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## article

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# How the governance of and through digital contact tracing technologies shapes geographies of power

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In this article, we use the COVID-19 pandemic to study governance through digital technologies. We investigate 'digital contact tracing' (DCT) apps developed in Austria and Norway and find their emergence, contestation and stabilisation as moments in which norms and values are puzzled through, and distributions of power change. We show that debates on DCT apps involved disputes on 'digital citizenship', that is, on the scope and nature of data that authorities are allowed to collect from citizens. Remarkably, these disputes were settled through the enrolment of a framework developed jointly by Apple and Google. Software became akin to a constitution that enshrined understandings of good citizenship into technological design, while also being a means through which geographies of power materialised. This article contributes to literature on technological governance by showing how the rising salience of technologies in governance transform political geographies and, as a consequence, democratic lives.

**Key words** technology policy • digital technologies • citizenship • co-production • constitutional moments • digital contact tracing (DCT) • COVID-19 pandemic • technological governance

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## Introduction

The COVID-19 pandemic exemplifies the salience of technologies in the governance of contemporary societies. As the virus spread from Asia to Europe in early 2020, policymakers in European countries turned to law to stop the exponential growth of infections. They closed national borders and imposed lockdowns, defining the basic

needs for which citizens could leave their homes. However, when it became increasingly clear that the virus would not disappear as quickly as it had appeared, policymakers also turned increasingly to technologies to re-enable some forms of public and economic life while still seeking to 'contain' the virus. The technologies were manifold. They included low-tech devices, such as face masks, infrastructure-intensive technologies such as tests and vaccinations, and digital devices such as apps that ventured into transforming citizens' private smartphones into public healthcare infrastructures.

Thus, the pandemic demonstrates that we cannot grasp contemporary governance without exploring how technologies are involved in efforts to govern societies. This article engages with the debates that accompanied the emergence of 'digital contact tracing' (DCT) apps in Austria and Norway. We used them as a case to make sense of the governance of *and* through technologies of contemporary societies and to map how political geographies are transformed as societies become ever more enmeshed with technologies.

Several scholars at the intersection of Policy Studies and Science and Technology Studies (Barry, 2001; Prainsack, 2008; Callon et al, 2011; Jasanoff, 2016; Laurent, 2017) have underlined the significance of technologies in the governance of contemporary democracies, noting that technologies are at once objects or matters to be governed *and* instruments and agents that govern. For instance, Gottweis argued that technologies are '[n]ot only the object of governance, such as in regulation policies, but they can also be seen as something through which [the] governance [of life] operates' (Gottweis, 2008: 22). Jasanoff noted that technology 'rules us much as laws do. It shapes not only the physical world but also the ethical, legal, and social environments in which we live and act' (Jasanoff, 2016: 9).

However, in practice, Policy Studies have engaged primarily with the governance of technology, paying less attention to the governance *through* technologies. Scholars have explored how state authorities and other democratically legitimised political agents govern technologies (Gottweis et al, 2008; Herrmann, 2009; Braun and Schultz, 2010), and have made recommendations on how authorities should govern technologies. In this article, we contribute to the scholarship on technological governance while also seeking to extend its scope from how democratically legitimised authorities oversee technologies, to how technologies transform political geographies – that is, those geographies of 'power and morality' (Jasanoff, 2015: 22) that distribute responsibilities and legitimise power and authority in democratic governance in often tacit ways.

Digital technologies make such an expansion of attention to transformations of geographies even more timely (Redden, 2018). They are 'developing trans-national networks, triggering new forms of resistance, solidarity and violence, while territorial borders are being simultaneously transgressed, fortified and distorted' (Papanastasiou et al, 2021). Previous research on digitalisation highlighted how 'platform companies', such as Apple, Google and Amazon, transform political economies (Dijck et al, 2018; Zuboff, 2019; Prainsack, 2020). They also transform political geographies, reshuffling and rescaling distributions of power and authority (Sharon, 2018; 2016; 2020). Digital technologies reconfigure relations and hierarchies between private sector, governmental and civil society organisations (Meijer and Boon, 2021). In addition, they mediate peoples' access and communication to public authorities and vice versa.

This article engages with the case of DCT apps, mapping the political geographies that coemerged with this instance of technological governance. We explored the dynamics in the emergence of these apps in Norway and Austria. Both countries were

pioneers in developing such apps in Europe in spring 2020. We asked: how did the governance of and through technologies work out in practice at the two sites? Which actors shaped this phenomenon, and with which means? Comparing differences and convergences across sites helped us map the political geographies that co-merged with (and through) DCT apps, and the means that crystallised them.

## Engaging with the emergence of digital contact tracing apps as a constitutional moment

When the virus SARS-CoV-2 began to spread in Europe, authorities used various technologies to manage the pandemic. An article in the renowned journal *Science* was one of the first to suggest epidemic control with ‘algorithmic instantaneous contact tracing assisted by a mobile phone’, deeming manual contact tracing too slow (Ferretti et al, 2020). From spring 2020 on, digital apps for contact tracing began to mushroom in European countries, becoming ‘one of the largest experiments in public health surveillance ever attempted’ (Blasimme and Vayena, 2020: 762). Policy scholars weighed in on this experiment, providing normative guidance on how DCT apps should be designed and overseen (Lucivero et al, 2020) and exploring citizens’ attitudes towards such apps (Zimmermann et al, 2021). Some also unpacked the politics of DCT apps, for example, shedding light on discussions of DCT apps in the French parliament (Rowe et al, 2020) or scrutinising how Google and Apple ended up being ‘portrayed as champions of privacy’ by data protection activists’ (Sharon, 2020). Drawing on Sharon’s work, we use DCT apps as a case that can help improve our understanding of technological governance.

We based our research on the framework of ‘coproduction’ (Jasanoff, 2004), which points to situations or ‘moments’ in which technologies emerge as particularly suggestive to explore the mutual shaping of solid technologies and liquid values and norms (Hurlbut et al, 2020; Jasanoff, 2004; 2011; 2016; Jasanoff and Metzler, 2020; Metzler, 2020). In such moments, pioneers of technologies entangle technical devices into ‘visions’, foregrounding normative dimensions that make the use of technologies desirable and legitimate (Hilgartner, 2015). Pioneers mobilise ‘common goods’ that ‘justify’ technological innovations (Sharon, 2018), at once defining problems that technologies might help to fix and envisioning worlds that technologies might enable (Morozov, 2013; Hilgartner, 2015). However, other actors, including competitors, public agents or civil society actors, contest the techno-moral visions of pioneers. They mobilise ‘stakes’ (Dussauge et al, 2015) or ‘matters of concern’ (Bellacasa, 2010; Callon et al, 2011) that pioneers might neglect or silence. And such actors raise ‘issues’ that they deem authorities need to take care of, often talking on behalf of a public they consider to be affected by the consequences of emerging technologies (Dewey, 1954).

Moments in which technologies emerge are thus particularly instructive for engagements with technological governance. Such moments can be approached as ‘constitutional moments’ (Hajer, 2003; Jasanoff, 2011). When technologies emerge, and visions and norms begin to percolate on the public stage, it is often not yet settled ‘who is responsible, who has authority over whom, [and] what sort of accountability is to be expected’ (Hajer and Wagenaar, 2003: 9). As actors simultaneously puzzle through the nature of a technology and how it ought to be overseen in moments in which technologies emerge, engaging with them allows us to explore the actors,

norms and means of technological governance empirically (Venturini, 2010). Their constitutional nature also makes them appropriate to map the political geographies of technological governance, sketching the redistribution of power, authority and responsibilities that digital technologies may entail.

### *Analysing DCT apps*

We explored DCT apps with the help of a ‘technology-centred’ comparison. We followed them to instances in which these were designed and launched, assessed and contested, and stabilised and redesigned. Through our analysis, we distilled three moments, comparing cross-cutting dynamics and transformations within the debates in the two countries.

Capitalising on the public nature of the debates on DCT apps, we unpacked these moments with the help of documents. For the Austrian case, we used the ‘APA Online Manager’, an Austrian Press Agency databank, to search for news reports on the Stopp Corona app in the major dailies, weeklies, as well as in the transcripts of the public television station ORF; and the database of the Austrian Parliament. For the Norwegian case, we used the media text databank ‘Atekst’, provided by the media monitoring company Retriever group, to search for news reports and comments on Smittestopp in major national dailies and weeklies, and the digital archive of the Norwegian Parliament. In both countries, our search included media texts that appeared between 1 March 2020, and 31 January 2021. We also analysed the evaluation reports written by an expert group and by the software developer. In both countries, we had up to 900 hits. In our analysis, it became apparent that many of them were repetitive. Therefore, we analysed in detail in particular those documents that shed light on new aspects of the respective DCT debates.

When unpacking the moments, we analysed the assemblage of actors gathered around the apps; we also analysed the visions and values, and concerns and issues, which the actors foregrounded in debates and/or enshrined into the technical design of the apps. The following questions guided our analysis: who talks, that is, which actors take a stance in relation to the app? What is the problem that the app should solve? What is criticised and deemed problematic about the app? What kinds of concerns and issues are articulated? How are positions justified? We analysed the documents separately in their respective original languages. We shared and discussed our analysis in meetings, while also constantly reflecting on it in the light of existing theories. Jointly discussing which insights our findings provided, helped us abductively to finetune our analytical categories and conceptual lenses (Timmermans and Tavory, 2012). When comparing sites, we paid attention to the differences *and* similarities between debates in Austria and Norway. While we saw many differences between the two sites, we were also intrigued by cross-cutting similarities as well as emerging convergences in the debates between the two countries. We interpreted the convergences as indicative of ongoing transformations at scales beyond the national. This approach enabled us to sketch the contours of the political geographies of technological governance.

In the following we report on our findings, structuring them along the temporal order of the three moments: a first moment, in which actors in both countries

envisioned DCT apps; a second, in which these visions were probed and contested; and a third moment, in which visions were stabilised.

## Envisioning DCT apps

In Austria and Norway, DCT apps were launched when both countries were experiencing their first ‘lockdowns’. In the context of many uncertainties and the risk that hospital intensive care units might be overwhelmed by the number of COVID-19 patients, authorities in both countries had turned to exceptional legal measures, suspending public life. The Austrian ‘Stopp Corona’ app was launched on 25 March 2020. Norway’s ‘Smittestopp’ followed on 16 April.<sup>3</sup> In both countries, the apps were tied to visions of how citizens could contribute to managing the COVID-19 crisis. However, in each country the actors who envisioned, developed and presented these apps, and the values they were expected to perform, were different.

### *Austria: breaking down chains of infection*

In Austria, civil society actors envisioned and developed the Stopp Corona app. The Austrian Red Cross, a private organisation with high standing in public life, spearheaded the app’s development. The Uniqua Private Foundation, the foundation of an insurance company, donated €2 million to fund it. Accenture, an international consulting company, designed and implemented the app. The ‘Federal Rescue Commander’ of the Red Cross, who was very much in the public eye in the early months of the COVID-19 crisis in Austria, also acted as the public spokesperson of the app.

The Federal Rescue Commander presented the app as a tool for citizens – or ‘the people’ (*die Menschen*) – to participate in the efforts of health authorities to contain the virus. He framed the app as a digital ‘contact diary’ with which users could record ‘personal encounters’ with a ‘digital handshake’ on their smartphones ([wien.orf.at](http://wien.orf.at), 2020). When users downloaded the app and gave their consent to the processing of data, they received a pseudonym. They could then use the app to manually record contacts with other users, storing their pseudonyms on their smartphones. If a user tested positive, they could use the app to notify all registered contacts of the last 48 hours, inviting them to isolate themselves. This, the Federal Rescue Commander explained, would happen ‘automatically and very quickly’ (ORF, 2020b), and notably significantly quicker than local health authorities could possibly trace contacts. The app could help citizens ‘protect’ (ORF, 2020c) themselves and others from transmitting SARS-CoV-2, thus ‘breaking down possible chains of infection’ ([wien.orf.at](http://wien.orf.at), 2020). If many people used the app, the Federal Rescue Commander explained, they could together make a ‘decisive contribution to slowing down or perhaps even stopping the epidemic in Austria’ (ORF, 2020b).

### *Norway: ‘Get our everyday life back’*

The Norwegian app ‘Smittestopp’ was envisioned by familiar bureaucratic state actors such as state agencies, regulations and an expert group. The Norwegian Institute of Public Health (NIPH), which played a central role in managing the pandemic in Norway, launched the app. To enable and legitimise it, the Ministry of Health and

Care Services adopted a regulation (Helse- og omsorgsdepartementet 2020). Simula, a prestigious, state-owned research institute on scientific computing and machine learning, secured the contract to develop the app.

The government envisioned two functions for the app: contact tracing and knowledge generation for policy evaluations. In terms of contact tracing, users received an automated notification if their smartphones had been close to an infected person for more than 15 minutes. Smittestopp 1.0 consisted of three parts (Ekspertgruppen, 2020b: 7): the app that users installed on their smartphones; cloud storage delivered by Microsoft; and web applications by NIPH and the Norwegian Public Health net (through which health service providers can legally exchange data). The app used phone numbers to identify the user, GPS to identify the user's location, and Bluetooth to search for other devices that had installed the app (Ekspertgruppen, 2020b: 8). The data about the user's position, as well as its distance to other users, were then stored centrally in a cloud (Ekspertgruppen, 2020b). Information about infection (which is categorised as sensitive health information) was not stored in the cloud but in the Reporting System for Infectious Diseases, which was also used for manual contact tracing (Høie, 2020a: 4). The respective data were processed in a de-identified and aggregated manner (Ekspertgruppen, 2020b: 8). Data were automatically deleted from the cloud storage after 30 days (Høie, 2020a: 13).

In terms of knowledge generation, health authorities wanted to use the gathered data to evaluate effectiveness of other public COVID-19 responses, thus experimenting with novel technologies to monitor the proportionality of their own actions. The vision of the government was to 'make it possible to reduce intervention measures as early as possible' (Høie, 2020b). In the words of the health minister, 'follow[ing] the development of the pandemic at the population level through anonymous data' would allow officials to 'see if the risk of infection increases when we gradually reopen society' (Høie, 2020b).

Public authorities conveyed the message that installing the app would help get 'our everyday life and freedom back' (Løkkevik et al, 2020: 4). The prime minister introduced Smittestopp as 'one step on the road to greater freedom' (Solberg, 2020). Installing the app was supposed to be part of the 'dugnad' (Sandvik, 2020), that is, what citizens could do as part of the community effort in defeating the pandemic. There was *no* legal obligation for citizens to submit to DCT (neither was this up for public discussion). Nevertheless, the government drew on strong arguments of civic duty: 'If we want to succeed in getting everyday life back', Smittestopp was necessary.

## Assessing DCT apps

When the two apps were launched in Austria and Norway, actors envisioned them as participatory tools with which citizens could contribute to manage the pandemic. Pioneers and spokespersons of DCT apps appealed to citizens to use them, thus entangling the digital tools into visions on good citizenship during the pandemic crisis. Notably, the kind of actors who spearheaded the development and design of the apps differed. In Austria, the Stopp Corona app emerged as a civic problem-solving effort, most likely following the assumption that citizens in Austria would neither trust nor use an app developed and overseen by state authorities. In contrast, Smittestopp was a government-initiated community effort in Norway, where there is an established culture for state authorities to collect and process data for public

health purposes (Åm et al, 2021). Smittestopp was also envisioned as a tool to collect data that could help authorities monitor the need for and effectiveness of policies taken to protect the health of citizens.

### *Austria: a thin line between participation and surveillance*

After its launch, the Stopp Corona app was discussed in several newspaper articles and opinion pieces, in which IT and legal experts were asked to assess the value of the app (Knyrim, 2020; Steiner-Gashi, 2020). A salient issue that cut across these reports regarded potential overflows of data collected with the app to state authorities or insurance companies (ORF, 2020c). The Red Cross emphasised that it had taken ‘data protection’ very seriously (wien.orf.at, 2020). It underlined that data could not overflow, as these were stored locally on users’ smartphones. Users were asked to provide their phone numbers only when they reported testing positive for COVID-19. This was also confirmed by several IT experts, who applauded the app for its ‘privacy by design’ (Spiekermann, 2020) approach and the minimalisation of data collection (Knyrim, 2020; APA, 2020a). Nevertheless, one NGO representative raised several concerns in a television interview and issued a report that circulated in social media (Lohninger, 2020). The NGO took issue with the app using a Microsoft server to enable the exchange of pseudonyms between smartphones running on different operating systems. They also asked to make public the source code so that ‘independent third parties can monitor it’ and so that the public could trust the app’s privacy claims (ORF, 2020a).

A second set of concerns regarded the app’s practical value (Krone.at, 2020). That users had to make digital handshakes manually was seen as a technical limitation to the usefulness of the app (APA, 2020b).

A third issue was the ‘voluntary’ nature of the use of the Stopp Corona app and the participatory citizenship that the Red Cross had envisioned. Various commentators doubted whether the number of citizens ready to use the app voluntarily could be high enough for it to produce tangible effects on chains of infection. Such doubts gained new salience when concern was voiced that ‘parts of the government [...] were] thinking hard about how the possibilities of new technologies could level the way back to normality’ (Renner, 2020). The suspicion was confirmed when, on 4 April, a senior member of the conservative government party ÖVP (*Österreichische Volkspartei*), used the occasion of an interview to wonder aloud whether making use of the app obligatory would ensure that the app could ‘help even more’ (Profil.at, 2020).

The interview engendered a public outcry on social media and triggered politicians, who had until then remained silent on the app, to join the debate. Members from the Green Party, ÖVP’s coalition partner, underlined that the senior politician had voiced his own opinion and was not speaking on behalf of the coalition government. Members of the opposition parties warned that the ÖVP was seeking to transform Austria ‘into a totalitarian spying and surveillance state’ (Sulzbacher, 2020). The opposition assured the public that they would not allow this crisis ‘to be used to restrict essential fundamental rights and freedoms’, moving Austria ‘toward a surveillance and police state’ (Neuhauser, 2020). A politician framed the app as an ‘electronic ankle bracelet’ such as prisoners wear (Neuhauser, 2020). Two days after excerpts from the interview became public, the senior member of the ÖVP announced a change in mind and assured that the party would ‘stay on the path of voluntariness’ (Der Standard, 2020a).

Nonetheless, the senior politician's thought experiment had lasting consequences on the ways the app was discussed in public. The issue of potential obligatory use and its constitutional permissibility continued to percolate in media debates (Al-Youssef et al, 2020; *Tiroler Tageszeitung*, 2020). It also became the focus of several governmental inquiries from opposition parties (Parlament, 2020a; 2020b; 2020c). Thus, some viewed the Stopp Corona app as 'tech for good' (Accenture, 2020) – that is, an app that complies with data protection standards while enabling altruistic citizens to participate in 'help[ing] to save lives and overcome the crisis' (Accenture, 2020) – while others had a more dystopian vision of the app's inherent potential to be used for a more nefarious purpose. In their vision, state authorities could turn these apps from a means of civic participation into an instrument for state surveillance, thereby infringing on the rights and freedoms of citizens. In public discussions and in inquiries raised in Parliament, the app increasingly became a symbol for the danger of a state that might abuse the pandemic as a window of opportunity to abuse technologies to undermine citizens' basic rights and freedoms.

### *Norway: from freedom from COVID to freedom from the state*

In Norway, Smittestopp was discussed in a polarised media debate, in which 'IT security and digital privacy' were the most prominent issues. It was highly controversial that Smittestopp was supposed not only to limit the spread of the coronavirus through DCT, but also to generate knowledge about movements and contact patterns of the population. During the app development process, the Ministry of Health and Care Services had appointed an independent expert group to review the Smittestopp source code. In its preliminary report, published a few days before the app was due to launch, the group advised holding off the launch until deficiencies in data integrity were repaired (Ekspergruppen, 2020a).

In the media debates, IT, privacy and technology experts' concerns and critique received considerable attention (Bugge, 2020; De Rosa, 2020: 8–9; Hageskal and Ueland, 2020: 12). The IT experts emerged in the public domain as a rather unified group speaking out about the potential negative consequences of Smittestopp. In May 2020, this actor group organised a petition against the app (Brodwall et al, 2020). They criticised the use of geolocation and the authorities' wish to use the data for research. The petition warned that such data could get into the hands of 'bad actors', which it defined as 'state, private sector, or hacker' that 'could spy on citizens' real-world activities' (Brodwall et al, 2020).

In the debate, future-oriented arguments dominated, highlighting that the country was in a crisis-induced constitutional moment and warning that decisions taken in this moment could outlast the crisis. In addition, demands for a *balance* between privacy rights and infection control – that is, a 'privacy vs. public health framing' (Sharon, 2020: 3) – characterised the public debate; both those arguing for and against the app insisted that their position upheld freedom: advocates for the app argued in favour of freedom from COVID, and data protectors argued in favour of freedom from the state.

In the shadow of privacy issues, a set of questions was also raised about the app's technical effectiveness. The app was reported to be a battery hog, rapidly draining phones. In addition, its usability was criticised (Aalen, 2020: 20–21). From mid-May 2020 and onwards, it became clear that the vision of the app as a 'community effort'



did not catch on. While 900,000 people were using the app by the end of April 2020, the number of active users dropped to 592,924 by early June (Datatilsynet, 2020: 9).

On 12 June 2020, the Norwegian Data Protection Agency (DPA) temporarily banned the app for not being in line with ‘data protection legislation’ (Datatilsynet, 2020). The agency evaluated the app to be a privacy intrusive policy measure and argued that infection control must not be at the expense of citizens’ fundamental right to privacy (Datatilsynet, 2020). DPA underlined two important principles in data protection legislation that the app violated: the principle of data minimisation, and the purpose principle, which stipulates that personal data shall be processed only for specific and explicitly stated purposes.

Thus, the government’s vision of a technology-enabled road *to* freedom from restrictive COVID-19 policy measures was challenged by visions of citizens’ right to freedom *from* states’ insight into their mobility.

## Stabilisation and convergence of the apps

Earlier we showed that, after the apps launched, their desirability and the legitimacy of the visions of the apps’ pioneers were publicly assessed and contested in both countries. Potential data flows to state authorities and ‘data protection’ emerged as *the* central matters of concern in both countries. ‘Data protection’ was also seen as the most salient value – indeed: *the* ‘common good’ (Sharon, 2018; 2020) – that was used to assess and endorse or contest DCT apps. IT-minded ‘data protectors’ primarily articulated this value. In both countries, they were deemed as having the necessary expertise to determine what this value ought to mean in practice and to assess the apps on behalf of citizens and publics.

In a third moment, the apps were stabilised. As we show later, the moment of stabilisation was also a moment of convergence across the two countries. The updated versions of both apps built upon the ‘Google/Apple Exposure Notification’ (GAEN) framework, which Apple and Google had developed jointly to make the operating systems interoperable (Sharon, 2020). Notably, Apple and Google also enshrined several standards into the use of this framework. These were simultaneously technical, ethical and political – or: constitutional (Jasanoff, 2016). The GAEN limited the range of data that DCT apps could collect, mediating the relationship between the national DCT app providers and citizens.

### *Austria: a civic platform unused by citizens*

In Austria, several updates of the Stopp Corona app have been released. In April 2020, an update enabled an automatic ‘handshake’ (Der Standard, 2020b) by which the app would track encounters with other users if they were closer than 2 metres for more than 15 minutes. However, the update was reported to function poorly on iPhones. The technical problems were sorted out when the GAEN framework allowed a major update of the app in late June 2020 (Proschofsky, 2020). Subsequently, the Austrian Stopp Corona app was also made interoperable with other European apps to facilitate DCT across borders.

While the app was further developed and eventually stabilised, an increasing number of actors began to assemble around the Stopp Corona app, joining the Federal Commander of the Red Cross’ appeals to citizens to use the app. While other members

of the government continued to remain surprisingly silent, the health minister repeatedly invited Austrians to use the app. Moreover, the NGOs that specialised in data protection and that had assessed the app in public in the second moment (endorsing and criticising it) were invited to analyse the app's source code (SBA Research, 2020). Finally, the Red Cross built a 'civic platform' to oversee further development of the app, drawing in various civil associations for this task (Vorarlberger Nachrichten, 2020). The NGO that had criticised the app after its launch was included in the platform. Thus, the Stopp Corona app was stabilised as a participatory technology that was envisioned, developed and assessed by civil society for civil society.

Despite, however, the actors' efforts to produce 'tech for good' in a participatory way – which was in itself a remarkable innovation in Austria – the Stopp Corona app was ultimately dismissed as a failure and also was reportedly hardly used by citizens. While the app continued to percolate in media reports in autumn 2020, it was often reported as an idea that had 'flopped' (Zankel, 2020). Often the app was framed as an instance of the federal government's failure to formulate a consistent, workable vision. Sometimes the Stopp Corona app was also cited as an instance of irrational concerns about protecting citizens' data and as evidence for a purportedly widespread 'technology scepticism and hostility' (Zettel, 2020) within the Austrian population (Nowak, 2020). Indeed, when Austria was hit hard by a second and then a third wave of infections between autumn 2020 and spring 2021, DCT was hardly mentioned in the media.

The number of Stopp Corona app users is difficult to quantify. By 23 January 2021, the app had been downloaded 1.36 million times. However, the data protection architecture prevents accruing data on how many phones the app was active on. Between June 2020 and January 2021, about 6,000 users had reported COVID infections via the app (Wimmer, 2021). When compared to the total number of infections in Austria (more than 340,000 by the end of January 2021), that number is small. Thus, while the pioneers had sought to design an app for citizens and 'the people' to give them an instrument with which to participate in efforts to stop the virus from spreading, also bringing in civil society organisations to oversee the app, it seems that the overwhelming majority of the 'people' ended up rejecting the invitation to participate.

### *Norway: a restart without take-up*

After the DPA had decided that Smittestopp could no longer collect data, the parliament prompted the government to include 'informed consent' options and to separate 'contact tracing' and 'knowledge generation' into two streams (Stortingstidende, 2020: 4457 ff). The media reported on a disagreement between the involved state agencies: the DPA had emphasised 'proportionality' when deciding that the invasiveness of the Norwegian app was not well aligned with Norway's low infection numbers. NIPH countered that the loss of this digital tool weakened Norwegian preparedness against COVID and that 'valuable data were getting lost' (Gullestad, 2020: 12).

While the NIPH continued to expect to use the app for knowledge generation, this possibility was dashed when Simula (the research institute that developed Smittestopp) published in September 2020 an evaluation report on alternative DCT solutions. Simula (2020) recommended the Norwegian government to use the GAEN framework when developing a new Norwegian DCT app, even though

their report was critical of Google and Apple. Their report is interesting for how they account for Google and Apple's role in the process of further developing DCT apps. They reported that app developers from Norway, Ireland, the UK, Iceland and Germany had an emergency meeting on 1 April 2020, five days after the launch of Smittestopp, because they realised that Smittestopp worked very poorly on iPhones. This led to Smittestopp having to store data centrally, for which it became heavily criticised. The only alternative solution was to get Apple to change its operating system. Simula reported that Norway, Germany and the UK had asked Apple for help, but Apple rejected their requests. A national newspaper quoted the director of Simula: 'Our experience after developing Smittestopp in collaboration with other countries' authorities and Europe's best technologists is how helpless nation states can be in the face of technology giants such as Google and Apple' (Johansen, 2020).

Thus, national authorities in Norway had to use GAEN, while the platform companies were promising citizens that GAEN would not enable authorities to collect data (Simula, 2020: 26). This implied that GAEN would not support the generation of knowledge about the spread of infection and population movements that the Norwegian authorities considered important. The GAEN could only be used for exposure notification (Simula, 2020). Thus, Google and Apple – and not the Norwegian authorities – ended up deciding which functions and public goods Smittestopp could serve.

On 21 December 2020, Norway's new Smittestopp based on the GAEN framework was launched. The new app's purpose was no longer 'knowledge generation'; it was designed only to be a tool for infection control. From its description at Helsenorge.no, it is apparent that the app's re-design in many ways was an answer to the concerns raised during the first period: (1) The new app stored everything on the phone and did not upload information to a central location as the old one did. (2) It used Bluetooth and not GPS. (3) It used far less battery power than the old one. (4) It was used only for infection tracking, not for analysis or research. (5) The new app did not collect data which could be used to identify users. (6) The new app did not automatically message other people (Helsenorge, 2021).

## Conclusion: 'citizenship by design'

In this article, we show that the COVID-19 pandemic exemplifies the increasing salience of (digital) technologies in the governance of societies, while also providing an epistemic window of opportunity to study related transformations in political geographies. What did we learn about technological governance and the shifting political geographies from our multi-sited case?

First, in both countries, groups of actors joined forces to develop these apps, envisioning them as tools that enabled citizens to participate in pandemic management. Pioneers entangled DCT apps in visions on good citizenship in pandemic times. The identities of the pioneering actors and the scope of the early visions differed between the two sites. The Stopp Corona app emerged as a civic problem-solving effort. Smittestopp was a government-initiated community effort. Moreover, while the Stopp Corona app was designed to enable only DCT, Smittestopp was also supposed to track movements in the population to generate evidence for evaluating public health policies.

Second, the apps and the visions of digital citizenship that pioneers sought to inscribe were contested in both countries. Data protection was a central concern in both countries while also serving as a – or perhaps indeed *the* – public value with which the value of the app was assessed, that is, either endorsed or contested, in public. Remarkably, data collections were considered particularly worrisome when these involved state authorities or when data was to flow to them. Ownership and flows of data, and the contested legitimacy of aggregations of data by state authorities thus constitute an important research focus for further studies of technological governance.

Third, in both countries, data privacy as a public value and matter of concern was foregrounded in particular by ‘data protectors’, who became the debates’ most vocal actors. Pioneers had taken data protection into consideration in various ways when designing the app. Unlike Smittestopp, the Stopp Corona app had followed a ‘privacy by design’ approach early on. However, in both countries we could witness that data protectors became vocal actors in the public assessment of the apps and their eventual stabilisation. They did *not* challenge the technological innovation as such; they contested *how* it was set up. They suggested how these apps should be designed to ensure that the public could (and would) trust DCT apps. They framed the app and its relationship to citizens as technical design problems, raising several demands, including 1) that the source code of the app should be open and transparent, 2) that data storage should be decentralised, and that 3) location positions should not be logged by public authorities. Put (perhaps too) succinctly, their position was that if only the code was open source, the app was legitimate and trustworthy. Thus, while the ‘data protectors’ in the DCT case represent a very technical form of expertise, they were also speaking on behalf of citizens and publics. Their expertise is tied to a vernacular that is simultaneously technical and normative – and thus political. The design standards are enmeshed with visions on the rights and entitlements of citizens, on the obligations of authorities, and on how the relationship between citizens and authorities ought to be mediated by design.

Fourth, in both countries the eventual stabilisation of the DCT apps was shaped by Google and Apple – two private companies headquartered thousands of miles from Norway and Austria. As the current versions of the Stopp Corona app and Smittestopp rely on the GAEN framework, Google and Apple ended up setting constitutional norms by design with which national actors had to comply if they wished to have a working infrastructure for their locally designed apps. The civil-society pioneers of the Stopp Corona app, who were situated at a distance from state authorities, were satisfied to use the GAEN framework, which enshrined norms they shared; the public authorities in Norway complied more reluctantly.

Thus, throughout the three moments we have explored, debates on DCT apps simultaneously imagined, contested and stabilised ‘digital citizenship’ – in terms of the scope and nature of data that authorities were entitled to collect from and on behalf of citizens and how digital technologies were allowed *and* expected to mediate the relationship between citizens and authorities. This shows that technological governance can also be assessed as a site where citizenship is envisioned and inscribed ‘by design’ – that is, made durable through the design choices of tech experts and global companies. We suggest the notion of ‘citizenship by design’ to denote the increasing mediation of the relationships between citizens and authorities through the design of technologies.

‘Citizenship by design’ has consequences for geographies of power. Neither in Norway nor in Austria did the apps turn out to be devices that allowed state authorities to increase the ‘reach’ of their authority and power. Yet, actors such as data protectors and transnational companies became more salient, mutually reinforcing their standing, power and authority. It would be rash to jump to general conclusions from a study that involved only two sites at a moment of crisis. However, our findings underline the importance of engaging with technological governance – that is, paying attention to the governance both of *and* through technologies to explore how digital technologies transform those geographies of power that shape democratic lives. How political geographies change with the increasing salience of technological governance certainly needs further scrutiny. Engaging with emerging technologies and following them with technology-centred comparisons could be one way to map the political geographies of technological governance. Such maps would then also allow us to consider the consequences of shifting political geographies of power for our democracies.

### Notes

<sup>1</sup> Both authors have contributed equally.

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<sup>3</sup> ‘Smittestopp’ in English is literally ‘Infection stop’.

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### Conflict of interest

The authors declare that there is no conflict of interest.

### References

- Accenture (2020) Stopp Corona-app – Digitale Kontaktverfolgung hilft, die Kurve abzuflachen, <https://www.youtube.com/watch?v=jYrzNxbhzSk>.
- Al-Youssef, M., Pichler, G. and Schmid, F. (2020) Rotes Kreuz ärgert Kritik an ‘Stopp Corona’-App, *Der Standard.at*, 16 April, <https://www.derstandard.at/story/2000116925810/rotes-kreuz-aergert-kritik-an-stopp-corona-app>.
- APA (2020a) Experten attestieren ‘Stopp Corona’-App datensicherheit, *Die Presse*, 27 March, <https://www.diepresse.com/5791827/experten-attestieren-stopp-corona-app-datensicherheit>.
- APA (2020b) ‘Stopp Corona’-App: user zweifeln an praxistauglichkeit, *Die Presse*, 31 March, <https://www.diepresse.com/5793368/stopp-corona-app-user-zweifeln-an-praxistauglichkeit>.
- Barry, A. (2001) *Political Machines: Governing a Technological Society*, London: Bloomsbury Academic.

- Bellacasa, M.P. de la (2010) Matters of care in technoscience: assembling neglected things, *Social Studies of Science*, 41(1): 85–106. doi: [10.1177/0306312710380301](https://doi.org/10.1177/0306312710380301)
- Blasimme, A. and Vayena, E. (2020) What's next for COVID-19 apps? Governance and oversight, *Science*, 370(6518): 760–62. doi: [10.1126/science.abd9006](https://doi.org/10.1126/science.abd9006)
- Braun, K. and Schultz, S. (2010) '... a certain amount of engineering involved': constructing the public in participatory governance arrangements, *Public Understanding of Science*, 19(4): 403–19. doi: [10.1177/0963662509347814](https://doi.org/10.1177/0963662509347814)
- Brodwall, J., Wasskog, T.A. and Sommerfeldt, S. (2020) Joint statement on contact tracing for Norway, <https://medium.com/@jointstatementnorway/joint-statement-on-contact-tracing-for-norway-331ee49fc6ff>.
- Bugge, S. (2020) Tror smitteappen vil feile, VG, 18 April, 8–9.
- Callon, M., Lascoumes, P. and Barthe, Y. (2011) *Acting in an Uncertain World: An Essay on Technical Democracy*, Cambridge, MA and London: MIT Press.
- Datatilsynet (2020) Varsel om vedtak om midlertidig forbud mot å behandle personopplysninger – appen Smittestopp, *Brev til FHI*, <https://www.datatilsynet.no/contentassets/1c72ac62cac145efa242942ca34c2cd0/20-02058-9-varsel-om-vedtak-om-midlertidig-forbud-mot-a-behandle-personopplysninger---smittestopp.pdf>.
- De Rosa, M. (2020) En type overvåkning vi normalt ikke ønsker oss, *Dagsavisen*, 17 April, 8–9.
- Der Standard (2020a) Sobotka blitzte mit Forderung nach verpflichtender App ab, *Der Standard*, 6 April, 2.
- Der Standard (2020b) 'Stopp-Corona'-App trackt automatisch, *Der Standard*, 11 April, 25.
- Dewey, J. (1954) *The Public and its Problems*, Athens: Swallow Press and Ohio University Press Books.
- Dijck, J.v., Poell, T. and Waal, M.d. (2018) *The Platform Society: Public Values in a Connective World*, New York: Oxford University Press.
- Dussauge, I., Helgesson, C., Francis, L. and Woolgar, S. (2015) On the omnipresence, diversity, and elusiveness of values in the life sciences and medicine, in I. Dussauge, C. Helgesson and F. Lee (eds) *Value Practices in the Life Sciences and Medicine*, Cambridge: Cambridge University Press, pp 1–28.
- Ekspertgruppen for kodegjennomgang av løsning for digital smittesporing (2020a) Foreløpig rapport for kodegjennomgang av løsning for digital smittesporing av koronaviruset, [https://www.regjeringen.no/globalassets/departementene/hod/fellesdok/rapporter/200409\\_forelppig\\_rapport\\_ekspertgruppe\\_sporingsapp.pdf](https://www.regjeringen.no/globalassets/departementene/hod/fellesdok/rapporter/200409_forelppig_rapport_ekspertgruppe_sporingsapp.pdf).
- Ekspertgruppen for kodegjennomgang av løsning for digital smittesporing (2020b) Endelig rapport for kildekodegjennomgang av løsning for digital smittesporing av koronaviruset, <https://www.regjeringen.no/no/dokumenter/endelig-rapport-for-kildekodegjennomgang-av-losning-for-digital-smittesporing-av-koronaviruset/id2703467/>.
- Ferretti, L., Wymant, C., Kendall, M., Zhao, L., Nurtay, A., Abeler-Dörner, L., Parker, M., Bonsall, D. and Fraser, C. (2020) Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing, *Science*, 368(6491): eabb6936. doi: [10.1126/science.abb6936](https://doi.org/10.1126/science.abb6936)
- Gottweis, H. (2008) Biobanks in action: new strategies in the governance of life, in H. Gottweis and A. Petersen (eds) *Biobanks: Governance in Comparative Perspective*, London and New York: Routledge, pp 22–38.

- Gottweis, H., Braun, K., Haila, Y., Hajer, M., Loeber, A., Metzler, I., Reynolds, L., Schultz, S. and Szerszynski, B. (2008) Participation and the New Governance of Life, *BioSocieties*, 3(3): 265–86. doi: [10.1017/S1745855208006194](https://doi.org/10.1017/S1745855208006194)
- Gullestad, F.H. (2020) Gir ikke opp sporingsapp, *Klassekampen*, 20 June, 12–13.
- Hageskal, A. and Ueland, T.H. (2020) Dette gir du fra deg. Smittestopp-appen lagrer opplysninger, *Dagbladet*, 18 April, 12.
- Hajer, M. (2003) Policy without Polity? Policy analysis and the institutional void, *Policy Sciences*, 36(2): 175–95. doi: [10.1023/A:1024834510939](https://doi.org/10.1023/A:1024834510939)
- Hajer, M. and Wagenaar, H. (2003) Introduction, in H. Wagenaar and M.A. Hajer (eds) *Deliberative Policy Analysis: Understanding Governance in the Network Society*, Cambridge: Cambridge University Press, pp 1–30.
- Helse- og omsorgsdepartementet (2020) Forskrift om digital smittesporing og epidemikontroll i anledning utbrudd av Covid-19. Lovdata FOR-2020-03-27-475, *OPPHEVET*, <https://lovdata.no/dokument/LTI/forskrift/2020-10-09-2001>.
- Helsenorge (2021) Smittestopp, <https://www.helsenorge.no/smittestopp/>.
- Herrmann, S.L. (2009) *Policy Debates on Reproductive Genetics: The Problematisation of New Research in Great Britain and Germany*, Frankfurt: Campus Verlag.
- Hilgartner, S. (2015) Capturing the imaginary: vanguards, visions and the synthetic biology revolution, in S. Hilgartner, C. Miller, and R. Hagendijk (eds) *Science and Democracy. Making Knowledge and Making Power in the Biosciences and Beyond*, London: Routledge, pp 51–73.
- Høie, B. (2020a) Svar til skriftlig spørsmål fra Lene Vågslid (A) til justis- og beredskapsministeren. Besvart: 28.04.2020 av helse- og omsorgsminister Bent Høie, <https://www.stortinget.no/no/Saker-og-publikasjoner/Sporsmal/Skriftlig-sporsmal-og-svar/Skriftlig-sporsmal/?qid=79414>.
- Høie, B. (2020b) Svar til skriftlig spørsmål fra Nicholas Wilkinson (SV) til helse- og omsorgsministeren, 5 May, <https://www.stortinget.no/no/Saker-og-publikasjoner/Sporsmal/Skriftlig-sporsmal-og-svar/Skriftlig-sporsmal/?qid=79486>.
- Hurlbut, J.B., Jasanoff, S. and Saha, K. (2020) Constitutionalism at the Nexus of life and Law, *Science, Technology, & Human Values*, 45(6): 979–1000.
- Jasanoff, S. (ed) (2004) *States of Knowledge: The Co-production of Science and the Social Order*, London: Routledge.
- Jasanoff, S. (2011) Introduction: rewriting life, reframing rights, in S. Jasanoff (ed) *Reframing Rights. Bioconstitutionalism in the Genetic Age*, Cambridge and London: MIT Press, pp 1–27.
- Jasanoff, S. (2015) Future imperfect: science, technology, and the imaginations of modernity, in S. Jasanoff and S.H. Kim (eds) *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, Chicago, IL and London: University of Chicago Press, pp 1–33.
- Jasanoff, S. (2016) *The Ethics of Invention*, New York and London: W.W. Norton & Company.
- Jasanoff, S. and Metzler, I. (2020) Borderlands of life: IVF embryos and the law in the United States, United Kingdom, and Germany, *Science, Technology, & Human Values*, 45(6): 1001–37.
- Johansen, P.A. (2020) Google og apple stoppet smittestopp, *Aftenposten*, 11 September, 22–3.
- Knyrim, R. (2020) Staatliche Tracking-app bei bedarf denkbar, *Die Presse.com*, 30 March, <https://www.diepresse.com/5792532/staatliche-tracking-app-bei-bedarf-denkbar>.

- Krone.at (2020) Europa sucht Technologien zur Hilfe in der Krise, *Kronen Zeitung*, 27 March, <https://www.krone.at/2125485>.
- Laurent, B. (2017) *Democratic Experiments: Problematizing Nanotechnology and Democracy in Europe and the United States*, Cambridge and London: MIT Press.
- Lohninger, T. (2020) Analyse der ‘Stopp Corona’-App des Roten Kreuzes, 1 April, <https://epicenter.works/content/analyse-der-stopp-corona-app-des-roten-kreuzes>.
- Løkkevik, O., Løf, A. and Buggeland, S.A. (2020) Regjeringen lanserte sin nye ‘Smittestopp’-app, VG, 17 April, 4.
- Lucivero, F., Hallowell, N., Johnson, S., Prainsack, B., Samuel, G. and Sharon, T. (2020) COVID-19 and contact tracing apps: ethical challenges for a social experiment on a Global Scale, *Journal of Bioethical Inquiry*, 17(4): 835–39. doi: [10.1007/s11673-020-10016-9](https://doi.org/10.1007/s11673-020-10016-9)
- Meijer, A. and Boon, W. (2021) Digital platforms for the co-creation of public value, *Policy & Politics*, 49(2): 231–48.
- Metzler, I. (2020) Imaginaries as infrastructures? The emergence of non-invasive prenatal testing in Austria, *BioSocieties*, 15(4): 601–26. doi: [10.1057/s41292-019-00171-7](https://doi.org/10.1057/s41292-019-00171-7)
- Morozov, E. (2013) *To Save Everything, Click Here: Technology, Solutionism and the Urge to Fix Problems That Don't Exist*, London: Penguin Books.
- Neuhauser, J. (2020) Ein freiwilliges Kontakt-Tagebuch, *Die Presse*, 5 April, <https://www.diepresse.com/5796267/ein-freiwilliges-kontakt-tagebuch>.
- Nowak, R. (2020) Social Distancing in der Innen- und Europapolitik, *Die Presse*, 18 September, 2.
- ORF (2020a) Stopp-Corona-app: interview mit datenschutzexperte thomas lohninger, ZIB Nacht (23:00), 2 April, Transcript available at APA De Facto Datenbank & Contentmanager GmbH.
- ORF (2020b) Report vom 31.03.2020, 31 March, Transcript available at APA De Facto Datenbank & Contentmanager GmbH.
- ORF (2020c) CoV: Datenschutz – Debatten um Stopp-corona-app, ZIB 2, 9 April, Transcript available at APA De Facto Datenbank & Contentmanager GmbH.
- Papanastasiou, N., Griggs, S. and Lorne, C. (2021) The spatial politics of governance, paper proposal for the Interpretive Policy Analysis Conference 2021, <https://ipa2021.net/wp-content/uploads/2021/01/P20.pdf>.
- Parlament (2020a) Antrag der Abgeordneten Mag. Harald Stefan, Kolleginnen und Kollegen betreffend Straffreiheit für Nutzer der Stopp-corona App, 11 August, [https://www.parlament.gv.at/PAKT/VHG/XXVII/A/A\\_00740/index.shtml](https://www.parlament.gv.at/PAKT/VHG/XXVII/A/A_00740/index.shtml).
- Parlament (2020b) Schriftliche anfrage der Abgeordneten Dr. Susanne Fürst, kolleginnen und kollegen an den bundesminister für Soziales, Gesundheit, Pflege und Konsumentenschutz betreffend ‘Stopp Corona’-App (1521/J), 15 April, [https://www.parlament.gv.at/PAKT/VHG/XXVII/J/J\\_01521/index.shtml](https://www.parlament.gv.at/PAKT/VHG/XXVII/J/J_01521/index.shtml).
- Parlament (2020c) Antrag der Abgeordneten Katharina Kucharowits, Kolleginnen und Kollegen betreffend gesetzlich verankerter Freiwilligkeit und Diskriminierungsschutz bei Contact-Tracing-Apps (519A/E), 30 April, [https://www.parlament.gv.at/PAKT/VHG/XXVII/A/A\\_00519/index.shtml](https://www.parlament.gv.at/PAKT/VHG/XXVII/A/A_00519/index.shtml)
- Prainsack, B. (2008) Governing through biobanks: research populations in Israel, in H. Gottweis and A. Petersen (eds) *Biobanks: Governance in Comparative Perspective*, London and New York: Routledge, pp 210–30.
- Prainsack, B. (2020) The political economy of digital data: introduction to the special issue, *Policy Studies*, 41(5): 439–46. doi: [10.1080/01442872.2020.1723519](https://doi.org/10.1080/01442872.2020.1723519)



- Profil.at (2020) Sobotka: 'Teilverstaatlichungen können sinnvoll sein', Profil.at, 4 April, <https://profil.at/oesterreich/sobotka-teilverstaatlichungen-interview-11430276>.
- Proschofsky, A. (2020) Neustart for Stopp-Corona-App, *Der Standard*, 27 June, 14.
- Redden, J. (2018) Democratic governance in an age of datafication: lessons from mapping government discourses and practices, *Big Data & Society*, 5(2): 2053951718809145.
- Renner, G. (2020) App könnte Ticket in die Normalität werden, *Neue Vorarlberger Tageszeitung*, p. 4, 1 April.
- Rowe, F., Ngwenyama, O. and Richet, J.L. (2020) Contact-tracing apps and alienation in the age of COVID-19, *European Journal of Information Systems*, 29(5): 545–62. doi: [10.1080/0960085X.2020.1803155](https://doi.org/10.1080/0960085X.2020.1803155)
- Sandvik, K.B. (2020) 'Smittestopp': If you want your freedom back, download now, *Big Data & Society*, 7(2): 1–11. doi: [10.1177/2053951720939985](https://doi.org/10.1177/2053951720939985).
- SBA Research (2020) Überprüfung der Stopp Corona-App: 'Unmittelbare Verbesserungen durch Experten-Bericht', OTS.at., 22 April, [https://www.ots.at/presseaussendung/OTS\\_20200422\\_OTS0056/ueberpruefung-der-stopp-corona-app-unmittelbare-verbesserungen-durch-experten-bericht](https://www.ots.at/presseaussendung/OTS_20200422_OTS0056/ueberpruefung-der-stopp-corona-app-unmittelbare-verbesserungen-durch-experten-bericht).
- Sharon, T. (2016) The googlization of health research: from disruptive innovation to disruptive ethics, *Personalized Medicine*, 13(6): 563–74. doi: [10.2217/pme-2016-0057](https://doi.org/10.2217/pme-2016-0057)
- Sharon, T. (2018) When digital health meets digital capitalism, how many common goods are at stake?, *Big Data & Society*, 5(2): 2053951718819032.
- Sharon, T. (2020) Blind-sided by privacy? Digital contact tracing, the Apple/Google API and big tech's newfound role as global health policy makers, *Ethics and Information Technology*, 23(Suppl 1): S45–S57.
- Simula (2020) Sammenligning av alternative løsninger for digital smittesporing, [https://www.simula.no/sites/default/files/sammenligning\\_alternative\\_digital\\_smittesporing.pdf](https://www.simula.no/sites/default/files/sammenligning_alternative_digital_smittesporing.pdf).
- Solberg, E. (2020) Statsministerens innlegg på pressekonferanse om smittesporing, 16 April, <https://www.regjeringen.no/no/aktuelt/statsministerens-innlegg-pa-pressekonferanse-om-smittesporing/id2697826/>.
- Spiekermann, S. (2020) Handy-App gegen die Infektion: sollen wir Bürger mitmachen?, Standard Blog: *Die Ethische Maschine*, 7 April, <https://www.derstandard.at/story/2000116611974/handy-app-gegen-die-infektion-sollen-wir-buerger-mitmachen>.
- Steiner-Gashi, I. (2020) Expertin: 'Es gibt ein grundrecht auf datenschutz', *Kurier*, 29 March, <https://kurier.at/ngen/corona-krank-per-handy-verfolgen-es-gibt-ein-grundrecht-auf-datenschutz/400795922>.
- Stortingstidende (2020) Stortingstidende: referat fra møter i stortinget. Nr. 97, 16 June, Sesjonen 2019–2020, 4457–63, <https://www.stortinget.no/globalassets/pdf/referater/stortinget/2019-2020/refs-201920-06-16.pdf>.
- Sulzbacher, M. (2020) Nationalratspräsident sobotka: 'Stopp Corona'-App kann mit verpflichtung noch mehr helfen, *Der Standard*, 4 April, <https://www.derstandard.at/story/2000116520911/nationalratspraesidentsobotka-stopp-corona-app-soll-verpflichtend-sein>.
- Timmermans, S. and Tavory, I. (2012) Theory construction in qualitative research: from grounded theory to abductive analysis, *Sociological Theory*, 30(3): 167–86. doi: [10.1177/0735275112457914](https://doi.org/10.1177/0735275112457914)

- Tiroler Tageszeitung (2020) Massive bedenken bei Handy-tracking, *Tiroler Tageszeitung*, 7 April, 20–1.
- Venturini, T. (2010) Diving in magma: how to explore controversies with actor-network theory, *Public Understanding of Science*, 19(3): 258–73. doi: [10.1177/0963662509102694](https://doi.org/10.1177/0963662509102694)
- Vorarlberger Nachrichten (2020) Nur Italien vertraut weniger auf die App, *Vorarlberger Nachrichten*, 6 July, <https://www.vn.at/vorarlberg/2020/07/05/nur-italien-vertraut-weniger-auf-die-app.vn>.
- wien.orf.at (2020) Rotes Kreuz: patienten verschweigen Covid-19, wien.ORF.at., 27 March, <https://wien.orf.at/stories/3041252/>.
- Wimmer, B. (2021) Bisher 10.000 warnungen mit Stopp-corona-app versendet, *Kurier*, 5 February, 6.
- Zankel, E. (2020) Warum funktioniert die Corona-App nicht?, *Kleine Zeitung*, 28 October, 10.
- Zettel, M. (2020) Mit Bleistift und Papier gegen das Corona-virus?, *Kurier*, 29 September, 6.
- Zimmermann, B.M., Fiske, A., Prainsack, B., Hangel, N., McLennan, S. and Buyx, A. (2021) Early perceptions of COVID-19 contact tracing apps in German-speaking countries: comparative mixed methods study, *Journal of Medical Internet Research*, 23(2): e25525. doi: [10.2196/25525](https://doi.org/10.2196/25525)
- Zuboff, S. (2019) *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*, New York: Public Affairs.
- Aalen, I. (2020) Korona kan ikke bekjempes med ukritisk teknologioptimisme, *Aftenposten*, 20 April, 20–1.
- Åm, H., Frøyhaug, M. and Tøndel, G. (2021) Helsedata som gullgruve? Forventninger til kommersialisering av helsedata i Norge, *Nytt Norsk Tidsskrift*, 38(1–2): 86–98.