to be sufficient, something NIPH disagreed with (Interviewee 15). Four days later, on June 12, the DPA notified NIPH that it would temporarily ban Smittestopp. The agency stated that based on the knowledge it had gained from the documents and the expert group report, the privacy violations were too severe for the app to be allowed to continue operating (DPA, 2020e). It also agreed to NIPH's request for a meeting, but made clear that all input to the case needed to be provided in writing. This shows how the DPA wanted to keep any subsequent interaction between regulator and regulated entities at a formal level.

NIPH stopped its work with personal data on June 16, and at this point Smittestopp 1 was rated by Amnesty International as one of the most intrusive apps in the world (Amnesty International, 2020), intensifying the public shaming already started by the DPA. The DPA permanently banned the use of Smittestopp 1 on July 6. In its official ban letter to NIPH, the DPA further specified that any activity from then on would be closely monitored and controlled (DPA, 2020f).

4.5 | Phase 4: Smittestopp 2

After the ban, NIPH was still committed to aiding manual infection tracking in Norway through the use of technology. It began reworking the app in September 2020, with assistance from the private firm Netcompany (NIPH, 2020b). This time, the development of the app was approached completely differently. Many lessons were learned during development of the first app. Technology and privacy experts were included in development, and the DPA was continually updated and consulted throughout the process (Interviewees 6, 14). Nevertheless, the DPA reminded NIPH that it was closely monitoring the new app and that it had the authority to demand and obtain all relevant information for inspection (DPA, 2020g).

Technically, the new app included only Bluetooth and not GPS and made use of decentralized data storage. It was also based on open source, ensuring the needed transparency (NIPH, 2020b). Furthermore, NIPH spent more time attending to the technicalities and privacy issues that had been criticized previously (Interviewees 12, 15). Regarding context, uncertainty was lower at this time, and the government had more knowledge about the crisis (Kvinnsland et al., 2021). NIPH had also learned more about how to interpret the law from the DPA. In an interview, the head of the DPA stated that the DPA had told NIPH what type of information it had to provide to citizens downloading the app (Interviewee 6).

In December 2020, the DPA said that the new app was more privacy friendly and praised NIPH for its "good assessments" (DPA, 2020h). It added that it could not guarantee that it would not intervene once more, as this was complicated technology. On December 21, 2020, the app was launched. As of September 2021, it is still in use and the DPA has not intervened since, implying its approval.

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5 | DISCUSSION AND CONCLUSION

The theoretical section of this article proposed three different types of regulatory intervention—rule-based, idea-based, and norm-based—for regulating emerging technology in times of crisis. All three approaches display quite different perspectives on regulation, each with their strengths and weaknesses. It was suggested that different levels of uncertainty, time pressure, and regulator's experience with regulatees' responses would impact which type of regulatory intervention regulators would be likely to embrace. Given these analytical directions, the following discussion summarizes the empirical findings and seeks to understand the various regulatory interventions chosen by the DPA when regulating Smittestopp. Building on this discussion, implications for further research are considered.

As the analysis reveals, determining regulatory intervention during the COVID-19 crisis was not an easy task for the Norwegian DPA. The data show that the DPA changed its approaches throughout the crisis, primarily based on knowledge of the technology and of the activities of regulatees, as well as its own experience with regulation and regulatees' responses to this regulation. Table 3 provides an overview of the uncertainty and urgency of the crisis, as well as the DPA's interventions.

In the beginning of the crisis, the DPA consistently conveyed an openness to new solutions and stated that privacy laws were not necessarily a hindrance to technological development. The work by the DPA was primarily communicative and idea-based, taking the form of either

TABLE 3 Timeline of regulatory interventions during the COVID-19 crisis

Regulation phase	Empirical evidence	Regulatory intervention	Uncertainty	Urgency
First phase: March 12–April 26, 2020	DPA converses with NIPH/Simula, emphasizing voluntariness, transparency, democracy, privacy-by-design, and open-source code.	Idea-based intervention.	High uncertainty (scarce information about the app and the virus).	High urgency (critical demand for information for the DPA on how to regulate such technology).
Second phase: April 27–June 11, 2020	DPA undertakes: (1) Inspection, auditing of technology. (2) Public shaming through media, stating rationale for rules.	Rule-based (and partly norm-based) intervention.	High uncertainty (still scarce information about the app and the virus; DPA does not know what NIPH/Simula are up to).	High urgency (DPA realizing that regulated entities did not change their behavior).
Third phase: June 12–October 5, 2020	DPA bans technology and ensures future control.	Rule-based intervention.	Medium uncertainty (enough information for the DPA to ban the app, in its opinion).	Medium urgency (NIPH stops its work on personal data).
Fourth phase: October 6–December 21, 2020	DPA investigates and controls new technology. Also praises NIPH for its work. DPA approves technology.	Rule-based and norm-based interventions.	Medium/low uncertainty (DPA knows what the technology does and is involved in the process. Government knows more about the virus).	Low urgency (DPA has control and adequate information about the app).

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direct dialogue with the regulated entities (NIPH and Simula) or updates to its website and media. NIPH and Simula appeared to perceive the rules as ambiguous, creating an opportunity for the DPA to provide its interpretation of privacy rules. As shown in Table 3, the DPA was generic about what fundamental beliefs should underlie the technology—for example, transparency—and specific when it came to the measures within the technology—for example, privacy-by-design—both of which are examples of idea-based regulation. This initial communication focus is consistent with findings in a recent study of crisis management in Norway, where the government at large focused on creating a fundamental common objective for combating the coronavirus crisis by shaping shared understandings of what the crisis was about and how society must deal with it (Christensen & Lægreid, 2020).

Lack of information about the contact tracing app and lack of response from regulatees was what prompted a change in regulatory intervention, causing the shift to the second regulation phase. This happened about six weeks after the initial announcement of the app (see Table 3). During this phase, the DPA formally inspected NIPH and Simula in order to retrieve information with the goal of reducing uncertainty about the technology. Throughout this stage, the DPA also repeatedly stated the reasons for inspection and the rationales for relevant laws, whether on its website, in Norwegian media, or to NIPH directly; these repeated statements can be regarded at least in part as a form of public shaming. Hence, here we see a predominantly rule-based approach (inspection) with certain facets of a norm-based appeal (naming and shaming).

Based on the regulatees' response to the regulation, the DPA again saw no other option but to alter its approach once more, moving to a third phase of regulation. At this stage, however, while the parameters of the crisis were still uncertain, uncertainty about the technology had been reduced as the DPA now had clear knowledge about what technological and privacy measures the regulatees had and had not implemented. With increased certainty, the DPA expanded its formal efforts by banning Smittestopp 1 and ensuring that it maintained future control of app development. The regulation at this stage was thus solely rule-based. With the introduction of Smittestopp 2 in phase four, the DPA remained in control but also praised the work of NIPH.

Consequently, the preceding elaborations suggest that regulatory interventions on the part of DPA depended on the level of uncertainty with respect to the crisis (due to the virus itself and the effects of lockdowns) and the contact-tracing technology, and how these evolved over time. To sum up, at the outset of the crisis, the DPA completely followed an idea-based approach. In phase two, rule- and norm-based interventions were embraced. Thereafter, the DPA pursued a strictly rule-based approach with the ban of the contact-tracing app. Finally, after the creation of Smittestopp 2, the DPA controlled the technology with a rule-based intervention but supported the intervention with norm-based elements.

Some propositions may be formulated based on the analysis above regarding the study of other types of (emerging) technologies in extreme situations and the study of regulation in crisis situations more generally. One can expect to see idea-based interventions at the start of a crisis, because regulators are likely to keep an open mind regarding ways to combat it. At this point, there is expected to be a mixture of perceived ambiguous application of rules, uncertainty regarding the nature of the crisis and the emerging technology, and the need to facilitate technological development to combat the crisis. This in turn creates an opportunity for regulators to communicate their own ideas about and interpretations of rules and technology and what values are important in crisis situations. Regulators might do this in order to attempt to reduce uncertainty, but also to impose their own ideas in order to impact the cognitive structures and beliefs of regulatees within the relevant regulatory field (Black, 2002).

Subsequent regulation in crisis situations will depend on whether regulatees are responsive to the initial interventions by the regulator, and whether uncertainty is reduced. On the one hand, one can expect that if regulators are successful in their interventions, they will want to

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avoid an adversarial relationship and will support the work of regulatees using norm-based measures such as praising. On the other hand, one can expect that if uncertainty is not reduced and regulatees are non-responsive, regulators will instead embrace rule-based measures such as investigations in order to confrontationally force a reduction of uncertainty regarding technology, likely in combination with norm-based shaming.

Even further into the crisis, there is a presumed increase of knowledge among government officials, the public, and relevant actors about the extreme situation and its impact on society. Additionally, interactions with regulatees provide the regulator with knowledge about the technology and about regulatees' behavior. Thus, on the one hand, one can postulate that a rule-based intervention will intensify by shifting to the use of sanctions, control, and command (as opposed relying on investigations) in situations in which time pressure increases and regulatees have not responded to either initial or subsequent interventions. On the other hand, if norm-based interventions have in fact been previously successful in reducing technological uncertainty earlier in the crisis, it is also likely that regulators will continue to pursue norm-based interventions in order to avoid an adversarial approach. This may occur in conjunction with formal incentives associated with a rule-based intervention. Idea-based interventions are highly unlikely at this point simply because time pressure is too great for this approach to have a significant impact.

Overall, idea-based regulation emerges as an opportunity for regulators to structure beliefs and ideas regarding technology when knowledge is limited, uncertainty is high, and time is pressing, as well as when other measures run the risk of curbing the necessary development of technology. Norm-based and rule-based intervention in various forms are more likely to appear as a crisis develops and uncertainty is reduced.

At a general level, this study contributes to deepening our understanding of the hitherto underexplored phenomenon of regulating emerging technology in crisis. Its findings demonstrate that we need to understand the exercise of different regulatory interventions based on levels of uncertainty and urgency. Moreover, the study suggests that idea-based regulation through regulatory conversations and communication is a key site of analysis when seeking to understand regulation in the context of crisis and emerging technology.

The suggested propositions can be tested on other digital tools developed during the COVID-19 pandemic. These tools involve big data, artificial intelligence, deep learning models, 5G technology, geospatial technology, robotics, smart applications, telemedicine, blockchain, and the Internet of Things (Mbunge et al., 2021). Such technologies present puzzles for regulators for both the present and the future. These technologies can also emerge in sectors such as finance, climate, or energy. Other types of technologies, like military technology, nanotechnology, or vaccines, are likewise often developed under conditions of great uncertainty in response to crisis. These technologies develop quickly, and often have unclear implications in both legal and moral terms (Mandel, 2009), which requires an intricate understanding of how they are regulated.

This study has several limitations. First, the propositions presented here are specifically related to crisis situations, which means that in more ordinary or stable circumstances they may not have the same applicability. Nevertheless, idea-based regulation is available outside of crises, although its effects may be uncertain and its outcomes are likely to be contested (Gilad, 2014).

Second, this study of how the dynamics of the three regulatory interventions can unfold must be considered in light of the political and administrative-legal domain in which they occurred. Norway is a country where the regulatory capacity of agencies is generally high. In this article's empirical case, the regulator has the final word, meaning the regulator can weigh its options and ultimately choose to sanction a technology that could potentially be vital in combating the pandemic. Not all regulators have such capacities, and this study may thus be more relevant for countries and policy sectors with more powerful regulators.

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Additionally, this study concerns a case of "regulation inside government" (Hood et al., 1999), where one government body regulates another. Under the GDPR framework in Europe, and in the case of DPAs in Europe, it is reasonable to assume that this would be the case for private actors as well. However, whether this is the case under different privacy laws and with different regulatory agencies is an empirical question that future research should seek to answer.

Moreover, the COVID-19 pandemic spans a relatively long period of time, which may suggest that the dynamics among regulatory interventions observed in this study could be different in crises with shorter timescales. Relatedly, the COVID-19 pandemic is not the first crisis in which government and regulators have needed to balance privacy, individual freedom, and surveillance. For instance, there have been health crises in the past where the relevance of epidemiological, technological, or governmental surveillance has been emphasized. Two examples are the 1957–1958 global influenza pandemic (Flahault & Zylberman, 2010) and the 2009 global swine flu pandemic (Baekkeskov, 2016). In both cases, governments across the globe had to monitor and contain a virus in order to avoid (extremely) high infection rates and to eventually facilitate vaccination.

Future research may take inspiration from the study at hand and investigate regulation in previous health crises, or regulation of other types of technology, in order to observe changes over time and to observe changes over time from a global perspective and make comparisons. Overall, the analytical directions and empirical findings of this study can guide researchers in their study of future events as well as of past crises, allowing us to gain a more informed understanding of regulatory dynamics in crisis situations.

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APPENDIX A: OVERVIEW OF DATA SOURCES

Time period	Data sources
Smittestopp 1 (March–July 2020)	**DPA and NIPH documents:** DPA (2020a, 2020b, 2020d, 2020e, 2020f), NIPH (2020a, 2020b) **Laws:** RDI (2020), Personal Data Act (2018) **Expert-Group reports:** Expert-Group (2020a, 2020b) **Conference/debate:** Tekna (2020), NBT (2020) **Podcast:** From May/July 2002, DPA (2020c) **Media:** NRK (2020a, 2020b)
Post-ban and Smittestopp 2 (July 2020–January 2021).	**DPA and NIPH documents:** DPA (2020g, 2020h), NIPH (2020b) **Commission evaluation:** Kvinnsland et al. (2021). **Evaluation report:** Simula (2020b) **Interviews:** 16 interviews with DPA, NIPH, and Simula +32 interviews with ministers and top administrative leaders (Corona Commission, 2021) **Conference/Debate:** PrivacyRules (2020), Simula (2020a) **Podcast:** From October/December, DPA (2020c)

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