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RECOVERY FROM THE CORONAVIRUS CRISIS

THE COVID-19 STATUS APP: A RISK-BASED TOOL TO ENABLE BUSINESSES TO REOPEN WHILE LIMITING THE SPREAD OF SARS-COV-2

by Julian Morris and Adrian Moore

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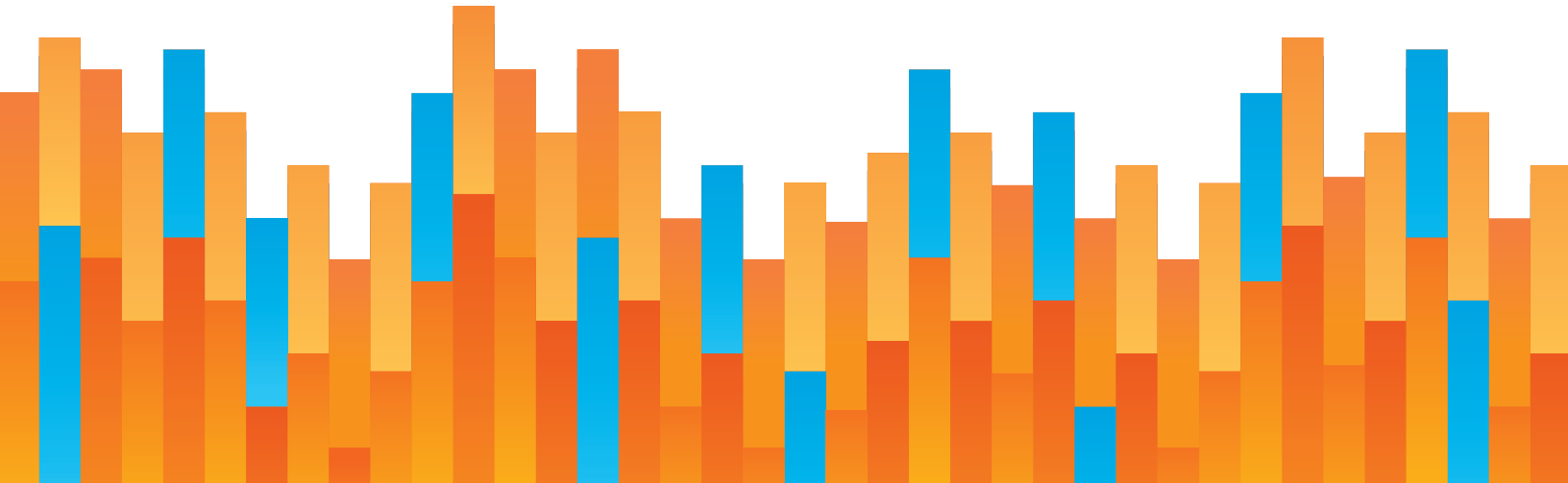

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EXECUTIVE SUMMARY

Until the prevalence of Covid-19 is reduced to minimal levels or there is herd immunity, businesses, churches and other organizations will likely have to continue to take measures to limit the risk of infection. This brief considers tools that could be adopted by businesses and other organizations to that end.

We emphasize that the purpose of these tools is to enhance trust and improve information sharing, so that individuals can move around more freely than would otherwise be the case in a world still filled with grave fear of a deadly disease. While such tools offer intrinsic benefits, they may also offer an alternative to the mandatory restrictions under which so many of us were or are laboring and which might otherwise be re-imposed should another wave of disease occur.

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BRIEFS IN THIS SERIES

Reason's series of policy briefs on *Recovery from the Coronavirus Crisis* includes:

- *Covid-19 Lockdown Problems and Alternative Strategies to Reopening the Economy*
- *Covid-19: Lessons from the Past and Other Jurisdictions*
- *The Covid-19 Status App: A Risk-Based Tool to Enable Businesses to Reopen While Limiting the Spread of SARS-CoV-2*
- *Monitor-Test-Trace-Isolate: Policies for Understanding and Reacting to Covid-19 Infections*
- *Risk Management Tools for Covid-19: Information on Activity Risks and Industry Standards*
- *PPE: How to Increase Production and Distribution of Masks Amid Covid-19*

PART 1

INTRODUCTION

In general, individuals have strong incentives to protect themselves from becoming infected with SARS-CoV-2. However, they have less incentive to avoid infecting others. Fortunately, in many cases measures taken to protect oneself from exposure, such as avoiding close proximity or wearing a face mask, also reduce the risk of exposing others if one happens to be infected. [1]

In general, individuals have strong incentives to protect themselves from becoming infected with SARS-CoV-2. However, they have less incentive to avoid infecting others.

[1] Some of the material in this brief is drawn from Morris, Julian, *Rebuilding Trust in Coronaworld*, Truthonthemarket. May 22, 2020. https://truthonthemarket.com/2020/05/22/rebuilding-trust-in-coronaworld/

Nonetheless, many people are fearful about interacting with others and perhaps especially of going back to work in crowded spaces. A May 12th poll by IPSOS-MORI for the *Washington Post* found that 74% of American adults want policymakers to "keep trying to slow the spread of the coronavirus, even if that means keeping many businesses closed," while just 25% prefer to "open up businesses and get the economy going again, even if that means more people would get the coronavirus."[2]

For the elderly and those with underlying conditions more likely to be adversely affected by Covid-19, such anxiety is understandable. But even many people less likely to become seriously ill or die from Covid-19 are worried. This is also not surprising: They may have a more vulnerable person in their household and are worried about the possibility of infecting them. They may have heard horror stories of young, otherwise healthy people who ended up on a ventilator and either died or suffered permanent lung damage. Or perhaps they read about the mysterious effects Covid-19 can have on other organs, ranging from the intestines to the brain. Or maybe they just don't know—and this is their reaction to uncertainty (fueled in part by public health models that predicted far higher death rates than proved to be the case).[3]

> *Given widespread uncertainty regarding who has the virus, how can one trust that the business at which one works, shops, or dines provides a safe environment free of Covid-19?*

Regardless of why a person fears Covid-19, the fact is that many do. And one thing common to all of us is a trust deficit. Given widespread uncertainty regarding who has the virus, how

[2] Blake, Aaron. "Two big warning signs for Trump in the new coronavirus poll — signs he doesn't seem to want to see." *Washington Post*. May 12, 2020. https://www.washingtonpost.com/politics/2020/05/12/2-big-warning-signs-trump-new-coronavirus-poll-signs-he-doesnt-seem-want-see/

[3] Shen, Chen, Nassim Nicholas Taleb and Yaneer Bar-Yam. *Review of Ferguson et al "Impact of non-pharmaceutical interventions..."* New England Complex Systems Institute. March 17, 2020. https://necsi.edu/review-of-ferguson-et-al-impact-of-non-pharmaceutical-interventions. Denim, Sue. *Code Review of Ferguson's Model*. Locdownsceptics.com. 10 May 2020. https://lockdownsceptics.org/code-review-of-fergusons-model/. Cochrane, John. An SIR model with behavior. *The Grumpy Economist*. May 4, 2020. https://johnhcochrane.blogspot.com/2020/05/an-sir-model-with-behavior.html

can one trust that the business at which one works, shops, or dines provides a safe environment free of Covid-19? This even extends to friends and colleagues: how can one individual trust another individual they might encounter while at work or at play? And it applies also to the use of taxis and rideshares; how can riders and drivers trust one another?

One possible way to address this trust deficit is to use a smartphone-based app that combines various pieces of information (time stamped virus tests and antibody tests, anonymized information about contacts with people who subsequently tested positive, and self-reported health-relevant data) to offer the most accurate and up-to-date status of an individual. In principle, such a status app could be used by employers to minimize the likelihood that their staff have Covid-19 (and to require those that may be infected to self-isolate and obtain a test). But the app's potential application is far wider:

- Universities, churches, theaters, restaurants, bars, and event organizers might utilize the status app not only for employees but also to determine who may participate and/or what forms of PPE they should utilize and/or where participants may congregate.
- Airlines might utilize status apps to determine who might fly and where passengers should be seated.
- Jurisdictions might utilize status apps as a means of facilitating more rapid immigration—and to enable those who most likely do not have Covid-19 to avoid most quarantine requirements.
- Taxis and ridesharing services, such as Uber and Lyft, might utilize data from the status app to help match riders and drivers.
- Personal services facilitators such as Thumbtack might utilize the app to help match service providers and customers.
- Hotels, AirBnB and vacation rental facilitators such as vrbo might use status apps for both hosts (and their employees and contractors) and guests, in order to minimize infection risk during a visit.
- Online dating and matchmaking services such as Match and Tinder might utilize status apps to help facilitate virus-compatible matches. (While SARS-CoV-2/Covid-19 is not really comparable to HIV/AIDS, it is noteworthy that sites already exist that seek to match people who are HIV positive.[4])

[4] E.g. POZ Personals, https://personals.poz.com/

PART 1

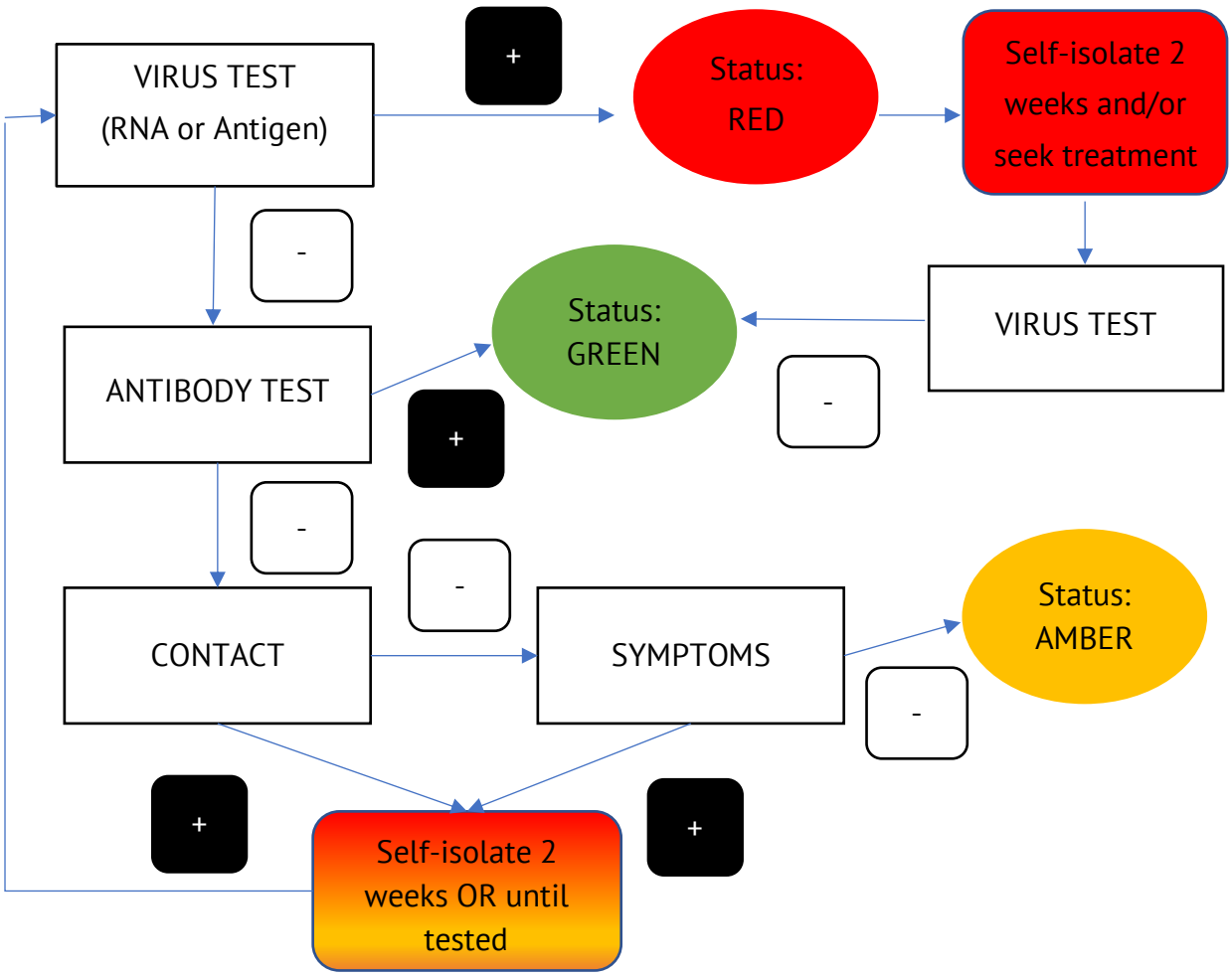
HOW WOULD A COVID-19 STATUS APP WORK?

A Covid-19 status app combines the results of several pieces of data pertaining to the health of an individual in order to generate a picture of that person's Covid-19 status, which can then be shared with businesses and other individuals. The different status categories could be:

- Red = Has Covid-19 (e.g. recently tested positive for virus)
- Red-Amber = May have Covid-19 (e.g. recently tested negative for virus but either has Covid-19-related symptoms or has been in contact with someone who tested positive).
- Amber = Is susceptible: Has not had Covid-19 and likely does not have Covid-19 (e.g. recently tested negative for Covid-19, has no Covid-19 symptoms, and has had no recent known contact with someone who tested positive).
- Green = Has had Covid-19 and is now presumed to be immune (either tested positive for Covid-19 and then tested negative for Covid-19, or tested negative for Covid-19 and also tested positive for antibodies) (See below regarding immunity concerns.)

Once vital thing to help make this work is continued expanded access to testing, as discussed in another policy brief in this series.[5] A schematic for such an app is shown in Figure 1.

FIGURE 1: SCHEMATIC FOR A COVID-19 STATUS APP



Consider how this might work for ridesharing. If the ridesharing app knows the user's verified Covid-19 status, it is able to match riders and drivers with individuals of consistent status or ensure that the driver takes appropriate precautions. For example, if someone with Covid-19 (i.e. Red status) needs a ride to a clinic, the app will find drivers who are Green or have declared that they are willing to accept the risk and the effect it would have on their own Covid-19 status (automatically turning them to Amber-Red, so that they are

[5] See *Monitor-Test-Trace-Isolate: Policies for Understanding and Reacting to Covid-19 Infections*, Moore, Adrian and Julian Morris. "Recovery from the Coronavirus Crisis." A series of briefs published by Reason Foundation. https://reason.org/policy-brief/recovery-coronavirus-crisis/

required to go into self-isolation and obtain a test). Meanwhile, an Amber rider can be matched with either an Amber or Green driver.

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Similarly, some organizations, such as churches, clubs, recreational groups, and gyms, could benefit by requiring or encouraging status tracking as a condition of participation, maybe only feasible using a status app. Gathering in groups is much less risky if those gathering have all tested negative for the virus recently or have some degree of immunity. Even if individual members are just participating in a contact tracing app, they are more likely to be informed if they are at risk and can avoid participating in the group for a time. The same could extend to sporting events and entertainment shows, where, rather than no live audience at all, those with a Green status are much less risky to allow in a gathering.

The status app could also help facilitate international travel. At present, many jurisdictions that are permitting international travel require 14 days' quarantine on arrival. While such requirements are understandable, they have resulted in an almost total collapse of international business and leisure travel. If passengers were able to demonstrate their current verified Covid-19 status through use of an app or other verification system accepted at their international destination, the doors of international travel could reopen more fully.

PART 3

IMPLEMENTATION ISSUES FOR A COVID-19 STATUS APP

There are numerous technical issues relating to the operation of an app designed to establish a person's Covid-19 status that must be addressed for it to function effectively. First, it will be necessary to ensure that the person using the app is the person whose status is being asserted. It should be possible to address this by storing the information from tests, contacts with infected people, and self-reported symptoms on an immutable digital ledger, and then using biometric identification both to record and to share status information. (Storing the status information on a person's phone in this way also avoids the risk of hacking that plagues centralized databases.)

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>
> Julian Morris and Adrian Moore

Next there is the question of authenticating test data recorded by the app. Ideally, this would be done by having a trusted third party—such as a doctor, nurse, or pharmacist—verify the data. If that is not feasible—for example because the test was carried out at home—then some other mechanism will be required to ensure the data are input correctly, such as rewards for accurate self-reports and/or penalties for inaccurate self-reports. (Self-reported data could also be treated within the system as less reliable, or simply as tentative—requiring verified test data to be added within a specified period.)

Beyond these verification issues, there remain problems with the specificity and sensitivity of tests—implying a likelihood of both false positives and false negatives. Although there are now both PCR and antibody tests that achieve very high levels of accuracy, even small numbers of false negative PCR tests and false positive antibody tests would clearly create problems for the effective functioning of the status app system. To address these problems, it may be necessary to undertake secondary testing for some (random) portion of the samples that are tested.

The more challenging problem is that of infection after tests are conducted. As noted above, this can in principle be mitigated—but not eliminated—by incorporating contact tracing and/or self-reporting of symptoms. Related to this is the possibility that having Covid-19 confers only limited immunity (as has been suggested in relation to some people who have seemingly become reinfected). This obviously poses problems for the notion of a "Green" status; if reinfection is possible, then Green clearly would not be a permanent designation and would require regular testing. The evidence remains ambiguous, with news of five U.S. sailors who had Covid, then tested negative twice, subsequently having new symptoms and testing positive again;[6] on the other hand, a recent study suggests that people who test positive after recovery do not have a live (infectious) version of the virus.[7]

[6] The Maritime Executive. "13 Sailors Who Recovered From COVID-19 Test Positive Again." *The Maritime Executive*. May 17, 2020. https://www.maritime-executive.com/article/13-sailors-who-recovered-from-covid-19-test-positive-again

[7] Garcia de Jesus, Erin. "New data suggest people aren't getting reinfected with the coronavirus." *Science News*. May 19, 2020. https://www.sciencenews.org/article/coronavirus-covid19-reinfection-immune-response

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Contact tracing apps have been used successfully in several locations as part of a strategy for containing Covid-19. However, the only really successful implementations so far have been those in China, South Korea and Hong Kong, which had a mandatory component and were highly centralized. By contrast, apps that required voluntary uptake have generally been less successful.[8]

One reason for the lack of success of voluntary contact tracing apps is heightened concern regarding privacy (for example, the app used in Hong Kong enables anyone to find the gender, age, and precise locations of every person in the city who currently has Covid-19).[9] To address these concerns, several groups have developed privacy-preserving systems. For example, the TCN coalition and the DP-3T consortium have developed a set of tools that enable the sharing of anonymized tokens with other nearby phones.[10] A version of that system has now been adopted by Google and Apple in an API that is being made available to government health authorities (but not to other private app developers).[11] Numerous governments in the U.S. and overseas have implemented contact tracing apps that implement either the DP-3T system, the Google-Apple system or another system.[12]

8 Findlay, Stephanie, Stefania Palma and Richard Milne. "Coronavirus contact-tracing apps struggle to make an impact." *Financial Times*. May 18, 2020. https://www.ft.com/content/21e438a6-32f2-43b9-b843-61b819a427aa

9 Latest Situation of Coronavirus Disease (COVID-19) in Hong Kong, https://chp-dashboard.geodata.gov.hk/covid-19/en.html

10 DP3T - Decentralized Privacy-Preserving Proximity Tracing, https://tcn-coalition.org/; https://github.com/DP-3T/documents

11 Google. *Google COVID-19 Exposure Notications Service Additional Terms*. May 4, 2020. https://blog.google/documents/72/Exposure_Notifications_Service_Additional_Terms.pdf

12 Howell, Patrick, Tate Ryan-Mosley and Bobbie Johnson. "A flood of coronavirus apps are tracking us. Now it's time to keep track of them." *MIT Technology Review*. 7 May, 2020.

Another reason voluntary contact tracing apps have not been successful is the lack of incentives to adopt them. The main benefit of a contact tracing app is that it notifies the user when they have been in close contact with someone who subsequently tested positive. Logically, the people most likely voluntarily to adopt a contact tracing app are those who are most risk averse. But those people would also presumably be taking strong measures to avoid contracting Covid-19, so they would be less likely to become infected. By contrast, the people most likely to become infected are those who are least risk averse. But those people are least likely to be motivated to use the contact tracing app. In other words, even if there is relatively wide uptake of the app (say, 40% of the population, as in Iceland),[13] it is likely to miss many of the people most likely to be spreading Covid-19 and so would not actually be very useful as a means of identifying and containing clusters.

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Tying the contact tracing app to a Covid-19 status app potentially overcomes this incentive compatibility problem, since anyone who wants to engage in an activity that requires use of the app would automatically participate in the contact tracing system. It could thus be quite effective at identifying instances of transmission that occur during activities that require the app to be used, which would also presumably be activities that put users at higher risk. Nonetheless, for the app to be useful as a means of identifying clusters of Covid-19, either a significant proportion of common activities would have to require use of the app (e.g. rideshares, gyms, and shopping malls) or it would have to be used by at least some proportion of those not required to use it for access to activities.

[13] Johnson, Bobbie. "Nearly 40% of Icelanders are using a covid app—and it hasn't helped much." *MIT Technology Review*. May 11, 2020. https://www.technologyreview.com/2020/05/11/1001541/iceland-rakning-c19-covid-contact-tracing/

Adding a symptom-monitoring component can help in two ways. First, by offering users a way to self-assess for early symptoms of Covid-19, it encourages more people to download and use the app. More important, symptom monitoring can help identify additional potential Covid-19 infections, both among the individuals reporting symptoms and among their contacts. Thus, the combination of test data, symptom data and contact tracing become the information determining a person's current status in a manner that is more reliable than relying on any one datum.

It should be noted that even combining these data will not make the status app 100% accurate. Some people with Covid-19 will likely slip through as Green or Orange and others will likely inadvertently be infected as a result. But the number of such instances is likely to be small and certainly much lower than would be the case without the use of the app. Moreover, widespread use of the app should dramatically reduce the infection rate throughout the population, with benefits to all.

It should be noted that even with a highly effective Covid-19 status app that combines verified test data with information from contacts, the information from contacts who test positive only arrive when that person tests positive, which in nearly all cases will be some time (days or even weeks) after the contact occurred. As such, there will continue to be some transmission (though this can likely be minimized through appropriate precautions, as discussed in other briefs in this series).[14] As such, people who are at most risk of severe forms of Covid-19—particularly the elderly and those with underlying conditions—would be well advised to take extra precautions.

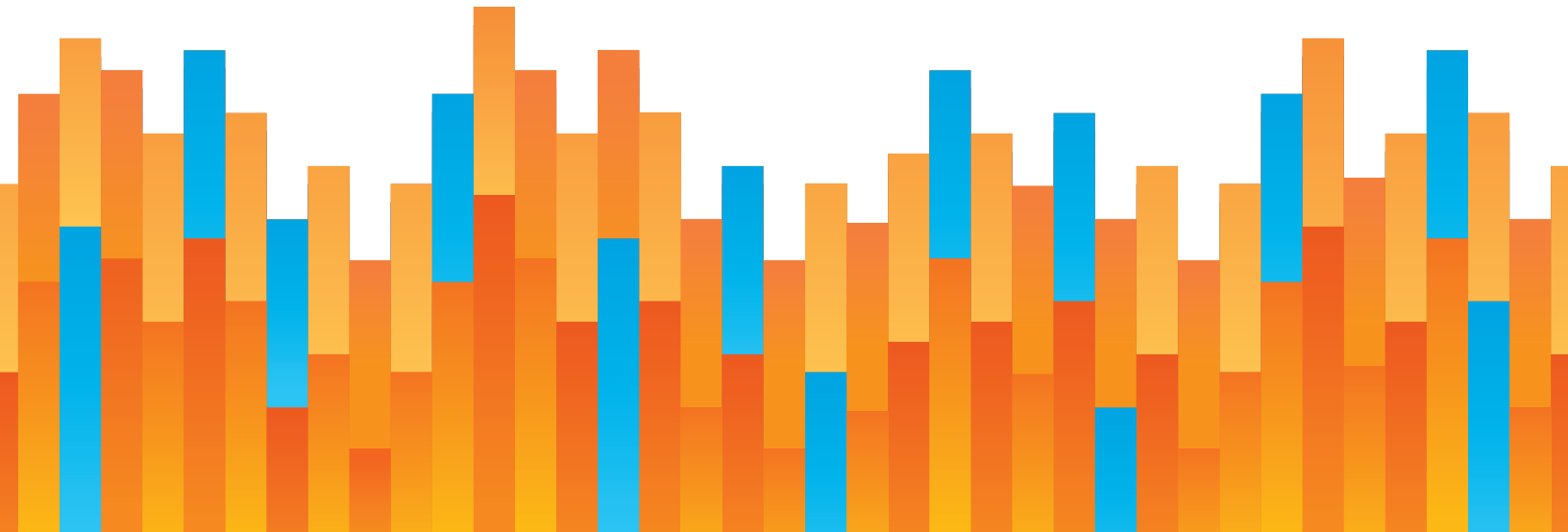
[14] Moore, Adrian and Julian Morris. "Recovery from the Coronavirus Crisis." A series of briefs published by Reason Foundation. https://reason.org/policy-brief/recovery-coronavirus-crisis/

PART 4

CONCLUSION

A Covid-19 status app with the characteristics described in this brief has the potential to enable businesses and other organizations to reopen more fully, more quickly. It could also be of great value as part of an alternative to lockdowns should there be a second wave of Covid-19—or should another pandemic hit. Given the economic devastation wrought by the combination of Covid-19 and the lockdowns, it seems likely that such an app would be welcomed as an autonomy-preserving, private, voluntary alternative.

ABOUT THE AUTHORS

Julian Morris is a Senior Fellow at Reason Foundation, Senior Scholar at the International Center for Law and Economics, and a Fellow of the Royal Society of Arts. He has written extensively on the law and economics of innovation, risk regulation, economic growth, human health, and environmental protection. Morris is the author of over 100 research papers and the editor of several books, including *Rethinking Risk and the Precautionary Principle* and *Sustainable Development: Promoting Progress or Perpetuating Poverty*. Prior to joining Reason, he ran International Policy Network, an international think tank that focused on issues relating to trade, health and the environment. He was also a Visiting Professor in the Department of International Studies at the University of Buckingham and a member of the Council of the School of Pharmacy. Before that, Morris ran the environment and technology program at the Institute of Economic Affairs in London. He is a graduate of the University of Edinburgh and has Masters degrees in economics and related subjects from University College London and Cambridge University. He also has a law degree from the University of Westminster.

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