## 3D Printing's Response to COVID 19 – Menelik Eshetu

The World Health Organization (WHO) designated COVID-19 a global pandemic on March 11, 2020. In addition to the mortality and illness, disruption due to this widespread disease has also affected global supply chains for critically needed medical supplies. Shortages include ventilators, respirators, masks, face-shields, and various other PPE. The global uncertainty created by COVID-19 has submerged the world into a crisis that is still unfolding. It has led to an increased need for factories to manufacture materials and devices across a range of services.

The versatility and quick prototyping of 3D printing has allowed a rapid mobilization of technology as a response to the emergency. During severe disruptions in supply chains - critical parts can be quickly manufactured through 3D printing. Also, the fact that we can use designs shared online makes the technology even more favorable. The additive nature of 3D printing enables product customization and incorporation of complex designs. The broad spectrum of applications in the fight against COVID includes personal protective equipment (PPE), medical and testing devices, personal accessories, visualization aids and isolation wards. More importantly – exciting new innovations such as **Maggy** and **Pulse** have recently come to light.

Maggy

In recent times many companies have developed all kinds of devices to encourage safety and physical distance between people. One of the latest inventions is **Maggy**, a portable device created with a 3D printer that helps people keep a safe distance from each other. The company was founded by Allan Segebarth, Ruben Miesen, Bart Embrechts and Nicolas Van Odijk, a group of Belgian entrepreneurs who promote social distancing through 3D printing during this crisis.
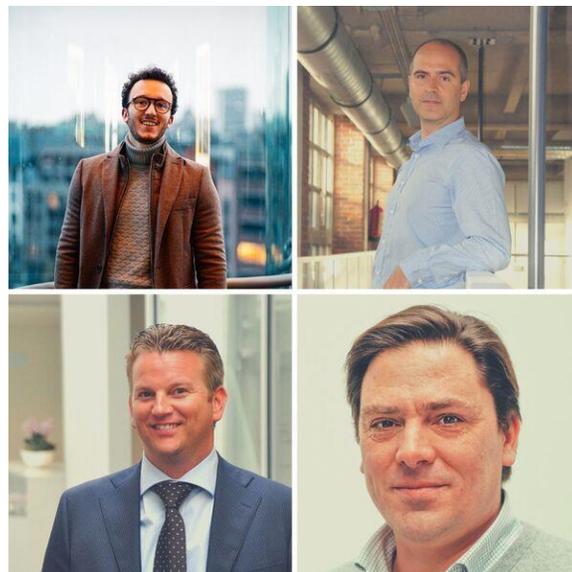
Allan Segebarth, Ruben Miesen, Bart Embrechts and Nicolas Van Odijk.

Maggy works by sending vibrations and sounds when a person approaches too close to your device. It has the latest generation of Bluetooth 5.2 chips allowing for precision of around 10-15 centimeters. It also integrates a rechargeable battery that can last up to 5 consecutive days. **Maggy** fits into a pocket or can be worn on a belt loop. It will detect other **Maggy** devices and warn the wearer if someone is too close. There is no need to download a mobile application - unless you want to detect other Bluetooth devices such as smartphones and smartwatches, change the alarm sounds, or look at social distance scores. The device has the advantage of being secure since no registration is necessary, and no user data can be collected.

Organizations, enterprises and governments can get access to the **Maggy** web platform which enables the contact tracing module - allowing people to monitor social distancing compliancy of their workforce and swiftly react in case of an infection. It is a great device for companies and organizations to provide their employees with an easy way to keep their work environment safe. It will help everyone keep a good social distance in factories, shops, museums, cultural sites, elderly homes or during family visits. **Maggy** works everywhere, both indoor and outdoor. Initially, **Maggy** was targeted for professional users. The device allows employees to maintain a safe distance from other people in the office. But museums and zoos could also lend a device to visitors for the duration of their visit. This increases the use of the device in other sectors and in the future - private individuals will also be able to use **Maggy**.

Pulse

We have been instructed time and time again that we should not touch our face with our fingers to limit our chances of contracting COVID-19. However, it's not always easy to avoid this reflex and for that reason NASA has released a 3D printed necklace designed to help us stop touching our face. The necklace has a proximity sensor with a 12-inch range and a coin vibration motor, that activates when you move your hand towards your head. The closer your fingers are, the more intense the vibrations get. You can find the list of parts you need, CAD designs to 3D print the case and directions on how to make the necklace for free online. NASA said it designed **Pulse** to be affordable and easy to put together. But we shouldn't forget that it's supposed to work alongside other coronavirus-prevention measures, such as maintaining distance and mask.


Proximity Dress

This is not the first time 3D printing has been used in the world of fashion. Projects have showcased the incredible design, freedom and innovation that can be achieved with 3D printing. Anouk Wipprecht works in the emerging field of Fashion Tech, which combines fashion design with engineering, science and user experience design. Using 3D printing technology, Anouk designed a dress, called the **Proximity Dress**, which creates physical barriers when a person is detected in the immediate surroundings of the wearer. To create this barrier, the dress integrates sensors that can detect movement. Therefore, as it detects movement, using a robotic 3D printed hip mechanism built into the dress and a resin 3D printed transparent collar with integrated sensors, the dress extends to create a barrier. This innovation has shown that any industry can have its own solution for COVID-19.

Nasal Swabs

The nasopharyngeal (nasal) swab is a critical component of the COVID-19 testing kit. Supply chains remain greatly impacted by the pandemic; therefore, 3D printed nasal swabs provide a cost-efficient and fast alternative to the standard swabs used for COVID-19 testing kits.
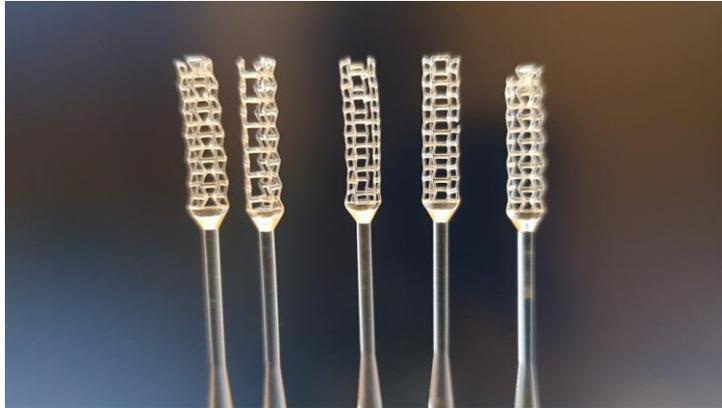
A research team from the School of Engineering at the University of Wolverhampton has taken these medical devices to the next level. They have developed a 3D printed smart swab that can self-adjust to make the awkward swabbing process more comfortable for the patient. Millions of people around the world have experienced the painful or uncomfortable sensation of having a plastic swab shoved up their noses. This is because, to date, nasopharyngeal (nasal) swabbing is the most prevalent form of testing for COVID-19. The new self-adjusting nasal swab design could alleviate the discomfort of the testing process by essentially shrinking to better fit a nose.

Face Shields

One of the challenges hospital staff are facing during the COVID-19 pandemic is the shortage of masks, face shields and other forms of personal protective equipment (PPE). Consequently, 3D printing technologies are being used to fill the gaps in the PPE supply chain. Additionally, changing recommendations of appropriate PPE use in response to the pandemic can easily be addressed with 3D printing technology.

Face shields not only act as a barrier against the virus, but they also serve as more effective eye protection from respiratory droplets over standard eye shields. As a result, the rapid manufacturing capacity of 3D printers paired with open source designed and readily available materials can allow for the creation of sufficient face shields to provide protection.

ACTIVAT3D Copper

Studies showed that 96% of the virus is killed in two hours and 99.2% of the virus killed in 5 hours on copper surfaces - as compared to three days on plastic, two days on stainless steel, and one day on cardboard. Although we still don't fully understand how copper kills viruses and bacteria, copper's special chemistry gives it a unique ability to lose varying numbers of electrically charged ions. These Copper ions react with moisture and oxygen to produce reactive oxygen which leads to the rupture of the outer membranes of the virus destroying it.

ACTIVAT3D copper can be used to coat surfaces that are commonly touched such as door handles, push plates and railings. It can also be used to 3D print solid copper parts. The use of copper antimicrobial surfaces can have a positive impact in hospitals and several other areas.

While copper is very common in electrical applications, it's not widely available in construction applications such as door fixtures. Copper parts are difficult to produce using traditional methods, thus 3D printing may be the only tool available to rapidly deploy copper. 3D printing technologies such as SPEE3D printers can be used to coat existing metal parts with copper and also print solid copper parts from scratch - once again proving that 3D printing technology could play a vital role in our fight against COVID-19

Face masks

Basic measures such as personal hand cleaning and social distancing are crucial. However, protective materials are also essential for all healthcare providers and the population in our fight against this virus. The COVID-19 pandemic has seen the wearing of masks becoming increasingly common, but finding one, and especially one that is comfortable + fits can be difficult. Researchers have taken the initiative to create customized 3D printed face masks which could ultimately be used by healthcare workers and other people. The common custom-made and/or 3D printed protective face mask consists of two reusable 3D-printed components and two disposable components. The reusable components include the face mask and the filter membrane - while the disposable components are the head fixation band and the filters. These characteristics help the mask to be reused several times using different types of filters.

When standard PPE is unavailable or there is a shortage of protective face masks for frontline workers and secondary support service health care professionals - 3D printed masks can become the barrier from getting infected by the virus. 3D printing technology has been used in different industries around the world for years. The application of this technology in production processes is therefore nothing new but the areas where this technology is now entering are new.

CONCLUSION

While the benefits on using 3D printing technology is immense - it must work to ensure that the emergency parts produced are safe, or at a minimum, safer than the alternative of not using them during the pandemic. Even with the urgency of the growing COVID-19 crisis, standard safety and quality measures of 3D printing should be upheld. Intellectual property remains another concern, particularly for reverse-engineering medical parts that cannot be purchased in a timely fashion during this pandemic. Given the situation we are facing today, legal experts and policy makers should come to agreements or allowances that save lives through 3D printing.

Although 3D printing is not yet able to fully replace traditional production it has many possibilities. With the help of this technology, industries can fill shortages in supply and resume operations. The versatility of 3D printing is suited to address supply–demand imbalances caused by socio-economic trends and disruptions in supply chains, Furthermore, it can play a huge role in creating jobs and have a positive impact on the global economy.