ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 12, Issue, 07, pp.12809-12811, July, 2020

DOI: https://doi.org/10.24941/ijcr.39296.07.2020

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

APLICACIONES DE LA FABRICACIÓN DIGITAL EN EMERGECNIAS SANITARIAS. UN CASO PRÁCTICO A PROPÓSITO DEL COVID-19.

***Victor Martinez-Pacheco and Raffaele Perez**

University of Campania "Luigi Vanvitelli", Department of Architecture and Industrial Design, Aversa, (Caserta) – Italy

ARTICLE INFO

Article History:

Received 07th April, 2020
Received in revised form
25th May, 2020
Accepted 27th June, 2020
Published online 30th July, 2020

Key Words:

3DPrint, Covid19, Emanuela Gambini, restoration, Francisco de Moradillo, Manuel and José del Olmo.

ABSTRACT

Open source 3d printing technology, for some years, has been preparing to respond to the needs of society where autonomous manufacturers take on challenges that until now were reserved for large companies in the industry. Schools work in laboratories taking on new challenges and opening new scenarios and teaching mechanisms. The world of architecture and home design is heading towards land that until now was unexplored and novel. In this research work, the aim is to explore through the experiment if the production on demand results in time, form and viable economy, since it is highly interesting since it greatly reduces the environmental impact of manufacturing. In short, the personal nature of autonomous production adds to the possibility of reusing plastics such as PET (polyethylene terephthalate), which cause great global pollution. The intention is to make it clear that from now on the great industry will surely lose its exclusive character, since on the one hand the FabLab, the Makers and the environmental impact are the main protagonists of the near future.

Citation: ***Victor Martinez-Pacheco and Raffaele Perez.*** **2020.** "Aplicaciones de la fabricación digital en emergecnias sanitarias. un caso práctico a propósito del covid-19.", *International Journal of Current Research*, 12, (07), 12809-12811.

INTRODUCTION

With the imminent arrival of the COVID-19 pandemic, the stress levels of health systems in all countries of the world have been tested. Also, of its industries and its capacity to respond to a situation of enormous anomaly(Rejón, Requena Aguilar, & Pérez Mendoza, 2020). The need for individual protection in this pandemic is essential to stop the spread of the virus. The contagion capacity of an affected individual, whether they have symptoms or not, has been shown to be really high(World Health Organization, 2020). In the course of the pandemic, we have seen that the stock of protective material such as masks, gloves, or disinfectants has decreased as its demand grew and its price increased (El Comercio, 2020). Health personnel have been the main victim of the shortage of protective equipment. Some examples are found in Wuhan, considered the first source of contagion. Thus, in an institution in this Chinese city, in the early stages of the COVID-19 outbreak, 29% of all infections occurred among health workers. Furthermore, in an initial COVID-19 report in 138 Chinese patients, it was estimated that 43 percent acquired infection in hospital. In Washington state, suboptimal use of infection control procedures contributed to the spread of the infection to 81 residents, 34 staffmembers, and 14 visitors in a long-term care facility. After retiring and within the "clean" areas, healthcare workers touch their faces every few minutes, and approximately half of these episodes involve contact with the mucous membranes, causing contamination of the skin of the face is an important portal of entry for respiratory viruses. The benefits of a globalized market have been questioned at the moment when countries have had, individually, to propose changes in their productive industries to provide the population with the necessary protection. Given this, volunteers from around the world who had 3D printers have put their machines, the vast majority domestic and open source, at the service of the community to collaborate altruistically in fighting the pandemic. This group, the so-called Coronavirus Makers, who in a few days and with their own means established an unprecedented decentralized production system that has directly collaborated to combat this global crisis. The contribution of the "maker" community has been since the manufacture with 3D printers of visors for the individual protection of restrooms, security forces, personnel exposed to the public or high-risk patients, as well as creating open source respirators before the overflow of the Intensive Care units lived in Italy. It has also gone through transforming equipment such as snorkel masks into non-invasive respirators or personal protective equipment, as well as the production of "salvaorejas" (pieces placed on the back of the head where to hook the gums of the masks instead of attaching them to the ears) to avoid that the prolonged use of the protections causes

****Corresponding author:*** **Victor Martinez-Pacheco,**
University of Campania "Luigi Vanvitelli", Department of Architecture and Industrial Design, Aversa, (Caserta) – Italy.

injuries to the toilets who wear them. Beyond 3D printing, innumerable proposals have been found for a similar purpose, such as the manufacture of gowns, masks or visors. It is also worth noting the contribution of companies that have adapted their production systems or functions to the active fight against COVID19.

MATERIALS AND METHODS

This article seeks to compile the main contributions of digital manufacturing in the fight against COVID-19 and its effectiveness. Although the existing literature regarding the manufacture of medical supplies to combat COVID-19 using 3D printing is limited, enormous amounts of articles have been produced since the beginning of the pandemic that address this situation. On the other hand, the Maker community and multiple "open source" collectives have developed parts, manuals and prototypes with the aim of putting knowledge into practice in an agile way. Examples of this are the Coronavirus Tech Handbook, a compendium of tools and resources for the response to the current health crisis that evolves in real time with updates from experts and volunteers (Coronavirus Tech Handbook). On the other hand, the aim is to present a practical example of the application of 3d printing in a health emergency situation framed at the level of a population of approximately 1.5 million inhabitants.

RESULTS

First, according to the compiled bibliography, public health guidelines recommend the use of gloves, gowns, filter masks, and full-face visors or glasses. Despite this, uncertainty persists regarding the role of some PPE elements, such as hoods and visors. Coverage tests reflected in the Public Health Guide of England were observed when performing aerosol generation procedures. A colloidal solution based on brown corn starch was sprayed with the volunteer's outstretched arms using 3 levels of PPE, including that recommended by Public Health England, which simulates droplet spraying. Test 1: hat, glasses, mask and gown. Test 2: hat, glasses, mask, gown and visor. Test 3: high neck full body suit and full face visor. It is observed in this case that the use of a visor only leaves the neck exposed. Instead, in Case 2 it shows that a high neck full body suit and full face visor removed skin contamination with drops in this model. The study showed that, despite complying with the Public HealWth England guide, healthcare workers remain vulnerable to drop contamination from exposed skin. To reduce SARS-CoV-2 transmission associated with droplets from exposed skin, healthcare workers require additional protection for the neck, face, and hair, such as a hooded turtleneck suit and full brim. In another recent protocol developed for pediatric endoscopies, they recommend: appropriate use of a respirator with filtering mask (N95, N99, FFP2 / 3 or PAPR), double gloves, face protection (full visor and / or face shield), disposable gown resistant to full body water, shoe covers and hairnet. The evidence therefore shows that the use of visors in situations of aerosol generation continues to be insufficient despite being a necessary component in personal protective equipment. Through this new production system, in the early days thousands of protective visors had been manufactured. The first models were produced in very small quantities to be donated to hospitals and to obtain first-hand possible design flaws and improve in a very short time.

This, replicated throughout the territory of Spain, allowed an agile improvement of the various models that designers created for the community. Some of these initial improvements were the reinforcement of the tie parts for the elastic fastening, the need or not to be hinged, or the incorporation of holes so that the fog does not tarnish the transparent protectors. In a second phase of improvement, production times were optimized, going from the almost three hours required at the beginning to print a model less than 20 minutes days later. All this with the support of the medical personnel who validated each of these small modifications. Thanks to this agile production system, more than 400,000 visors, 100,000 masks, 20,000 gowns were delivered one month after the alarm in Spain (https://www.coronavirusmakers.org/). This collective, organized at a national level with more than 15,000 volunteers, is coordinated at the regional level, reaching 5,000 members in the community of Madrid or 1,000 members in the Region of Murcia. The subdivisions, in turn, succeed each other to organize more versatile work groups that respond to the same objectives and organization as the previous ones. This is the case of the Murcian subgroup of Coronavirus Makers Murcia of the Polytechnic University of Cartagena, where in a few days staff and students of the university, as well as businessmen and individuals joined a group of more than 50 people who in a few days produced more than 6000 Protective visors with 3D printing. Listed below are some of the major healthcare equipment and supplies where 3D printing has played a leading role during the pandemic.

Masks: Masks were some of the first resources to be manufactured in 3D because of the pandemic. During the first days of the anomaly, multiple users of "the maker community" designed, shared, and printed models with the aim of filling in the lack of protective masks. It must be emphasized that these pieces, except that they have the necessary filters or have a special coating for this function in post-processing, do not serve as a physical barrier against the virus since the micropores generated by the FDM technology are of a diameter greater than the size of the New Coronavirus.

Facial screens: Protective visors were the star of 3D printing as an agile method of producing sanitary material. Diverse communities and companies around the world developed and shared designs to make them increasingly agile, cheap, useful and accessible to everyone.

Respirators and valves: Given the shortage of self-contained respirators, several groups of engineers, in collaboration with different institutions and health personnel, are developing prototypes and manufacturing the different parts that compose them using 3D printing (Pearce, 2020). Even adapters have been produced to create respirators and Personal Protective Equipment with adapted snorkel masks. The greatest advances in "open source" respirators in Spain have been carried out through the A.I.R.E project (for its initials in Spanish, Innovative Aid to Breathing).

DISCUSION

The visors, as the main element produced in 3D during the pandemic, has proven to be an important piece in the prevention of infections during Covid. However, the visor as a protection element is insufficient for the prevention of contagion. There is not enough scientific literature to guarantee that visors made by 3d printing and household materials

prevent contagion. Furthermore, the use of this material may involve the risk of suffering a false sense of security. Another risk to take into account in the manufacture of these elements is the possible chain of contagion. As controls, clear protocols and specific training are not established, the possibility that an infected manufacturer spreads the virus to professionals and patients is a possibility to take into account for future protocols, taking the case of Murcia as an example, where the Makers deposited the pieces in some points and the sanitary services were in charge of the disinfection, assembly and distribution. In the case of the Region of Murcia, there was an early response, when there were still very few cases. This, added to a production of the maker community together with the high health authorities, could imply one of the lowest contagion rates in Spain. It should be borne in mind that some of the models are not homologated or approved by the corresponding health authorities and that, depending on each area or country, the manufacturing requirements to achieve this homologation may vary. In the case of the Region of Murcia, work was done in the incipient moments of the pandemic with the authorities of the Murcian Health Service to obtain approval for use, testing and logistics. This streamlined manufacturing and distribution, as well as ensuring safer use for users.

Conclusion

- Given the number of infections and the global situation, the volunteer communities mobilized to find an answer to the shortage and the danger it posed to public health.
- The effectiveness of decentralized production and the possibility of testing useful equipment whose lack of approval does not diminish its practical and temporary nature have been demonstrated.
- In the Region of Murcia thousands of Personal Protective Equipment have been produced using open source 3d printing that have been used by health professionals, professionals exposed to the public, security forces and bodies, etc., during the early ages of the pandemic.
- A protocol was organized between the maker community and the health authorities of the Region of Murcia that made it easier for the makers to work, depositing the pieces at points prepared for it, and managing the disinfection, assembly and distribution of the health authorities themselves, thus limiting possible infections.

REFERENCES

Coronavirus Tech Handbook. (s.f.). Recuperado el 23 de 05 de 2020, de https://coronavirustechhandbook.com/contents#other

El Comercio. (27 de 02 de 2020). El coronavirus dispara el precio de las mascarillas: 1380 euros el pack. Obtenido de https://www.elcomercio.es/sociedad/coronavirus-dispara-precio-mascarillas-contagio-20200227114518-nt.html?ref=https:%2F%2Fwww.google.com%2F

Pearce, J. M. (2020). A review of open source ventilators for COVID-19 and future pandemics. F1000 Research. doi:https://doi.org/10.12688/f1000research.22942.1

Rejón, R., Requena Aguilar, A., & Pérez Mendoza, S. (18 de 03 de 2020). Los hospitales de Madrid bordean el colapso por la llegada de casos y la escasez de material para atajar el coronarivus. Obtenido de https://www.eldiario.es/sociedad/hospitales-Madrid-bordean-material-coronarivus_0_1007200253.html

World Health Organization. (07 de 03 de 2020). Critical preparedness, readiness and response actions for COVID-19. Obtenido de Interim guidance: https://apps.who.int/iris/bitstream/handle/10665/331422/WHO-COVID-19-Community_ Actions-2020.1-eng.pdf?sequence =1&isAllowed=y

****