Going viral: a science communication collaboration in the era of COVID-19 and social media

Siouxsie Wiles (✉️ s.wiles@auckland.ac.nz)
University of Auckland  https://orcid.org/0000-0002-0467-0015

Toby Morris
The Spinoff

Rebecca Priestley
Te Herenga Waka - Victoria University of Wellington

Short Report

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Abstract

On 9 March 2020, two days before the World Health Organization declared COVID-19 a global pandemic, microbiologist and infectious diseases expert Associate Professor Siouxsie Wiles released the first output from her collaboration with cartoonist Toby Morris: an animated GIF (Graphics Interchange Format) known as ‘Flatten the Curve’. The graphic went viral on Twitter with over 10 million impressions in three days. Flatten the Curve was the first of more than 70 graphics produced by the Wiles and Morris collaboration, all designed as accessible visual communication about COVID-19. The graphics, all released under a Creative Commons CC-BY-SA-4.0 license, have been translated into multiple languages, used by communities, politicians, and public health officials around the world, and the collaborators have won multiple awards for their work.

1 Introduction

The COVID-era collaboration between microbiologist and science communicator Associate Professor Siouxsie Wiles and cartoonist Toby Morris has produced more than 70 visually engaging and sharable graphics (Table 1), aimed at helping people understand the evolving scientific understanding of the virus and the public health measures introduced in response to the pandemic.

Many of Aotearoa New Zealand's five million residents were on summer holidays when news of what would become the COVID-19 pandemic started emerging in late 2019/early 2020. When Wiles returned home in mid-January from a trip to Europe, she soon found herself responding to requests from TV, radio, print and online journalists.

Wiles identified a need for information about the science of the emerging pandemic, and the importance of working collectively to get through what was likely to be an extremely disruptive and distressing time, so began writing explainers and opinion pieces for online magazine The Spinoff. Taking advantage of New Zealand's dark hours to catch up with northern hemisphere news, Wiles got into a routine of late-night reading of situation reports by the World Health Organization (WHO), European Centre for Disease Prevention and Control (ECDC) and the United States Centers for Disease Control and Prevention (CDC), the latest scientific papers and pre-prints, and tweets by trusted scientists – distilling the information into articles to go live the next morning. Soon Wiles was writing new articles almost daily, many focused on how New Zealanders could prepare for the arrival of COVID-19 (Wiles, 2020a, 2020b).

The Wiles Morris collaboration that is the subject of this paper began after Wiles saw a post on Twitter in late February 2020 by health policy and population health educator Dr Drew Harris (@drewaharris) (Fig. 1A) (Harris, 2020). Harris’ tweet reminded people that while COVID-19 control measures may only delay cases rather than prevent them, that could be “the difference between finding an ICU bed and ventilator or being treated in the parking lot tent”. The tweet included a graph illustrating the concept of using protective measures to ‘flatten the curve’ and keep cases within the capacity of healthcare systems.
What struck Wiles about Harris’ graph was that it didn’t articulate how individual attitudes and actions could impact the spread of COVID-19 and thus help ‘flatten the curve’. Wiles felt that such an important and empowering message needed to be clear and more visually engaging. With a history of working closely with artists, animators, and illustrators on a variety of science communication projects (Wiles and Harris, 2013; Wiles and Klee, 2013, 2015; Wiles, 2014), Wiles asked The Spinoff editor Toby Manhire if Morris – whose cartoons on political and social issues she admired – would be interested in illustrating a new version of the graph. Wiles and Morris, who had never met, were soon on the phone discussing ideas.

This paper documents some of the key outputs of the Wiles Morris collaboration then comments more broadly about the collaboration and offers advice for other scientists and illustrators working together. It includes quotes from a series of Zoom interviews by Rebecca Priestley with Wiles and Morris, as well as with The Spinoff editor Toby Manhire and publisher Duncan Greive. These interviews were conducted between July and October 2020 under Victoria University of Wellington Human Ethics Committee approval #28669. Unless otherwise specified, all social media analytics reported are for the period March-October 2020.

2 Context

Aotearoa New Zealand is an island nation in the South Pacific with a population of more than five million people. The islands were settled by Polynesian voyagers in the thirteenth century then colonised by the British in the 1800s. One in six people in the country now identify as having indigenous Māori ethnicity (Stats NZ, 2020). While English is the predominant language spoken, the country’s official languages are te reo Māori and New Zealand sign language (Ō Tātou Reo | Ministry for Ethnic Communities).

Aotearoa New Zealand’s first COVID-19 case was reported on 28 February 2020, in a woman who arrived from Iran (New Zealand Ministry of Health, 2020). Three weeks later, with 28 confirmed cases of COVID-19, the government sealed the borders to everyone except citizens and residents (Unite against COVID-19, 2021). On 23 March a national state of emergency was declared, and the country pivoted from a mitigation approach to an elimination strategy. On 26 March, following the country’s first confirmed case of community transmission, the New Zealand government implemented one of the world’s strictest lockdowns – Level 4 of a four-level alert system – while scaling up testing and contact tracing (Unite against COVID-19, 2021). New Zealand’s first COVID-19 death was reported on 29 March and daily cases peaked at 89, on 5 April. On 9 June 2020, after 1,154 confirmed COVID-19 cases and 22 deaths, but with no active cases, the country lifted all restrictions except those in place at the border.

Over the next year, restrictions came and went as different regions, and sometimes the whole country, cycled in and out of different alert levels in response to the detection of community transmission of COVID-19. Rollout of the Pfizer/BioNTech vaccine began in February 2021, with priority given to border and managed isolation and quarantine (MIQ) workers, healthcare workers and vulnerable and elderly populations (Hipkins, 2021).
After 100 days with no community transmission of the virus, on 17 August 2021 detection of the Delta variant of COVID-19 led to an immediate nationwide lockdown which lasted for two weeks and continued for longer in the country’s biggest city of Auckland. In December 2021, as the Omicron variant was spreading around the world, all of New Zealand moved away from the COVID-19 Alert System to the COVID-19 Protection Framework, a three-tiered (red, orange, yellow) traffic light system which offered greater freedom to those who were vaccinated (Unite against COVID-19, 2022). Omicron was found to be spreading in the community in January 2022 and the entire country moved to ‘red’.

As part of the response to the pandemic, the government introduced contact tracing requirements, vaccine mandates, and mask mandates. For example, rolling out from October 2021 vaccine mandates were introduced to workers in health and disability services, Police, Defence Force, Fire and Emergency services, schools, and border and corrections services. Masks were required on flights, public transport, in taxis, retail, public facilities, in some education settings, and in close proximity businesses, food and drink businesses, public events, and gatherings.

Compliance levels with the mandates were moderate to high (Kaine et al., 2022) but at the same time as Wiles and Morris were publishing their graphics, there was a rise of disinformation and anti-government sentiment (Soar et al., 2020). On 6 February 2022, a day when there were 208 new community cases of COVID-19, groups of protesters began travelling to New Zealand’s Parliament grounds for what became an illegal occupation of the grounds and surrounding streets. By 2 March 2022, when the final protesters were forcibly removed from Parliament, daily community cases of COVID-19 reached 22,152. Fuelled by online mis- and disinformation about the safety of the Pfizer/BioNTech vaccine, as well as far-right anti-government propaganda, the disorganised group of protesters called for the end of all COVID-19 restrictions, including mask and vaccine mandates, and made violent threats to government leaders, journalists, academics, and public officials involved in, or reporting on, the COVID-19 response (Hannah et al., 2022).

In September 2022 the COVID-19 Protection Framework was retired, replaced by a set of public health advice that specified mask-wearing under some circumstances, most notably in settings such as aged care and healthcare facilities (Unite against COVID-19, 2022). The requirement for household contacts of COVID-cases to isolate was also removed, unless they also tested positive, and New Zealand’s border fully reopened, including to unvaccinated travellers.

Compared to other countries, New Zealand has had high uptake of the initial two dose COVID-19 vaccine regimen. According to Manatū Hauora Ministry of Health statistics, as of October 2022, 11,826,909 total vaccine doses have been administered in New Zealand (New Zealand Ministry of Health, 2022b). This equates to 90.2 percent of the eligible 12+ population having completed the primary course, 73.2 percent of the eligible 18+ population having received a first booster, and 41 percent of the eligible 50+ population having received a second booster (New Zealand Ministry of Health, 2022b). A paediatric vaccine is also available to those aged 5–11 and as of October 2022, 268,012 first doses and 151,816 second doses have been administered (New Zealand Ministry of Health, 2022b). As of 23 October 2022,
the Manatū Hauora Ministry of Health reported 1,831,233 confirmed cases of COVID-19 (New Zealand Ministry of Health, 2022a). The widespread use of at-home rapid antigen tests since the emergence of the Omicron variant means that this is almost certainly an underestimate due to under-self-reporting; it is likely that to date at least half of all people in New Zealand have had a COVID-19 infection. As of 23 October 2022, there have been 2,095 deaths attributed to COVID-19 (New Zealand Ministry of Health, 2022a), one of the lowest cumulative per capita death rates in the world.

The focus of this paper is a series of graphics produced by Siouxsie Wiles and Toby Morris in response to the COVID-19 pandemic. Wiles is a microbiologist and infectious diseases expert and one of New Zealand’s most visible and celebrated science communicators. Her awards include the inaugural 3Rs Prize from the UK National Centre for the Replacement, Refinement, and Reduction of Animals in Research (NC3Rs) in 2005 and the New Zealand Prime Minister’s Science Media Communication Prize in 2013. In 2019 she was appointed a member of the New Zealand Order of Merit for services to microbiology and science communication. Morris is an award-winning illustrator, comic artist, and writer with a Bachelor of Arts in English literature and political science. He is well known for highlighting important social issues in his non-fiction online comics, including The Pencilsword for New Zealand broadcaster RNZ (Morris, 2017) and The Side Eye for online magazine The Spinoff (Morris, 2022). The Spinoff is an independent New Zealand-based media brand and content agency founded in 2014 (Spinoff, 2022). It covers current affairs and pop culture in an online magazine style, focusing on features, analysis, and opinion.

3 Scientist-cartoonist Collaboration

Flattening the curve

Duncan Greive, the managing editor, and I were a bit shell shocked – as was most of the country – but we realised that what The Spinoff was at that point had to change because the mood of the country had changed, and this was an issue that was too pressing and serious to treat the way we would treat any old cultural or political news story. … One of the decisions we made when things became serious is that the last thing people need now is hot takes, which would surprise some people, given The Spinoff is, you know, not afraid of a hot take on a whole lot of cultural and political elements, but we thought that it was just too serious and too complex to have people smashing out 600 word polemics or opinion pieces.

Toby Manhire, The Spinoff editor, 28 July 2020

As previously described, Wiles and Morris began collaborating after Wiles saw Dr Drew Harris’ tweet describing the concept of ‘flatten the curve’ in late February 2020 (Fig. 1A) (Harris, 2020). The result was a GIF that alternated between a ‘whatever’ approach, where no action is taken (Fig. 1B), and a ‘careful’ approach, which included washing hands, not touching faces, and staying home when sick (Fig. 1C). Morris replaced the red and blue colours of the original graph because of their affiliation with certain political parties in New Zealand, the USA, and many other countries. He also added an illustration of a hospital with a ‘full’ sign to signify health system capacity.
The Wiles & Morris ‘Flatten the curve’ GIF was released under a Creative Commons CC-BY-SA-4.0 license and accompanied by an article on The Spinoff (Wiles and Morris, 2020r). Wiles shared the GIF on Twitter on 9 March 2020. It was an instant success, gaining 1.9 million impressions within 48 hours. The New Zealand Prime Minister Jacinda Ardern used it at a national press conference on 14 March. It spread around the world, gaining over 10 million impressions. International news media published it in their articles about COVID-19. After being translated into several European languages by volunteers, coder Marc Sutter (@marcsutter on Twitter) developed an automated system to translate the graphic into any language (Sutter, 2020b). Wiles and Morris’ ‘Flatten the curve’ GIF went, pardon the pun, viral. The GIF was updated in February 2022 to reflect changes in health measures, such as the use of masks and vaccines, since the GIF was first released (Fig. 1DE) (Table 1) (Wiles and Morris, 2022e).

Stop the spread: the elimination message

I knew immediately when I saw [Stop the Spread] that it was going to go around the world. It’s an incredible piece of communication that in the space of seconds conveys the critical importance of taking responsibility for what you do and its impact on other people. I remember seeing that on a Saturday evening and just thinking this is going to be massive and I scheduled it to run on Twitter the next morning, and by the time I woke up it had, you know, thousands of shares already.

Toby Manhire, Spinoff editor, 28 July 2020

On 11 March 2020, just days after Wiles and Morris’ ‘Flatten the curve’ GIF was released, the WHO declared COVID-19 a global pandemic (Ghebreyesus, 2020). Two days earlier, on 9 March 2020, Professor Roy Anderson and colleagues had published an article in The Lancet (Anderson et al., 2020) expressing their view that COVID-19 had developed into a pandemic and small chains of transmission were occurring in many countries, alongside the extensive spread already being seen in countries such as Italy and Iran. In their paper they illustrated an alternative to ‘flattening the curve,’ where interventions reduced cases to near background levels. It also cautioned that this approach came with the risk of a resurgence if the interventions were lifted too soon.

Motivated by the success of ‘Flatten the curve’, their shared values, and the ease with which they had collaborated, Wiles asked Morris if he would work with her again to illustrate the alternate pandemic management strategy highlighted by Anderson and colleagues. Wiles and Morris dubbed this strategy ‘Stop the spread’ but in epidemiological terms it is better known as elimination. Again, Wiles wanted to show the public that their actions mattered. The new GIF cycled through three scenarios (Fig. 2). In the first, the lack of a collective response sees cases rapidly overwhelm health system capacity (Fig. 2A). In the second, a strong collective response results in the elimination of COVID-19 as the best-case scenario (Fig. 2B). In the final scenario, a strong but short-term collective response results in a resurgence in cases (Fig. 2C).

The ‘Stop the spread’ GIF was released under a Creative Commons CC-BY-SA-4.0 license and accompanied by an article on The Spinoff (Wiles and Morris, 2020d). Wiles shared the GIF on Twitter on
13 March 2020, and it soon gained more than one million impressions, including more than 4,300 retweets and 5,100 likes. While this GIF did not achieve the international success of ‘Flatten the curve’, which saw 10 million impressions, it was useful within New Zealand to help the public understand the elimination strategy which the government began pursuing in the latter part of March 2020.

Breaking the chain of transmission

‘I think that magenta just sort of clicked with me as being quite a bright and distinctive colour and it was very useful to have that as a visual shorthand. I sent Siouxsie an email saying I hope you are comfortable with this, people have pointed out that it’s matching your hair, I hope you’re not thinking that I’m making you synonymous with a virus or something like that. And she said, no, no, it’s fine. It works, so let’s keep rolling with it.’

Toby Morris, 10 August 2020

With cases growing rapidly around the world, after ‘Stop the spread’ Wiles’ next goal was to explain the concept of exponential growth and show how one case can quickly branch out into more and more transmission chains. She also wanted to illustrate how individual decisions and actions can end a chain of transmission. In ‘Breaking the chain’, Morris chose to depict COVID-19 cases as pink dots, with each case resulting in a further two to three cases connected by pink lines (Fig. 3A). Chains are broken – and the pink dots and lines turn grey – by actions such as working from home, or not attending a social gathering (“this person didn’t go to that BBQ [barbeque]”) (Fig. 3B). The suggested actions reflected Wiles’ advice at the time that people begin working from home if possible and minimise their contact with others.

Again, the GIF was released under a Creative Commons CC-BY-SA-4.0 license and accompanied by an article on The Spinoff (Wiles and Morris, 2020k). Wiles shared the GIF on Twitter on 22 March 2020 where it gained more than 2.5 million impressions, including more than 13,700 retweets and 16,000 likes. Soon afterwards the GIF began being adapted and adopted by official communications channels in many countries, including Argentina, Australia, Germany (Fig. 3C), and Scotland. Wiles and Morris updated the GIF in August 2021 to reflect the change in recommendations for reducing transmission since the release of the original GIF (Fig. 1D).

One of the most striking adaptations of ‘Breaking the chain’ was by the Centre for Children’s Law and Policy, an organisation based in Washington D.C, USA, which focuses on protecting the rights of children within the youth justice and other systems. In their adaptation, actions such as working from home or not attending a social gathering are replaced with actions to reduce the spread of COVID-19 in the youth justice system (for example, “police issue verbal warning or citation instead of arrest” and “judges release youth from secure facility to community supervision program”) (Fig. 3E).

In September 2020, Wiles and Morris adapted the ‘Breaking the chain’ GIF for a series of graphics about the ‘infodemic’ (Zarocostas, 2020) – the overabundance and rapid spread of both accurate and
Communicating key public health measures and scientific concepts

[We wanted to] 'help people explain the idea that we have to stay close to each other, and not mix groups and stuff. And I had gotten off the phone and been sketching ideas of family units or whatever the term for it could be. And later the Prime Minister had a press conference and she said the word “bubble” in that. And I was watching, with my notepad, half listening and half working, and was like “bubble!” You know, like, that’s it. And within a minute I had a text from Siouxsie and from Toby saying “the Prime Minister just said bubble”, like, that’s it, that’s the term that we were trying to think of. And that was a really effective metaphor, very easy to grasp, because, it’s you know, very fragile. The bubble, you know that you’re inside it, or it’s broken. And as soon as we had that idea, it seemed like that would be an effective visual metaphor, be easy enough to draw, something that explained the idea very clearly.

Toby Morris, 10 August 2020

On 26 March 2020, five days after the introduction of the four-tiered Alert Level system, New Zealand began one of the world’s strictest lockdowns. Wiles and Morris immediately began producing graphics to help people understand the importance of following the public health measures of the Alert Level system. For example, in announcing the move to Alert Level 4, Prime Minister Jacinda Ardern suggested everyone think of themselves as being in a ‘bubble’ with the people they live with (Kearns et al., 2021). Under Alert Level 4 people had to stay in their bubble so if someone within a household was incubating COVID-19, spread beyond that bubble would be limited. The bubble concept, first suggested by academic Tristram Ingham for use in the disabled community, was used widely by the government and the media (He Kitenga, 2020). Wiles and Morris produced a series of graphics showing, for example, bubbles being popped by people visiting other households (Fig. 4A) and how COVID-19 could spread between bubbles if just one person from each household did not follow the rules (Table 1).

As case numbers continued to rise and New Zealand began to record deaths from COVID-19, Wiles and Morris produced graphics explaining the concept of the ‘lag’ (Fig. 4B) so people would understand that it would take several weeks to begin to see the impact of the Alert Level system measures. Because of the incubation period of the virus, which at the beginning of the pandemic was two to ten days for most people, daily case numbers reflected infections that occurred in the previous one-to-two weeks. Similarly, because it took many weeks for some people to become seriously ill from COVID-19, deaths were expected to continue for many weeks after case numbers had begun to decline.

One graphic was inspired by confusion over the word ‘elimination’ which has a different meaning in epidemiology (to reduce to zero or near zero in a particular area) than in everyday use (to get rid of completely). Wiles and Morris brainstormed other dual-meaning words that the public would be hearing during the pandemic and the result is the “A few definitions” graphic (Fig. 4C). One of the words included in this graphic is ‘model’. In science, a model is a simulation or representation of the real world, whereas
in everyday language a model is a small replica, or a person who demonstrates clothes. Morris represented the word model using a mouse and fly, which researchers commonly use as surrogates for humans in scientific experiments, as well as the mathematical formula initially used by one of the teams modelling potential COVID-19 cases in New Zealand (Binny et al., 2021).

Over the course of the pandemic, Wiles and Morris continued to produce graphics with most falling into one of two categories: 1) explaining scientific concepts and 2) explaining public health measures. Their efforts to explain scientific concepts included a graphic that showed the different ways of detecting a COVID-19 infection before the rollout of vaccines (Fig. 4D) and a graphic that used the analogy of a bicycle lock to explain how different COVID-19 variants arise (Fig. 4E). To help explain public health measures, Wiles and Morris produced graphics covering interventions such as masks (Fig. 4F), vaccines (Fig. 4G-I), and contact tracing (Fig. 4J). When communicating about vaccination, they not only explained the diverse ways vaccines are made, but specifically focused on how mRNA vaccines work (Fig. 4G), and how the COVID-19 vaccines were developed so fast (Fig. 4H). Wiles and Morris used the concept of multiplayer video games to explain how vaccines work and ‘community immunity’ (Fig. 4I). This graphic was also turned into a video for release on YouTube (Wiles and Morris, 2021k). Wiles and Morris also adapted graphics by Jono Hey (@sketchplanator on Twitter) (Hey, 2020), and Dr Ian M. Mackay (@MackayIM on Twitter) (Mackay, 2020) based on Professor James Reason and colleagues’ “Swiss cheese model of system accidents” (Eagle et al., 1992; Reason, 2000) to show how public health measures can work together to protect people from COVID-19 (“The Swiss cheese model”, Fig. 4K). When rapid antigen tests became more widely available in New Zealand, Wiles and Morris made a graphic explaining how to correctly take a nasal swab (Fig. 4L) based on advice posted online by otolaryngologist Dr Eric Levi (@DrEricLevi on Twitter) (Levi, 2022). Early in the pandemic Morris also worked with Wiles on a longer form comic (Morris, 2020) exploring what was known or suspected about COVID-19 at the time.

While communicating about COVID-19 has been the focus of the Wiles-Morris collaboration, they have more recently used their platform to communicate about other health issues such as antibiotic resistance (Wiles and Morris, 2021p) and the 2022 Monkeypox epidemic (Wiles and Morris, 2022f).

4 Discussion

The work they did had a measurable and real impact in New Zealand and around the world, and will have saved people's lives. I sort of pinch myself saying that, but I think the ability to be able to communicate those concepts and why they matter so much will have changed people’s decision-making.

Toby Manhire, The Spinoff editor, 28 July 2020

In Aotearoa New Zealand, public communications about the COVID-19 pandemic initially came from daily briefings from the Prime Minister Jacinda Ardern and the Director-General of Health Ashley Bloomfield, supported by a government communications campaign (Beattie and Priestley, 2021). But direct communication by scientists such as Wiles, along with others such as epidemiologist Professor Michael
Baker, public health expert Dr Ayesha Verrall, and COVID-19 modellers Professors Shaun Hendy and Michael Plank, also played a key role in educating New Zealanders, and then the world, about COVID-19.

Lauded and harassed

... people were so hungry for information they could rely on, information which, in an accessible way, conveyed the health and science implications of the pandemic ... and the beautiful thing about Toby and Siouxsie's work was that it had a calm voice, you know it spoke to you in a way which, after consuming [it, you were like] okay, this is really scary, but I can deal with it

Duncan Greive, The Spinoff managing editor, 14 October 2020

As a result of the success of their collaboration, in November 2020 the Designers Institute of New Zealand awarded Wiles and Morris the ‘Purple Pin’ Public Good Award, with judges describing their work as taking “a simple and human approach to a once in a lifetime problem,” providing “complex information in an accessible, clear and concise fashion” in “an environment where science and facts were highly contested” (Design Institute of New Zealand, 2020). On 31 March 2021 Wiles was named 2021 Kiwibank New Zealander of the Year, with the citation acknowledging her work with Morris creating graphics “seen by millions and even used by governments and organisations as part of their official pandemic communications” (Kiwibank New Zealander of the Year Awards, 2020). In recognition of the collaboration, Morris won Best Graphic Artist and Cartoonist of the Year at the Voyager Media Awards 2021 and the Prime Minister’s Science Communication Prize 2021 for producing “some of the most effective science communication on COVID-19 seen anywhere in the world” (The Prime Minister’s Science Prizes, 2021). The success of the Wiles-Morris collaboration led the New Zealand Science Media Centre to encourage further scientist-illustrator collaborations, holding a Drawing Science workshop in June 2021 and collaborating with The Spinoff and Daylight Creative to publish an illustrated guide for researchers who want to learn how to collaborate with illustrators (Science Media Centre, 2022).

But there has been a dark flipside to the success of this campaign, and Wiles’ visibility through the pandemic. Already used to a certain level of harassment as an outspoken pink-haired woman with a public profile, the pandemic has seen Wiles subject to violent online abuse, harassment and threats from disinformation campaigners who accuse her of, for example, “misleading the public” and “supporting a government to perform medical experiment (sic) on it’s (sic) citizens ” (Wiles, 2022).

Creative Commons licensing of GIFs and graphics

Siouxsie said sort of almost in passing “hey, do you think we could make this work Creative Commons”, and I sort of went “oh?” And I remember thinking about it very briefly, because you wouldn't normally do that when it's copyrighted work for a publication. It's not the normal thing to give it away. But these were strange times and it was important work and I said, “well yes okay let's do that, why not?” And we did. And it meant that [the graphics] could be translated by people elsewhere, it meant that people could adapt it for their own purposes, it meant that people could kind of build on the work that had started and get it
in front of as many eyeballs as possible without feeling as though they had to check in with us ... It sort of became almost a running joke, the ways that different parts were used, and sometimes bastardised in different comms operations around the world. We haven't got them all, but I've got many of them in a folder which make quite interesting viewing. You know, we got sent photos of a phone box in Berlin that had Toby's illustration on it.

Toby Manhire, The Spinoff editor, 28 July 2020

One of the key factors in these graphics being shared so widely, in New Zealand and around the world, and adapted to a range of different languages, cultures and environments, is the Creative Commons licensing. Creative Commons licences are free, easy-to-use copyright licenses that provide a simple, standardised way for content creators to maintain their copyright while giving others permission to share and use their creative work without the individual negotiations necessary under the more traditional “all rights reserved” form of copyright (Creative Commons). There are a range of Creative Commons licenses available which allow the content creator to specify whether their work can be distributed, remixed, adapted, and built upon, and whether this can be done commercially or non-commercially.

All the images produced as part of the Wiles and Morris collaboration were released under a Creative Commons CC-BY-SA-4.0 licence. This means that anyone is free to use them, and adapt them, providing they give appropriate credit and share them under the same conditions. As previously described, coder Marc Sutter developed an automated system to translate the ‘Flatten the curve’ graphic into any language which he posted to the online open-source software hosting service GitHub on 28 March 2020 (Sutter, 2020b). By April 2020, Sutter had done the same for the ‘Breaking the chain’ graphic (Sutter, 2020c) and the ‘Stay in your bubble’ graphic (Sutter, 2020a). In April 2020, The Spinoff also arranged for all the graphics and GIFs produced to date to be translated into te reo Māori (Hayden, 2020). In August 2020 in response to a community outbreak of COVID-19, several more graphics and GIFs were translated into te reo Māori and into Cook Islands, Samoan, Tongan, and Niuean languages in collaboration with Moana Connect (formerly Moana Research).

Over the weeks and months that followed, people continued to translate and share the graphics and GIFs around the world. In June 2020, the World Health Organization contracted The Spinoff’s Auckland-based team to develop COVID-19 communications resources for the global organisation which saw many of Wiles & Morris’ original GIFs and graphics adapted and released to a global audience.

Tips for working with visual communicators

Usually, I would read [Siouxie's] first go at it and I would make a very scruffy sort of pencil sketch animation, just with a few crude frames, like spend half an hour on it or something, and send that back to her and Toby and say, “this is how I've understood what you said, am I on the right track, have I understood you right here?” And sometimes that would be like “yep, that's right, let's go for it”. Other times, it would need a bit more conversation back and forth, she'd have some sort of clarifications or corrections, or sometimes I would have missed the point and she would explain it to me more clearly. But
to me, it starts to make sense when I start to actually draw it rather than chatting about it back and forth, sometimes it’s easier to sketch it rather than describe what I’m going to sketch initially.

Toby Morris, 10 August 2020

For scientists wanting to improve their science communication efforts by working with visual communicators, Wiles advises that they understand the limits of their own communications expertise and seek out collaborators with complementary skillsets. She also suggests you consider collaborating with others with a shared set of values as some agreement on why you’re communicating can help build rapport and synergy between collaborators. It is also helpful to build long-term relationships and credibility with journalists, artists, and visual communicators. Wiles recommends that you ask for advice from academics and practitioners who work and research in the field of science communication and be prepared to read some of the theory. Finally, she asks that you consider sharing your successes and failures with the wider community, through conference presentations, blogs and academic articles.

For visual communicators wanting to improve their science communication efforts by working with scientists, Morris advises that effective collaboration is a lot about respecting each other’s expertise and playing to each other’s strengths. The scientists will likely be the experts in what you’re going to say, and you can help with how you’re going to say it. He also suggests you work together to figure out precisely what it is you’re trying to say, and then stick to the point. It’s more effective to say one thing clearly than several things cluttered. Morris also says that sometimes working with unfamiliar subject matter can be an advantage; in many respects you as a visual communicator are probably in the same position as the audience. If you find a way – a metaphor, a diagram, an analogy perhaps – that helps you understand the science, that’s likely to help your audience understand it too. Simplicity is also key, so Morris advises trying to trim out any elements that aren’t working towards making your point clearer. Similarly, the visuals should be used for communication, not just as decorations. Morris recommends finding ways where you can condense information into the imagery and trim out words; showing someone doing something can be more effective than telling them about it. Finally, Morris advises that you be aware of subconscious messaging. Images are great at communicating information, but also, less obviously, tone. Images can feel warm or cold, calm or hectic, welcoming or aggressive. Think about the colours you use, the style of your artwork, and the complexity of your layouts. These can be used subtly to help set the mood your communication will be received in.

5 Conclusion

In this paper we have documented the accessible visual COVID-19 communications produced by microbiologist and infectious diseases expert Associate Professor Siouxsie Wiles and cartoonist Toby Morris. Their collaboration began with the release in early March 2020 of an animated GIF known as ‘Flatten the Curve’ (Wiles and Morris, 2020r). They went on to produce more than 70 graphics (Table 1), all released under a Creative Commons CC-BY-SA-4.0 license, many of which have been translated into multiple languages, and used by communities, public health officials, governments, and organisations all
around the world. One of the main limitations of developing communications during the pandemic, has been the speed with which both understanding about COVID-19 has changed as new evidence emerges but also how the emergence of new variants of the virus impacted on infection dynamics and public health measures. For this reason, in February 2021, Wiles and Morris began dating their graphics, and added a disclaimer that information may change with the emergence of new variants.

As the COVID-19 virus continues to spread, evolve, and claim lives around the world there is an ongoing need for accessible and effective public health messaging. All the graphics produced by Wiles and Morris (Table 1) are available on the Spinoff website, along with information about how to use and credit them (The Spinoff, 2021).

**Declarations**

**Conflicts of Interest**

Toby Morris is creative director of The Spinoff and former creative director and now freelance contributor to Daylight, a content creation agency based in Auckland, New Zealand.

**Funding**

This work received no funding.

**Acknowledgments**

The authors would like to thank Alex Beattie, from the Centre for Science in Society at Te Herenga Waka Victoria University of Wellington, for social media analytics, and Jo Bailey, Massey University, for organising and hosting the Zoom interviews that are quoted from in this paper. SW and TM would like to thank Toby Manhire and Duncan Greive for their support, and Te Pūnaha Matatini for funding the translation of several of their graphics into te reo Māori, Cook Islands Māori, Samoan, Tongan, and Niuean. SW would like to thank the members of the Bioluminescent Superbugs Lab for their support.

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important [Accessed October 3, 2022].


covid-vaccine-summit [Accessed October 1, 2022].


**Tables**

Table 1. Graphics produced by Wiles and Morris. * indicates those graphics to which a date was added on release.
<table>
<thead>
<tr>
<th>Graphic</th>
<th>Date of release</th>
<th>Description</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pandemic/infection dynamics related</td>
<td></td>
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</tr>
<tr>
<td>Flatten the curve</td>
<td>9 March 2020</td>
<td>Adaptation of Dr Drew Harris’ ‘Flatten the curve’ graph</td>
<td>(Wiles and Morris, 2020r)</td>
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<tr>
<td>Stop the spread</td>
<td>14 March 2020</td>
<td>Adaptation of ‘Flatten the curve’ graphic incorporating information from Anderson et al (2020)</td>
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</tr>
<tr>
<td>The lag</td>
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<td>Graphic illustrating that because of the incubation period, current COVID-19 cases reflect transmissions that occurred as many as two weeks earlier.</td>
<td>(Wiles and Morris, 2020x)</td>
</tr>
<tr>
<td>What happens when people get COVID-19</td>
<td>12 April 2020</td>
<td>Graphic adaptation of data on hospitalisations and deaths gathered during the joint World Health Organisation/China mission in February 2020</td>
<td>(Wiles and Morris, 2020w)</td>
</tr>
<tr>
<td>Prevalence: how common is COVID-19?</td>
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<td>Graphic explaining the difference between high prevalence and low prevalence</td>
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</tr>
<tr>
<td>When success looks like an overreaction</td>
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<td>(Wiles and Morris, 2020s)</td>
</tr>
<tr>
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<td>Adaptation of ‘Stop the spread’ graphic, reminding people to follow the Alert Level 3 public health measures to prevent a resurgence of COVID-19.</td>
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</tr>
<tr>
<td>COVID-19: our body vs the virus*</td>
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<td>Graphic illustrating how the amount of virus and antibodies changes during an acute COVID-19 infection. Adapted from (He et al., 2020) (Adams et al., 2020).</td>
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<tr>
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<td>The disease triangle</td>
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<tr>
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<td>Graphic illustrating how differences in the host and environment can impact on the risk and consequences of being infected with COVID-19.</td>
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<tr>
<td>COVID-19 variants</td>
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<tr>
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<tr>
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<td>Graphic adaptation of a graph created by Professor Christina Pagel and shared on Twitter illustrating the COVID-19 negative feedback cycle. (Wiles and Morris, 2022b)</td>
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</tr>
<tr>
<td>Flatten the curve - 2022 edition*</td>
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<td>Update to Flatten the curve graphic (Wiles and Morris, 2022e)</td>
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</tbody>
</table>

### Transmission-related

<table>
<thead>
<tr>
<th>Break the chain</th>
<th>22 March 2020</th>
<th>Graphic illustrating exponential growth and how individual actions can break transmission chains (Wiles and Morris, 2020b)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>26 March 2020</td>
<td>Adaptation of ‘Break the chain’ graphic just showing exponential growth and transmission chains. (Wiles and Morris, 2020ad)</td>
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<tr>
<td>Transmission chains</td>
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<tr>
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<td>Contacts: close versus casual</td>
<td>22 August 2020</td>
<td>Graphic defining what is meant by the terms close and casual contacts, clusters, and community transmission (Wiles and Morris, 2020g)</td>
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<tr>
<td>COVID-19 transmission 101 – full version*</td>
<td>5 February 2021</td>
<td>Graphic illustrating when people are likely to be infectious, the various routes by which COVID-19 transmits, and the conditions under which superspreading events happen. (Wiles and Morris, 2021b)</td>
</tr>
<tr>
<td>COVID-19 transmission 101 – when are people infectious?</td>
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<td>Graphic illustrating when people are likely to be symptomatic and when they are likely to be infectious after being exposed to COVID-19. (Wiles and Morris, 2021b)</td>
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<td>Graphic illustrating the various routes by which COVID-19 is likely transmitted. (Wiles and Morris, 2021b)</td>
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<tr>
<td>COVID-19 transmission 101 – super-spreaders*</td>
<td>5 February 2021</td>
<td>Graphic illustrating the conditions under which superspreading events happen. (Wiles and Morris, 2021b)</td>
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<tr>
<td>Cracking the case*</td>
<td>17 February 2021</td>
<td>PCR and antibody testing, genome sequencing, and contact tracing working to trace the origins of any transmission chains to help understand how COVID-19 transmits and make the country’s border controls more robust. (Wiles and Morris, 2021g)</td>
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<tr>
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<tr>
<td>Chasing down an outbreak*</td>
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<td>Update to the graphic describing how New Zealand uses PCR and antibody testing, genome sequencing, and contact tracing (Wiles and Morris, 2021g)</td>
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</tbody>
</table>
working to identify transmission chains as the country experiences an outbreak of the delta variant. Update includes the addition of wastewater testing. [Morris, 2021m]

| **COVID-19 transmission 101 - updated*** | 19 August 2021 | Update to the previous COVID-19 transmission 101. | (Wiles and Morris, 2021f) |
| **Five factors for COVID-19 safety*** | 22 December 2021 | Graphic describing five factors that influence the risk of catching and spreading COVID-19. | (Wiles and Morris, 2021e) |

**COVID-19 Symptoms related**

| **COVID-19 vs colds and flu** | 2 April 2020 | Graphic showing the difference between symptoms of COVID-19, flu, and colds. | (Wiles and Morris, 2020c) |
| **COVID-19 symptom chart - updated** | 30 April 2020 | Updated version of the COVID-19 symptom chart to include new symptoms like loss of smell. | (Wiles and Morris, 2020z) |
| **Potential symptoms of COVID-19 - updated*** | 18 August 2021 | Updated graphic describing the various potential symptoms of COVID-19 | (Wiles and Morris, 2021c) |

**Bubble-related**

| **Don’t pop your bubbles! Version 1** | 26 March 2020 | Graphic illustrating the breaking of household bubbles by visiting others. | (Wiles and Morris, 2020ad) |
| **Don’t pop your bubbles! Version 2** | 26 March 2020 | Graphic illustrating the breaking of household bubbles by visiting others. | (Wiles and Morris, 2020ad) |
| **Stay in your bubble** | 1 April 2020 | Graphic illustrating how COVID-19 could transmit between households if people didn’t follow the Alert Level 4 public health measures. | (Wiles and Morris, 2020ab) |
| **Apartment bubbles** | 3 April 2020 | Graphic explaining the concept of household ‘bubbles’ in the context of an apartment. | (Wiles and Morris, 2020a) |
| **Cleaning shared spaces** | 3 April 2020 | Graphic explaining the importance of regularly cleaning shared areas to prevent the transmission of COVID-19. | (Wiles and Morris, 2020a) |
| **Back in our bubbles** | 12 August 2020 | Graphic illustrating the public health measures to eliminate community transmission of COVID-19 during an outbreak of the delta variant in New Zealand. | (Wiles and Morris, 2020i) |

**Contact tracing-related**

<p>| <strong>Contact tracing</strong> | 18 April 2020 | Graphic illustrating how contact tracing works to break chains of transmission. | (Wiles and Morris, 2020y) |
| <strong>Contact tracing apps</strong> | 23 May 2020 | Adaptation of the ‘Contact tracing’ graphic to explain the difference between centralised and decentralised contact tracing apps. | (Wiles and |</p>
<table>
<thead>
<tr>
<th>Project</th>
<th>Date</th>
<th>Description</th>
<th>Reference</th>
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<tbody>
<tr>
<td>New phone who this?!</td>
<td>23 May 2020</td>
<td>Graphic explaining the need for contact tracers to have to date contact information on the population</td>
<td>(Wiles and Morris, 2020f)</td>
</tr>
<tr>
<td><strong>Facemask-related</strong></td>
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<tr>
<td>Facemasks</td>
<td>6 April 2020</td>
<td>Graphic explaining the difference between respirator, surgical, and cloth masks, and how to wear masks correctly to prevent droplet transmission.</td>
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<tr>
<td>Masks in NZ</td>
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<td>Graphic explaining why masks weren’t required to be worn in public in New Zealand</td>
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<tr>
<td>Masks and COVID-19 transmission risk</td>
<td>15 August 2020</td>
<td>Graphic illustrating the differences mask-wearing makes to the risk of spreading COVID-19.</td>
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<tr>
<td>Universal masking</td>
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<td>Graphic illustrating how universal masking protects the community from those who are infectious.</td>
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<tr>
<td>Masks 101 – updated*</td>
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<td>Update to previous graphic on masking.</td>
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<tr>
<td>Wishing it’s over doesn’t make it over*</td>
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<td>Graphic likening wearing a mask when COVID-19 is in the community to wearing a seatbelt.</td>
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<tr>
<td><strong>Other public health measures-related</strong></td>
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<tr>
<td>Get tested</td>
<td>30 April 2020</td>
<td>Graphic illustrating the importance of getting tested quickly to prevent transmission chains growing</td>
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<tr>
<td>Keeping safe at level 2</td>
<td>14 May 2020</td>
<td>Graphic illustrating the public health measures in place to keep people safe from COVID-19 when New Zealand was at Alert Level 2.</td>
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<tr>
<td>The Emmental (Swiss) Cheese model – International edition</td>
<td>22 October 2020</td>
<td>Graphic illustrating the Swiss Cheese model of systems accidents as it can be applied to managing COVID-19.</td>
<td>(Wiles and Morris, 2020h)</td>
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<tr>
<td>The Emmental (Swiss) Cheese model – New Zealand edition</td>
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<td>Graphic illustrating the Swiss Cheese model of systems accidents and describing how it was being applied by New Zealand to manage COVID-19.</td>
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<tr>
<td>The Emmental (Swiss) Cheese model – now with added vaccines*</td>
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<tr>
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<tr>
<td><strong>Immunisation/vaccine-related</strong></td>
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<tr>
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<td>Graphic illustrating the main ways to make a</td>
<td>(Wiles</td>
</tr>
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<td>Topic</td>
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<td>Description</td>
<td>Authors</td>
</tr>
<tr>
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<tr>
<td>Why we immunise</td>
<td>13 November 2020</td>
<td>Graphic illustrating the different reasons people get vaccinated. Created in paid partnership with Te Hiringa Hauora New Zealand Health Promotion Agency.</td>
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<tr>
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<tr>
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<tr>
<td>How were COVID-19 vaccines developed so fast?*</td>
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<tr>
<td>Power up*</td>
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<td>(Wiles and Morris, 2021d)</td>
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<tr>
<td>Looking forward to summer*</td>
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<tr>
<td>Vaccines work against delta – cases*</td>
<td>29 October 2021</td>
<td>Graphic showing the impact of the Pfizer vaccine on cases during New Zealand’s delta outbreak.</td>
<td>(Wiles and Morris, 2021o)</td>
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<tr>
<td>Vaccines work against delta – hospitalisations*</td>
<td>29 October 2021</td>
<td>Graphic showing the impact of the Pfizer vaccine on hospitalisations during New Zealand’s delta outbreak.</td>
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<tr>
<td>Mis/disinformation</td>
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</tr>
<tr>
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</tr>
<tr>
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<td>21 August 2021</td>
<td>Graphic illustrating the differences between misinformation and disinformation and describing the red flags to look out for.</td>
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</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td>Examples of non-contact greetings</td>
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</tr>
<tr>
<td>Topic</td>
<td>Date</td>
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</tr>
<tr>
<td>A few definitions</td>
<td>24 April 2020</td>
<td>Graphic illustrating the differences between some words when used by researchers versus the public.</td>
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</tr>
<tr>
<td>COVID-19 variants</td>
<td>26 January 2021</td>
<td>Graphic illustrating how new COVID-19 variants arise using the analogy of a bicycle lock.</td>
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<tr>
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<tr>
<td>How to take a nasal swab*</td>
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</tr>
<tr>
<td>Monkeypox: stop the stigma, stop the spread*</td>
<td>22 August 2022</td>
<td>Graphic Illustrating the ways in which monkeypox can spread and some information on the 2022 global outbreak</td>
<td>(Wiles and Morris, 2022f)</td>
</tr>
</tbody>
</table>

**Figures**
Figure 1

Graphic representations of 'Flatten the curve'.

Wiles and Morris based their graphic on a Tweet by Dr Drew Harris (A). The first version Wiles and Morris released was a GIF which presents expected daily COVID-19 case numbers where no action is taken (B) and where people adopt a ‘careful’ approach, which included washing hands, not touching faces, and
staying home when sick (C). An updated version was released by Wiles and Morris in 2022 where the ‘whatever’ approach now included an anti-mask/vaccine mandate protestors (D) and the ‘careful’ approach now included references to masking, vaccination, and other public health measures (E).

Figure 2

The Wiles and Morris “Stop the spread” graphic.
This graphic was released as a GIF which presents expected daily COVID-19 case numbers under three scenarios: in the absence of a collective response (A), in the presence of a strong collective response (B), and in the presence of a strong but short-term collective response (C).

**Figure 3**

Graphic representations of ‘Break the chain’.
Wiles and Morris’ ‘Break the chain’ graphic represents how transmission chains can grow in the absence (A) and presence (B) of various actions. There were many adaptations of this graphic including by the Federal Ministry of Health in Germany (C). Wiles and Morris updated their graphic August 2021 to show the importance of public health measures like vaccination and test-trace-isolate (D). Adaptation of the graphic by the Centre for Children's Law and Policy (E). Adaptation of the graphic by Wiles and Morris to show the measures people could take to stop the spread of misinformation and disinformation (F).

![Figure 4](image)

**Selection of graphic produced by Wiles and Morris.**

Wiles and Morris’ graphics include illustrations of the “bubble” concept for households (A), how the incubation period of the virus results in a ‘lag’ (B), dual-meaning words (C), different ways to detect a COVID-19 infection (D), COVID-19 variants (E), masks (F), how mRNA vaccines work (G), how the COVID-
19 vaccines were developed so fast (H), the concept of ‘community immunity’ (I), contact tracing (J), the “The Swiss cheese model” (K), and how to correctly take a nasal swab (L).