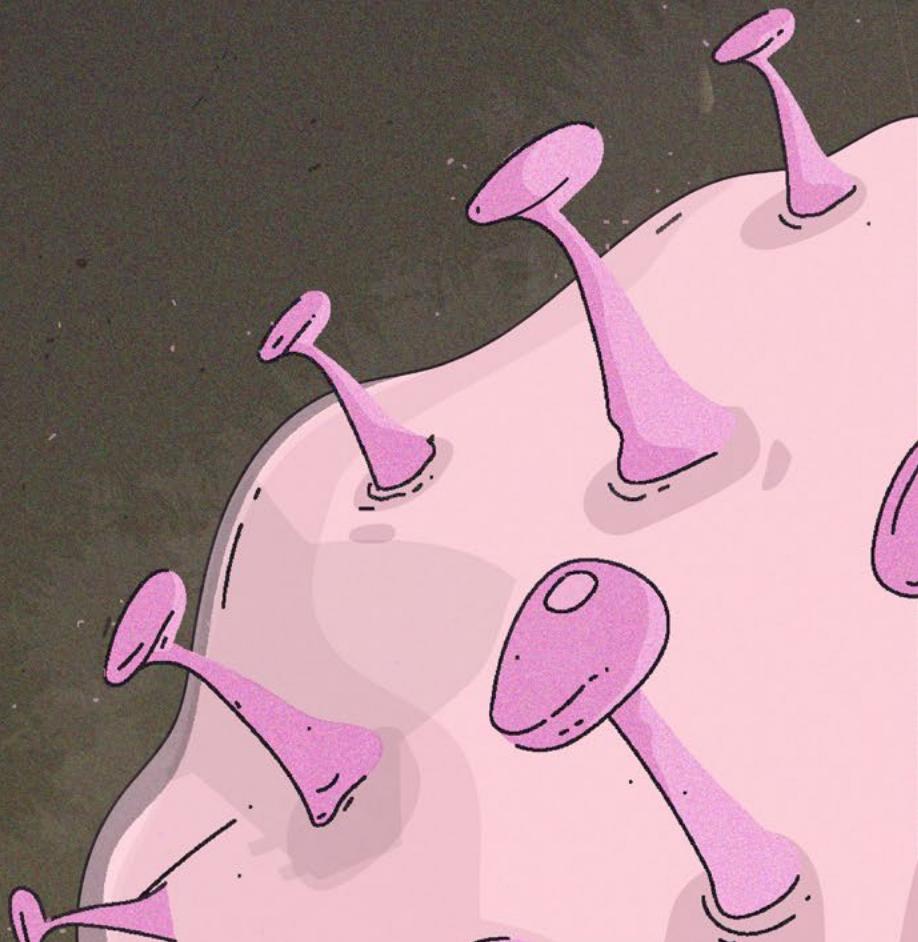


Digital Health and the fight against the **COVID-19** **Pandemic**

The Medical Futurist
Handbook



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Personal message from The Medical Futurist

Dear Reader,

We are living through an experience the vast majority of us have never had before and I'm sure we will remember these times even decades from now. The COVID-19 pandemic brought a struggle to our already overwhelmed healthcare systems and billions of us have to stay at home to practice social distancing.

Reading the news makes us anxious as we still don't know when and how it will end. We don't know when we can be with our loved ones and when we can go back to our jobs. However, there are reasons to be optimistic about. The vaccine is in the making; creative makers globally help medical professionals with the supply shortages; telemedicine finally gets the attention it deserves; and even artificial intelligence got into the spotlight to have a role in care so it can live up to its potential.

Let's have no doubts, [this is going to be over](#). But the life we go back to might not be the same as before. The globalized life we used to live turns out to be unsustainable and our healthcare systems are not prepared for a next pandemic. There is a lot of work to be done.

We designed this handbook to be a short summary of technological efforts worldwide and also to provide some paths in this jungle of false and unreliable information that you can rely on.

We hope you will find it useful and if you come across something that the handbook missed, please let us know so we can update it through medicalfuturist.com.

Stay safe!

Kind regards,

Dr. Bertalan Meskó

Director of The Medical Futurist Institute and The Medical Futurist

Introduction

We are living in unprecedented times. The new strain of the coronavirus is spreading at an alarming rate, so much so that the World Health Organization (WHO) [declared it as a pandemic on March 11th](#). Others still are drawing comparisons to films like Contagion or even projecting post-apocalyptic scenarios popularized in video games like The Last of Us or Resident Evil.

However, this [COVID-19 strain](#), thought to have originated either by transfer from a non-human host or evolved into a disease-causing strain within the human population, is very real and is causing distress on every level of society. In particular, its virulent nature is putting the elderly and the immunocompromised at higher risks.

As the COVID-19 pandemic unfurls in front of our very eyes, affecting more and more countries and even more people, governments around the globe are taking drastic measures to curb the spread, while scientists race against time to find an effective vaccine. It's paramount to heed to the advice of recognized health institutions and local authorities. However, technology and digital health are playing important roles to fight the crisis in the frontlines as well as within the population under lockdown. These will be the focus of this e-book, serving as a handbook of useful resources surrounding the current crisis.

Moreover, during this lockdown we increasingly become dependent on online outlets for news and information sources. Most of us are bound to stay at and work from home in an attempt to flatten the spreading curve, both of which sprouted, somewhat ironically, viral hashtags on social media. Unfortunately, amidst this pandemic, another havoc is being wreaked on social media, with thriving misinformation - the so-called ['infodemic'](#).

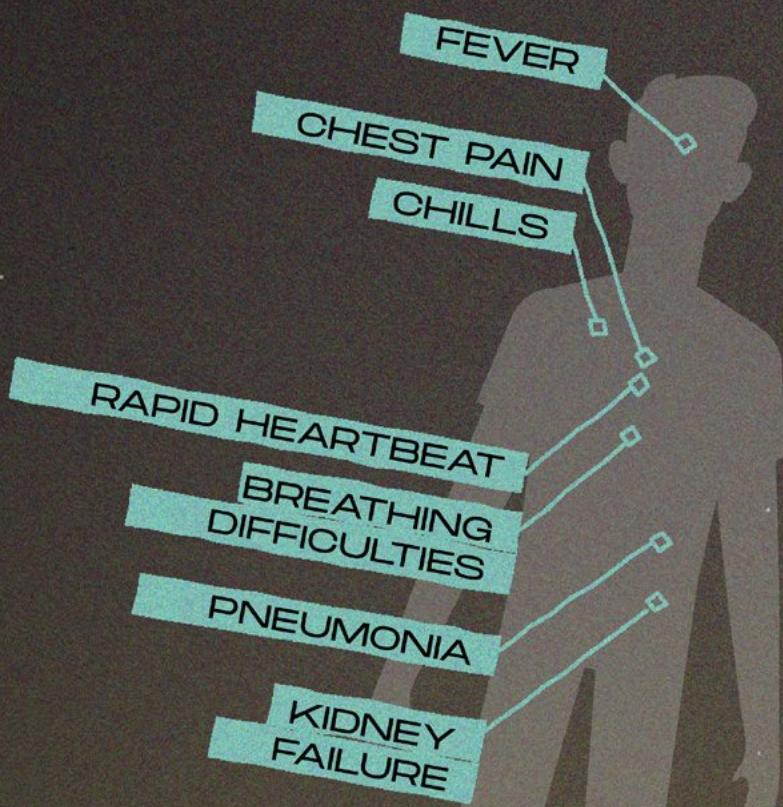
At The Medical Futurist, we always strive to provide the latest news accurately. Even during the ongoing pandemic, our team is working hard with this philosophy in mind. To that end, we present this e-book, available for free, as a helpful handbook for anyone looking for information related to the COVID-19. It will also share means to help yourself and others combat the virus right at home, with trusted resources curated by us.

Understanding the curve with tech-driven models

While it's paramount to flatten the curve - a reference to limiting the spread of the disease, which will lower the peak in a graphical representation - it can help to better understand the said curve. Expert epidemiologists are constantly using epidemiological models to predict the spread of diseases and the COVID-19 is no different. The US Centers for Disease Control and Prevention (CDC) is [currently working with several teams](#), with experience forecasting the flu, so as to make more informed decisions.

However, you can have access to similar tools in order to better understand the severity of the illness and even map it to your own locality's demographic. There are several useful online tools allowing you to visualize the spread of the virus and to better understand it.

The Washington Post [created a 101 explainer](#)¹ of disease spread. Working with a fictional disease aptly called simulitis, they created animated graphs and visuals showing how the disease spreads and how important it is to limit contact.



Understanding the curve with tech-driven models

Harvard research fellow Alison Hill [built one such online tool](#)² that allows you to model various scenarios for research and education purposes. You can input your own parameters such as population size, clinical factors and transmission rate, and simulate how these affect the spread, intervention, death rate, and recovery of the COVID-19 in the form of easy-to-understand graphs. It's particularly useful to visualize how interventions like social distancing or quarantining can be effective.

Another handy tool is the [model developed by the University of Pennsylvania](#)³. It allows users to plug in data to simulate the impact of COVID-19 on hospitals. This method can help hospital administrators better prepare for managing the disease, as well as inform people about how their local hospital's capacity can be exceeded if proper measures to limit the contagion are not taken.

Others yet are using data analytics to help professionals understand and manage the pandemic better. In the UK, the NHS Digital is [employing this method](#) to help hospitals cope with the increasing pressures. By using data collected from the CDC, the New York Times [created a tool](#)⁴ to compare the fatality of COVID-19 to other major killers like cancer and heart disease. It allows you to adjust variables about the infection and fatality rates to better grasp the severity of the disease.

Sources:

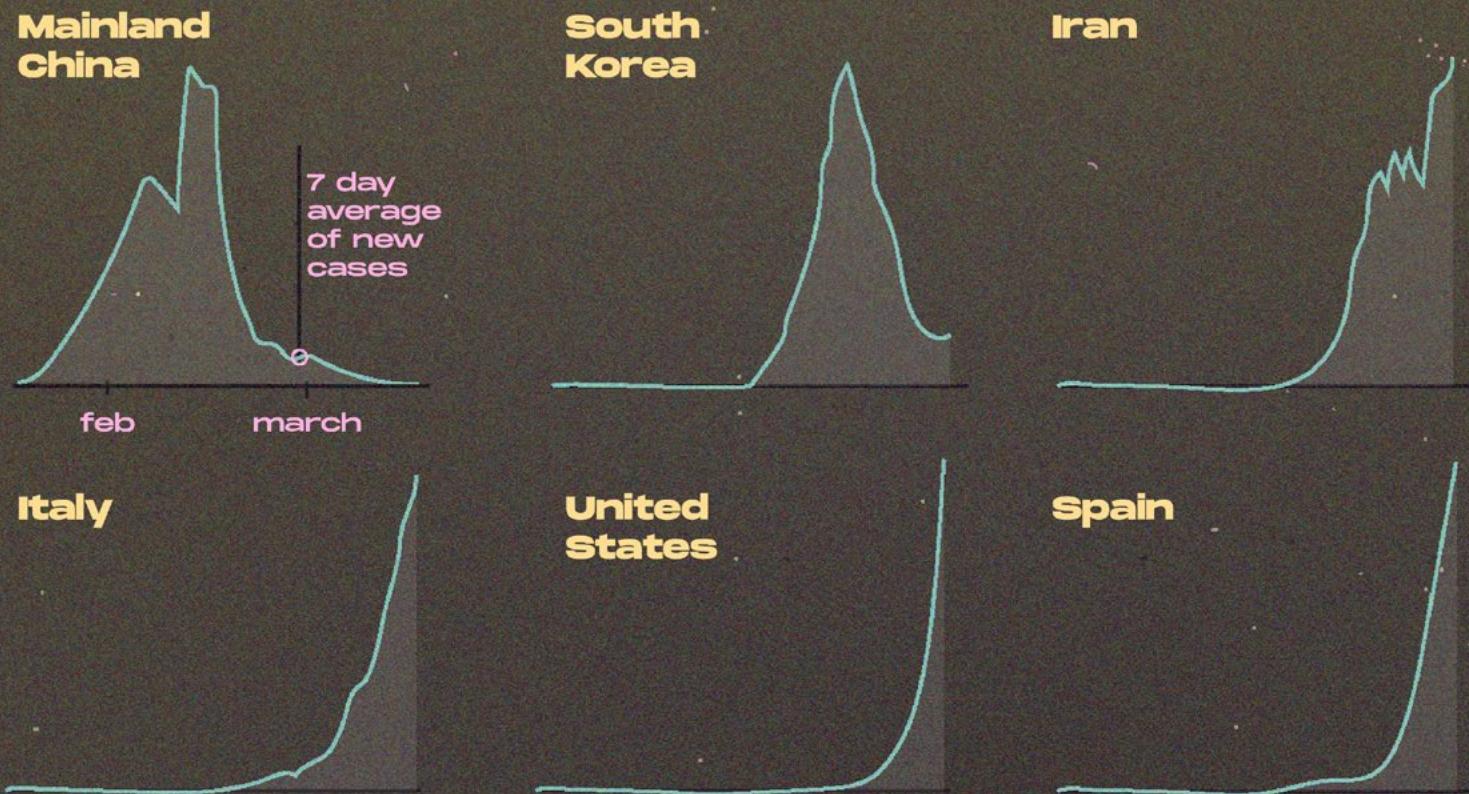
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2. <https://alhill.shinyapps.io/COVID19seir/>
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charting viral territories with interactive maps

Staying ahead of the flood of information and filtering out the relevant ones to get pertinent data surrounding the current issue might be challenging. To address this, interactive online maps prove to be useful.

The Center for Systems Science and Engineering at Johns Hopkins University launched one such [online dashboard](#)¹ collecting data [from various trusted sources](#). It allows users to easily visualize and track the data on mortality, recovery and spread globally and for specific countries.

Microsoft also launched a similar [interactive Bing map](#)², drawing its data from sources like the CDC, the WHO, the European Centre for Disease Prevention and Control (ECDC), and Wikipedia. It details the number of active, recovered and fatal cases globally and countrywise, and has the advantage of listing related news. However, it might not be posting the most timely updates, as [some reports show](#), but can still serve to provide general information.



charting viral territories with interactive maps

The aim of these interactive maps and dashboards is to provide the public with an understanding of the outbreak situation as it unfolds, using transparent data sources. There are also more examples out there, as [listed by MIT Technology Review](#), that provide more technical details or are specific to certain countries, but the aforementioned ones are those we found to be more concise and user-friendly.

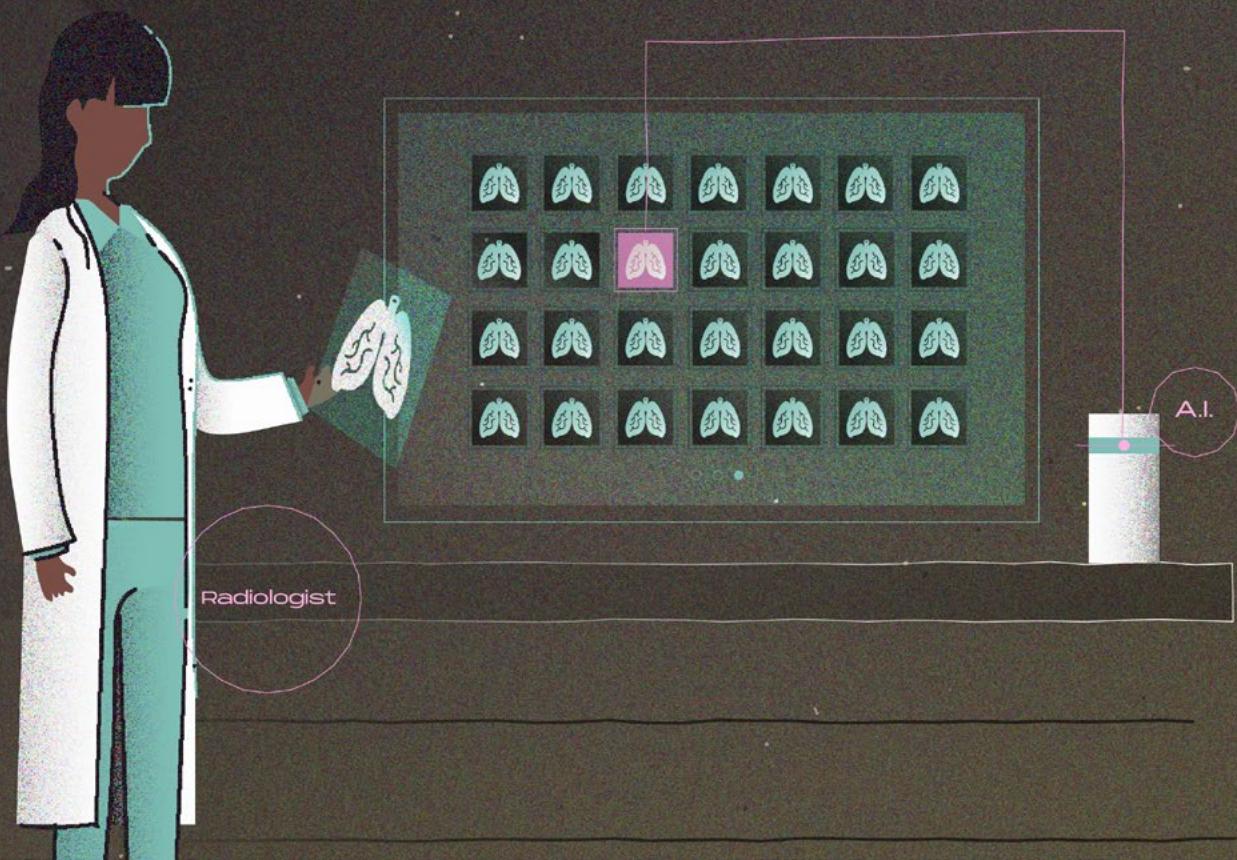
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Artificial intelligence for extra intelligence

Before the WHO and the CDC issued warnings about the COVID-19's spread, it was a company called BlueDot that [first sounded the alarm](#)¹ back in December 2019. Its secret weapon is an artificial intelligence (A.I.)-based algorithm that identifies a trend by scouring through news reports, airline data, and reports of animal disease outbreaks. These trends are then analyzed by epidemiologists who can then alert the company's clients.

Amid the pandemic, [several other organizations](#) are using a similar method. A team led by a professor from the University of Southampton in the UK used anonymized movement data from smartphones and flights to [explore the disease's spread](#)² from Wuhan and how it could affect other cities soon after the first alerts. Another group of researchers synthesized data on case reports, human movement and public health interventions [using A.I. to model the spread of COVID-19](#)³ and showed how shutdowns delayed the epidemic growth.



Artificial intelligence for extra intelligence

A.I. is not only being used to track the disease but also to help diagnose it. Hospitals in China are [employing such software](#)⁴ to detect signs of COVID-19 pneumonia in radiologic scans. A new A.I. algorithm developed by the Chinese tech giant Alibaba can detect COVID-19 infections from CT scans of patients' chests [with 96% accuracy](#)⁵ in a matter of seconds!

As a means to look beyond, A.I. is being deployed to mine the load of research papers surrounding the COVID-19 which have accumulated since the outbreak. The White House [recently announced such an initiative](#) involving tech companies and academics, in hopes of getting more insights into the disease.

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4. <https://www.wired.com/story/chinese-hospitals-deploy-ai-help-diagnose-covid-19/>
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Remote healthcare and serious chats with chatbots

With whole countries under quarantine and encouraging social distancing, such measures can be effective to contain the virus. But what to do if you feel sick, have suspicious symptoms or need monitoring for an ongoing treatment while at home? Telemedicine and chatbots are becoming increasingly attractive solutions under the current circumstances.

The [CDC](#) and [WHO](#) are both advocating for telemedicine to monitor patients and reduce risks of them spreading the virus by traveling to hospitals. The UAE is collaborating with telecom companies to [set up the first virtual hospital in the Middle East](#). The US Government is also following suit, [taking significant steps](#) in order to expand telemedicine services. [Altoida NMI¹](#) is making its remote [brain health monitoring service free](#) for clinics and telehealth providers during the pandemic to support the continuity of care for patients with cognitive dysfunction while at home.

In the meantime, demands for such services have [skyrocketed](#). Amwell's telemedicine app usage has gone up by 158% in the US since January while PlushCare reports that virtual appointments increased by 70%. The latter even plans to introduce [at-home testing kits²](#) for COVID-19.



Remote healthcare and serious chats with chatbots

In Italy, one of the most affected countries by the pandemic, the startup Paginemediche [launched an online chatbot](#)³, developed following guidelines of the Ministry of Health, to support remote triage of potential COVID-19 cases. [Several institutions](#) in the country have adopted the solution as a measure to reduce hospital visits and cross-contamination.

For Americans, the CDC has partnered with Microsoft's Healthcare Bot service to launch a COVID-19 chatbot. After a series of questions regarding symptoms, the [Coronavirus Self Checker bot](#)⁴ shares useful links as well as local health department contacts.

In the U.K., Healthcare Communications has [deployed a chatbot](#)⁵, available to any NHS service, that instantly answers the most common questions, using verified sources. The company also provides an eClinic video consultation platform for virtual appointments and patient assessment.

A global option has been developed by Emory University's School of Medicine. This '[Coronavirus Checker](#)'⁶ asks you questions about your age, location and symptoms to output a summary about your risks for COVID-19 and recommendations according to the CDC.

Source:

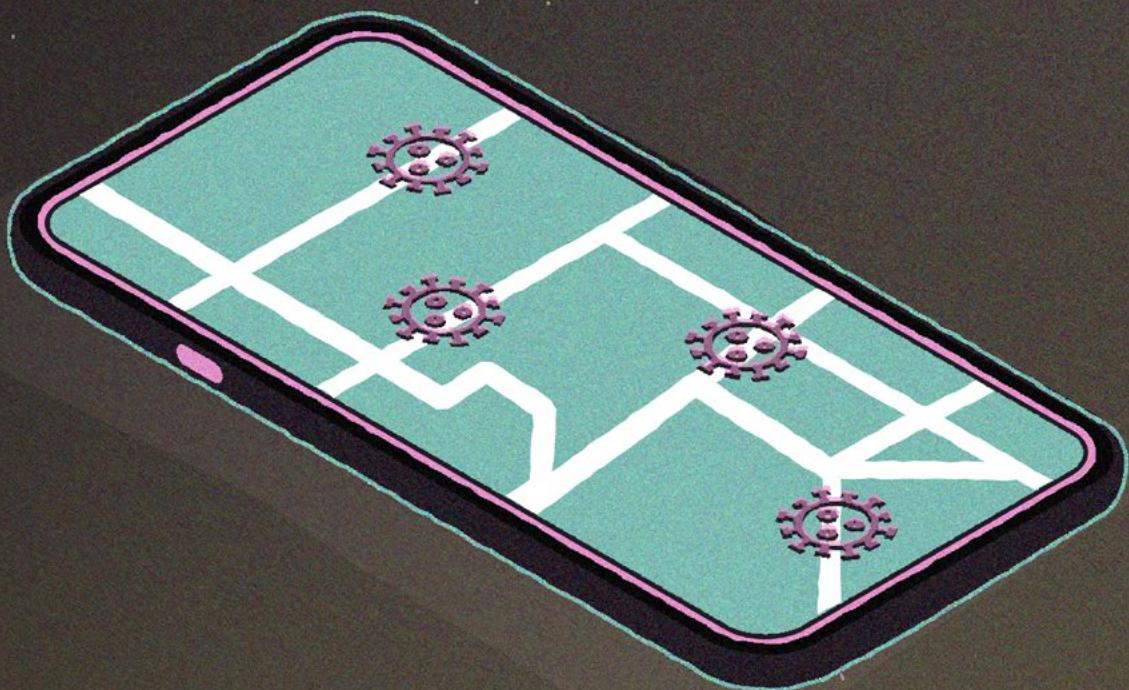
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Contact tracing via phone tracking

A government tracking individuals from their phones' data might raise eyebrows in usual situations, but we are living in unusual times, and the method is being employed for the greater good. As a means to facilitate contact tracing, some authorities are tracking their population's movement from their smartphones so as to limit the virus' spread.

South Korea's success in managing the outbreak [relies in part on surveillance](#). The authorities used data from CCTV footage, bank transaction and phone use to locate who has been exposed to COVID-19. Those people are then alerted via text and are able to trace back who might have been infected.

Israel is adopting a similar approach. The country's Prime Minister [authorized Shin Bet](#), the country's internal security agency, to use phone location data to fight COVID-19. Those who might have been in contact could be alerted via text to quarantine themselves.



Contact tracing via phone tracking

In Singapore, the government launched the [TraceTogether app](#)¹ as a community-driven means for contact tracing. After downloading and consenting to participate, users' phones will record their location and movements via Bluetooth and wireless signals, as well as detecting other app users in proximity. Health authorities can subsequently [contact those who might have been exposed](#) to COVID-19 and use the app's record to identify others potentially affected.

Other organizations are also working on similar solutions. The open source project [CoEpi](#)² was recently launched to transparently develop a similar app. MIT researchers have [a similar project](#)³ going on, allowing users to log their movements and compare it with others infected with COVID-19.

Of course, such an unconventional method raises privacy issues as exemplified with South Korea where safety texts [exposed private information on individual people](#). Such measures will prove to be a test of people's trust in authorities as well as an opportunity for the same authorities to securely manage sensitive data and build trust. It might all sound like a politically-correct Orwellian novel, but we are living in strange times.

Sources:

1. <https://www.tracetogether.gov.sg/>
2. <https://www.coepi.org/>
3. <https://play.google.com/store/apps/details?id=edu.mit.privatekit>

Digital health for mental health

COVID-19 can be mentally taxing on the population as people are forced to stay indoors for days on end. It's even more psychologically demanding for healthcare professionals overworked and overburdened to manage the contagion. In these trying times, digital health apps are lending a helping hand.

The mental wellbeing app, Headspace, is offering its [Premium option¹](#) for free to healthcare professionals working in public health in the U.S through 2020. For the general public, the company launched the free in-app [Weathering The Storm²](#) feature. It contains a selection of free meditations, sleep, and movement exercises designed to support consumers around the world during the COVID-19 outbreak.

[Sanvello³](#), the digital behavioral healthcare solution, opened up its Premium content during the COVID-19 crisis. It uses a combination of cognitive behavioral therapy, meditation, mood and health tracking to help people get through difficult times like the ones we are all experiencing.



Digital health for mental health

Yale University's massively popular "[The Science of Well-Being](#)"⁴ course is seeing a resurgence. Available for free on Coursera, it engages participants in a series of challenges designed to increase one's own happiness and build more productive habits.

A recent [study from the American Heart Association showed](#) that taking some time to relax can lower both blood pressure and cardiovascular disease risk. If you have some time, why not try those suggested methods out?

Source:

1. <https://www.headspace.com/health-covid-19>
2. <https://www.headspace.com/covid-19>
3. <https://www.sanvello.com/coronavirus-anxiety-support/>
4. <https://www.coursera.org/learn/the-science-of-well-being>

Wearables to the rescue

Stuck at home with your wearable? There's plenty you can do with it indoors, be it reminding you not to touch your face or even helping track the virus.

By opting for the [DETECT study](#)¹, owners of wearables from companies like Apple, Fitbit and Garmin can help spot viral outbreaks and aid healthcare authorities to take prompt actions. Participants can share data about their heart rate, sleep and activity levels, as well as respiratory symptoms, medications, electronic health record data and results from a flu, strep or Covid-19 test. The rationale is that your [heart beats faster than normally if you have a viral infection](#) and the other information can help streamline the type of disease.

One of the preventive measures one can take to prevent COVID-19 infection is not touching the face because it is how the virus transmits from inanimate objects to mucous membranes. However, as simple as this might sound, the action has become a quasi-subconscious reflex for many, with people touching their face [over 20 times an hour on average](#). [Immutouch](#)² from Slightly Robot



Wearables to the rescue

is a wearable that can help combat this habit. After an initial calibration, the wristband will buzz whenever your hand comes close to your face.

Lockdowns are disrupting every sector of our lives, including physical activity. In fact, Fitbit noted a [4% to 38% decline](#) in step counts worldwide as a result of the current crisis. To keep people active (and prevent them from turning into their [Wall-E counterparts](#)), the company is giving away a free 90-day trial of [Fitbit Premium](#)³ with hundreds of workouts to keep you moving indoors. Their smartwatches also have a [watch face](#)⁴ that reminds you to regularly wash your hands as well as a timer to time your hand washing for at least 20 seconds.

Source

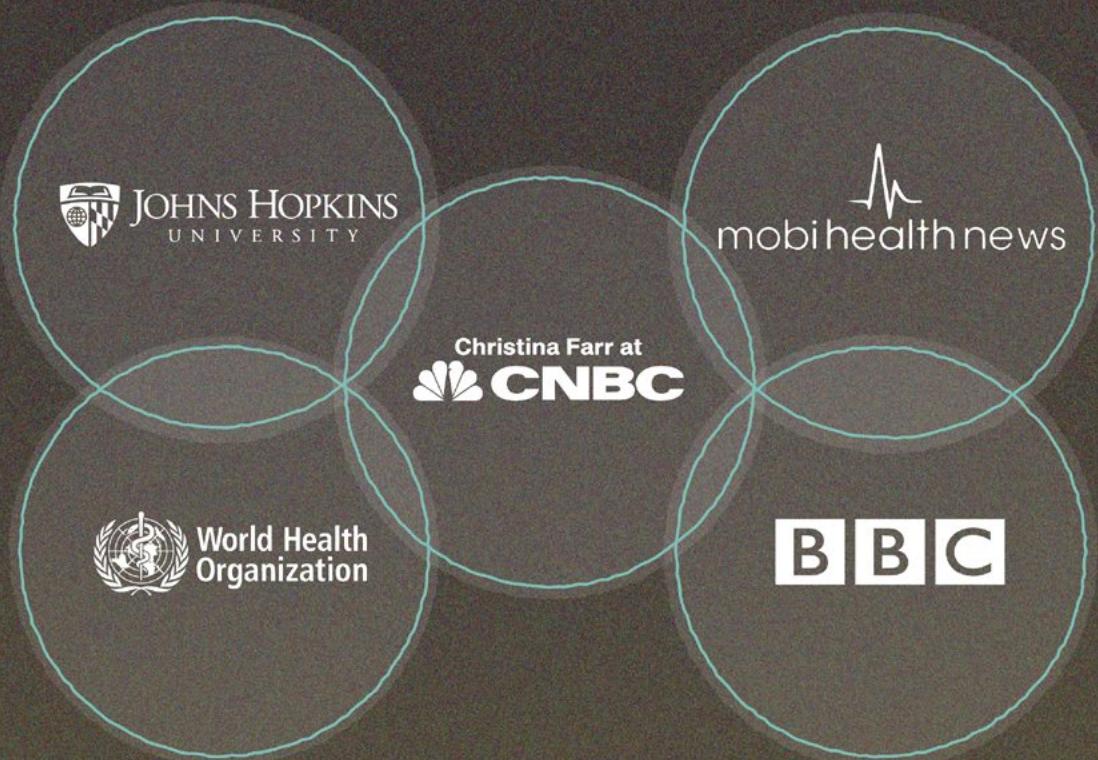
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Social media for the greater good

In [his talk at the Anti-Defamation League](#), comedian Sacha Baron Cohen labelled the likes of Facebook, Twitter and YouTube as the “greatest propaganda machine in history”. These comments aren’t exaggerations given the [rampant flood of fake news and hate speech](#) circulating on social media. However, the latter is also a source of useful resources during the ongoing pandemic.

With [over 3 billion social media users](#) worldwide, social media has an unprecedented outreach across all age groups. While this fact has been used for spiteful ends, it is also being used to spread useful information about the novel coronavirus. The [WHO took to TikTok](#)¹ to raise awareness of the disease [among younger audiences](#). The platform has also been used by Vietnamese officials [to encourage hand washing](#)² and was quickly adopted worldwide.

These platforms are also being used to help people stay healthy indoors. Planet Fitness is hosting [free daily livestreamed workouts](#)³ on Facebook with trainers and surprise celebrity guests. Their aim is to help relieve stress, stay active and feel great right at home.



Social media for the greater good

As philosopher [Slavoj Zizek has recently said](#), it's "a sad fact that we need a catastrophe to make us able to rethink the very basic features of the society in which we live." Amidst the COVID-19 catastrophe, social media is trying to redeem itself as a force for good and we could all benefit from the help they offer.

Source:

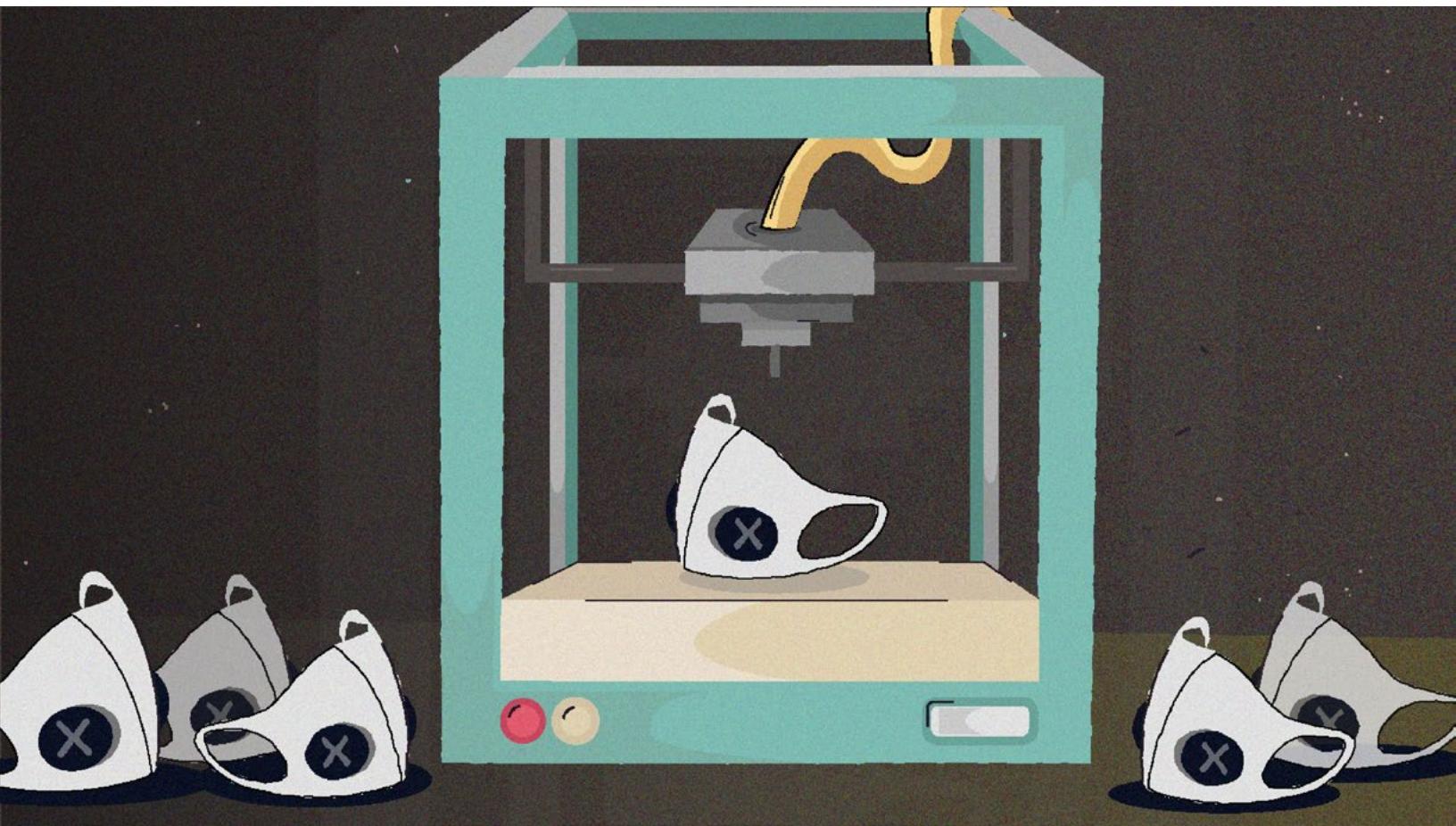
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3. <https://www.facebook.com/planetfitness/posts/10157386688639856>

Running short on medical equipment? Why not 3D-print them?

3D printing is creating wonders in the medical field, bringing sci-fi concepts to reality. The technique has been used to print [living skin](#) with blood vessels, [multilayered medication pills](#) and [prosthetics](#). Of course, 3D printing has its uses to fight the pandemic we are facing.

One of the most pressing issues facing healthcare professionals worldwide is the lack of medical equipment due to the overwhelming number of cases they have to deal with. This shortage has prompted the do-it-yourself (DIY) community to band together and do what they do best: create. Such a group in Spain going by the name of [Coronavirus Makers](#)¹ have designed [open-sourced masks and even mechanical ventilators](#) for milder symptoms which can be 3D-printed.

At the center of the outbreak in Italy, [a 3D-printing startup](#)² supplied hospitals with valves required to connect respirators to oxygen masks as the company making those had trouble keeping up with the demand. Since then, the original device maker has reportedly [refused to share the design files](#)



Running short on medical equipment? Why not 3D-print them?

which are covered by copyright and patents. However, many [more alternatives](#)³ sprouted online, by the maker community.

Others yet are using [3D-printed parts to ingeniously modify snorkeling masks](#)⁴ to use as a C-PAP mask for oxygen therapy.

Solutions geared towards the general public rather than hospitals also abound. Materialise, a 3D-printing company, has released a [3D-printing file for a hands-free add-on](#)⁵ for common door handles.

If you possess a 3D-printer, you could also download the design files to print this equipment to donate to healthcare centers. Every contribution counts!

Source:

1. <https://www.coronavirusmakers.org/index.php/es/>
2. <https://www.thefablab.it/>
3. <https://www.3dprintingmedia.network/covid-19-3d-printed-valve-for-reanimation-device/>
4. <https://www.isinnova.it/easy-covid19-eng/>
5. <https://www.materialise.com/en/hands-free-door-opener>

Leveraging people power with crowdsourcing

In a similar vein to open sourcing designs for 3D-printing medical equipment, other communities are leveraging the power of the community to fight COVID-19 with [free resources](#).

Researchers released [a free database](#)¹ with more than 45,000 scholarly articles, relating to COVID-19 for use by the global research community. The aim is to make this information easily accessible in one location for researchers as well as enabling A.I.-based algorithms to [easily mine for insights](#). Treading the same path is The Lancet, which created a [Coronavirus Resource Centre](#)² with free access to the novel coronavirus content published by its journals.

The open innovation challenge platform Agorize launched the [Code Life Ventilator Challenge](#)³ to find the best low-cost, user-friendly and easy-to-manufacture ventilator design. The top three designs will be made for free to download and winners will be awarded a cash prize thanks to spon-



Leveraging people power with crowdsourcing

If you have time on your hands and wish to learn more about outbreaks like the COVID-19 from an epidemiology point of view, then Johns Hopkins University has got you covered. Its [free Teach-Out 2-week introductory course](#)⁴ on Coursera will walk you through the science of such pandemics.

Sources:

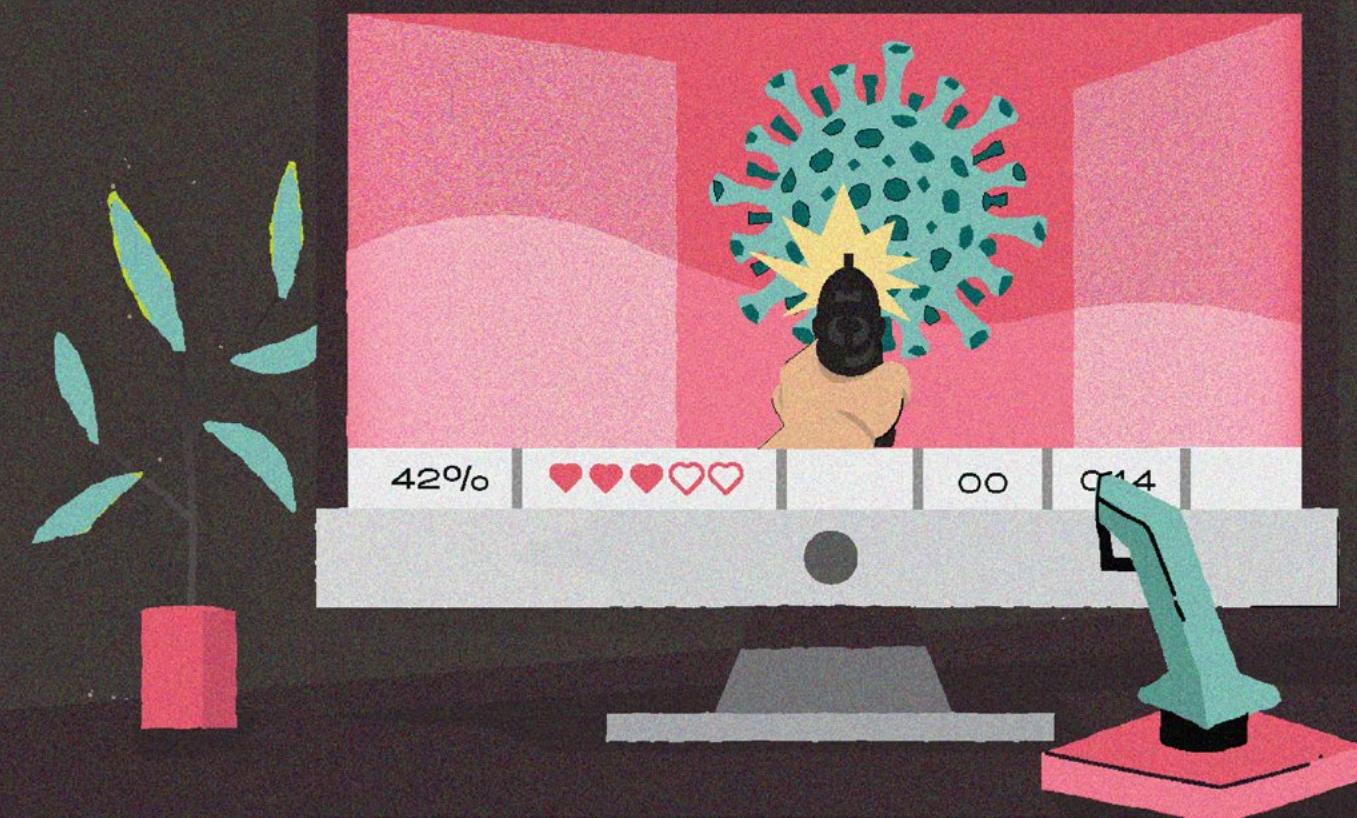
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Gaming vs. COVID-19

Are you a gamer or simply want to proactively take on COVID-19 in a more interactive way? Then the favourite activity [shared by billions worldwide](#) can help.

[Foldit](#)¹ is an online computer game where players, without any prior biochemistry knowledge, can compete to solve puzzles by folding protein structures so that they best fit to a target. The best solutions can help better understand diseases like [AIDS](#) and find potential therapies. The not-for-profit company released puzzles adapted to the coronavirus so that players can find promising antiviral proteins. The best ones will be manufactured and tested at the University of Washington Institute for Protein Design in Seattle. At the time of writing, [99 such solutions](#) have been generated by Foldit players and will undergo testing for their effectiveness against the disease.

PC gamers with beefy gaming specs can also contribute to the fight with [Folding@Home](#)² by donating their unused GPU and CPU computing power. The aggregated computational resources will be used to run simulations so as to find potential drug candidates against conditions like cancer,



Gaming vs. COVID-19

ALS, Parkinson's and, of course, [COVID-19](#). The gaming giant [NVIDIA](#) as well as the [Reddit gaming community](#) have called for PC gamers to assemble against the novel coronavirus. Even if you don't have a high-end gaming PC, you can still contribute by allocating your desired computing power for Folding@Home.

Now is the time to prove your parents that spending all these hours on Doom and Mass Effect were warranted!

Sources:

1. <https://fold.it/>
2. <https://foldingathome.org/>

Big tech joins the fight

These challenging times can also serve as a test for big tech companies' reputation and they've been doubling down to work on their image.

Verily, Google's life sciences branch, [released a website](#)¹ to screen people in the Bay Area of California for COVID-19. After answering screening questions, those eligible can get a free testing and later be alerted when the results are available.

Following suit is Apple. The tech giant recently launched [a website](#)² and [an app](#)³ to help screen for the novel coronavirus. They both function fairly similarly, with questions about your symptoms, travels and if you've been in contact with someone exposed to the virus. Subsequently, the algorithm will output the recommended next steps.

A couple of years ago, the Chan Zuckerberg Initiative, Facebook CEO Mark Zuckerberg's philanthropic arm, launched an open source cloud-based platform to detect and respond to disease



Big tech joins the fight

outbreaks called [IDseq](#)⁴. Its bioinformatics platform is now being [used to track COVID-19's spread](#).

To combat misinformation on Facebook, Twitter and YouTube, [the respective companies intervened](#) to promote news from reliable sources while flagging dubious ones. Google's algorithm is promoting news from the CDC and the WHO, while Twitter is [tagging manipulated media](#).

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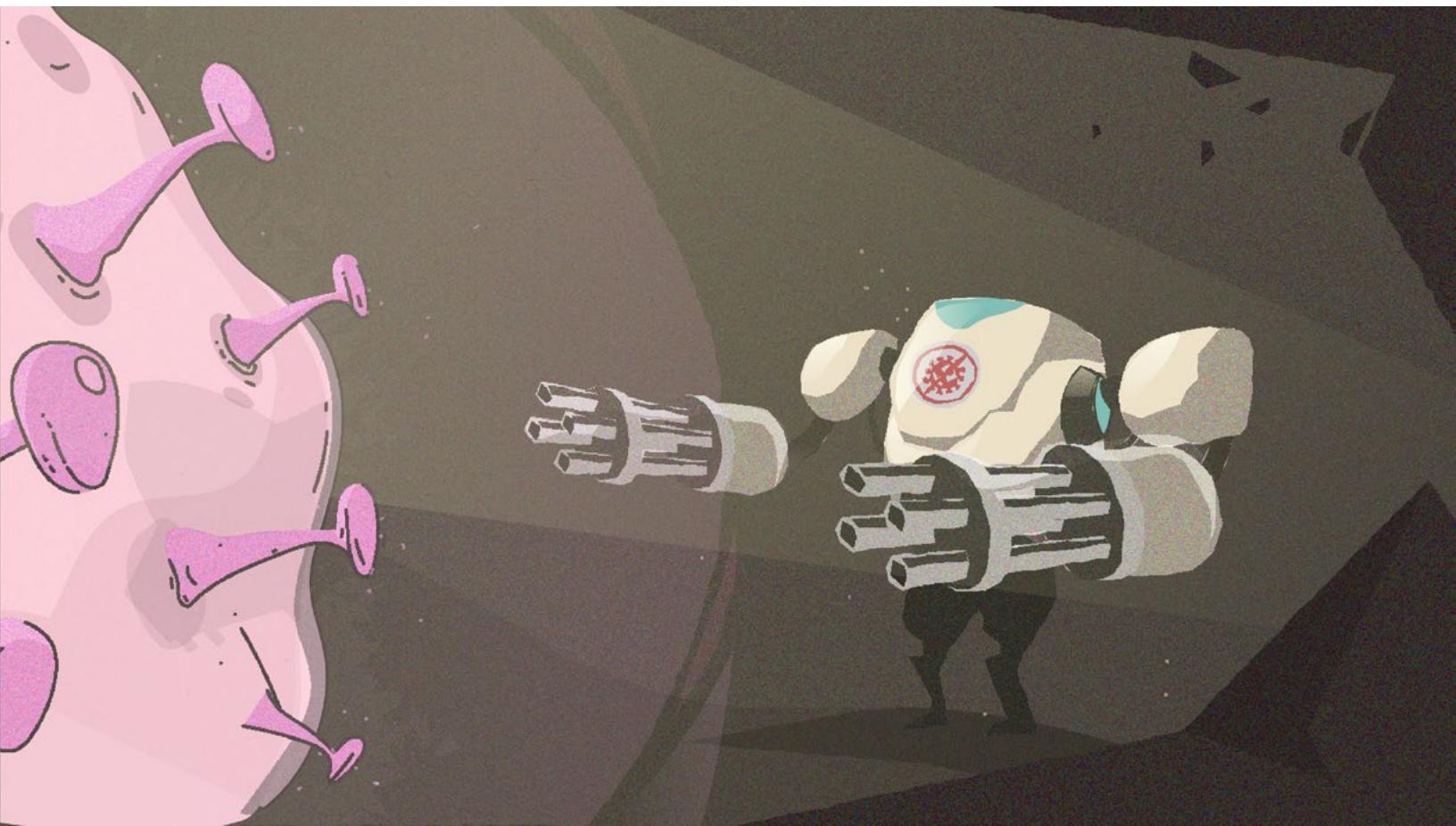
Robots in the frontline

Having robots in the healthcare setting sounds like overly futuristic, sci-fi scenarios to many, but they are realities in our present times. In fact, they might be best suited to fight lethal infectious diseases as they are impervious to cross-infections, unlike human medical professionals.

In China, e-commerce giant JD.com [deployed self-driving robots](#)¹ to deliver medical goods to Wuhan. The startup Shanghai TMIRob sent robots to disinfect wards, intensive care units and operating rooms in hospitals in the city.

Back in January, doctors in a U.S. hospital [used a robot](#)² to assist them to take vitals of a patient infected with the COVID-19 virus so as to minimize exposure. They could communicate via a screen on the robot and the latter also had a stethoscope to take the patient's vitals.

Robots used to monitor recovering stroke patients are [being repurposed](#)³ in Thailand to measure patients' fevers and allow physicians to communicate with patients via video call. Four hospitals in



Robots in the frontline

Bangkok have adopted the solution which has an undeniably cool nickname based on its appearance: ninja robots.

The Belgian robotics company ZoraBots is also pitching in. Belgium issued a ban on visits to elderly people's homes so as to break the transmission chain. ZoraBots [provided their robots](#)⁴, free of charge, to these care centers so that they can keep contact with their close ones remotely.

Medical robotics expert Guang-Zhong Yang believes that the considerable contribution of robots during this pandemic should serve as a wake-up call to invest more in them. This way we can [better prepare for the next outbreak](#).

Sources:

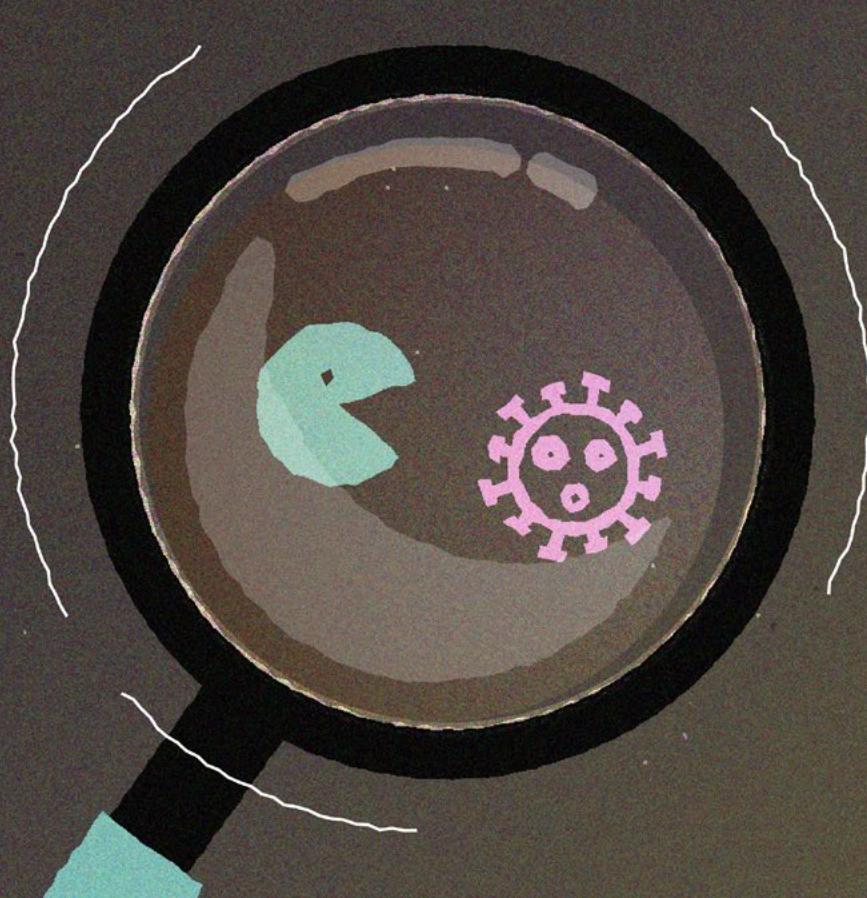
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Have you heard the one about SHERLOCK, PAC-MAN and CRISPR?

Researchers working with the superstar gene editing tool CRISPR are taking some interest in the COVID-19 fight.

Scientists from the New York Genome Center and New York University have [recently published their findings](#) on a new technique using CRISPR to suppress gene expression. They have then adapted it to COVID-19 to [identify optimal guide RNAs](#)¹ that could be used for future detection and therapeutic applications, and made these predictions available online.

Stanford University researchers [published their findings](#)² on a CRISPR-based technique that can target over 90% of all coronaviruses, including COVID-19, and inhibit them. Their Prophylactic Antiviral CRISPR in huMAN cells approach - stylized as PAC-MAN as a [reference to the classic video game](#) - can locate the best spots to attack to lower the virus genome concentration inside the human cells and block the production of the viral proteins.



Have you heard the one about SHERLOCK, PAC-MAN and CRISPR?

Others yet are using the technique to enable faster testing for COVID-19 in a matter of minutes. Protocols for the [SHERLOCK](#)³ and [DETECTR](#)⁴ COVID-19 detection test have been open sourced for clinical purposes.

Sources:

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4. <https://mammoth.bio/wp-content/uploads/2020/02/A-protocol-for-rapid-detection-of-the-2019-novel-coronavirus-SARS-CoV-2-using-CRISPR-diagnostics-SARS-CoV-2-DETEC-TR.pdf>

To be continued...

As Chinese [**President Xi Jinping said**](#), "The fight against the epidemic cannot be achieved without the support of science and technology". Given the exponential rate of development in technology, we are bound to see more practical examples of technology aimed at helping people to fight this global crisis. As such, as we come across more helpful resources, we will update this handbook in due time.

Additionally, you can keep in touch with the latest developments on our website, [**The Medical Futurist**](#). We have weekly articles blending the current trends in science, technology and medicine and news relating to COVID-19 aren't foreign to our field of expertise.

You are also welcome to join our [**Patreon premium community**](#) for early access and exclusive analyses.

