STRATEGIC DESIGN RESEARCH JOURNAL

Designing for the pandemic: individual and collective safety devices

Isabella de Souza Sierra [a] * | Márcio Fontana Catapan [a]

[a] Federal University of Paraná, Department of Graphic Expression and Graduate Program in Design: Curitiba, Brazil.
* Corresponding author: isabella.sierra@ufpr.br

ABSTRACT

The rapid spread of COVID-19 has generated a demand for health-related safety equipment. The development of these emergency products raises several questions, in particular the possible lack of concern for health, satisfaction, and safety of users in addition to the immediate safety against the COVID-19. Considering these issues, the objectives of this work are to categorize, identify trends, and propose strategic approaches to the development and alteration of individual and collective safety solutions for facing the pandemic. For that, we conducted a review and categorization of industrial design products developed during the pandemic using the database Behance. We found 171 developed products. Of these, we classified 99 as individual safety solutions, with the majority being masks and face shields, 59 as being collective safety solutions like disinfection booths, physical transparent separators, and sanitary dispensers and 13 were solutions geared to hospital use such as hospital furniture, testing solutions, and medical safety procedures. From the analysis of these products, we noted four major themes: protection from the infection, isolation, and physical barriers for enabling safe interaction, disinfection, and testing that can be used as a strategic guideline for the development of new solutions for this context.

Keywords: Product Development, Review, Safety, Strategy.

INTRODUCTION

The pandemic caused by the rapid spread of the Coronavirus COVID-19 has generated a demand for health-related safety equipment (Javaid et al., 2020). This caused scarcity and lack of equipment even for essential health activities like the use of such equipment by health professionals. In this context, a wide proliferation of individual home solutions has been noticed (Ishack & Lipner, 2020). These try, using available materials and equipment, to supply the generated emergency demand.

In this initial phase, there was a focus on the development of essentially individual equipment such as masks, face shields (transparent face protectors) and reuse of packaging for distribution of alcohol in gel form (Ishack & Lipner, 2020; Mostaghimi et al., 2020) these were emergency solutions for containing immediate problems. Still, it is clear that with the progress of the pandemic and the perception that its effects will be more constant and difficult to mitigate, there is an increase in the development of collective transition solutions for the attempt to reinsert people in face-to-face activities (Ham, 2020; Kim & Lee, 2020).

This led to a focus shift to collective safety equipment such as decontamination booths (for people and objects), transparent separators for fixed station workers (supermarkets, pharmacies, and offices), collective alcohol gel dispensers in circulation areas, touchless soap dispensers, infrared thermometers, sorting booths and methods of social distancing, etc.

The development of these emergency products raises several questions, in particular the possible lack of concern for satisfaction, and safety of users in addition to the immediate safety against the COVID-19. Still some concerns arise on the actual effectiveness of these products. This was demonstrated in the study of Perić and Perić (2020) that showed that a great number of mask designs were not effective due mostly to imperfect fitting. The authors also suggested that with simple virtual simulations, these problems could have been anticipated.

Considering these issues, there is a need for the adoption of robust methodologies for the development and testing of these products, as well as for the identification of the essential requirements of this equipment such as effectiveness, safety, and user comfort. Therefore, the objectives of this work are to categorize, identify trends, and propose strategic approaches to the development of individual and collective safety solutions for facing the pandemic.

In other contexts, design tactics and strategies have been traced that may help to elucidate some of the motivations with which these products are being developed such as the need to predict interactions of users and developers, feedback looping marketing research for bettering products, networking, designing product and service simultaneously, customization, testing and sustainability planning (Persson, 2016; Reim, Parida & Örtqvist, 2015). Nonetheless, in other aspects, this is a largely unprecedented time of which the only possible comparisons are natural disasters and the creation of emergency design (Rocha & Venancio, 2017; Bashawri, Garrity & Moodley, 2014).

Also, the design method has evolved to predict user testing and users experiencing the products during its development (Suri, 2003) which is increasingly difficult if the developers are following social distancing guidelines. So, another question is posed on how to test these products in this context, and how technology can help us in this undertaking. In complement, Persson (2016) indicates that some of these solutions may be closely related to iteration, cooperation through the internet, simulation, virtual prototyping, and additive manufacturing.

1. METHOD

This is an investigative paper based on the review and categorization of industrial design products developed during the pandemic to solve individual and collective safety concerns related to the Coronavirus COVID-19. The database used for the review was Behance (https://www.behance.net/) which is the biggest international portfolio website.

The parameters for the search were industrial designs developed as a response to the pandemic from Mars 11th, the date that WHO declared the pandemic (UNA-SUS, 2020) to June 30th. The searches contained the words: *quarantaine*, *cuarentena*, quarantine, *quarentena*, pandemic, *pandemia*, COVID, virus, and coronavirus.

These products were categorized in individual and collective solutions and them by product type. For all of the products we also identified the state of development, intended fabrication method, general concept, and main design problems. From this we also extracted trends, comparing the number of products and similarity of the solutions. Finally, we proposed

Sierra, I. S. & Catapan, M. C. (2021). Designing for the pandemic: individual and collective safety devices. *Strategic Design Research Journal*. Volume 14, number 01, January – April 2021. 264-274. DOI: 10.4013/sdrj.2021.141.22

strategic approaches for the development of the products and discussed the influence of the pandemic on industrial design, new technologies, and fashion.

2.RESULTS

In total, we found 198 results, but since some of them were repeated on more than one search we analysed 171 developed products. Of these we classified 59 as being collective safety solutions (Figure 1) with the majority being disinfection booths, physical transparent separators, and sanitary dispensers and 99 as individual safety solutions (Figure 2), with the majority being masks and face shields. And finally, we also found solutions geared to hospital use such as hospital furniture, testing solutions, and medical safety procedures in a total of 13 products or systems (Figure 3).

As it is possible to verify in the three figures the solutions vary in their development stage and most of them, 134, are in the conceptual phase (78%), 17 were homemade and were meant to be made at home by the users (10%) and 20 were made using rapid fabrication (11%). Of the conceptual and prototyped products, some of the conceptual ones were intended to be fabricated in rapid fabrication and some of the rapid fabrication solutions were meant to be industrially mass-produced after the testing phase.

For the collective solutions (Figure 1), some questions arouse such as size, installation, and adaptations to already existing structures. The greater part of the collective solutions was geared to monitoring and dispensation of sanitary agents and the configuration of the products depended primarily on that.

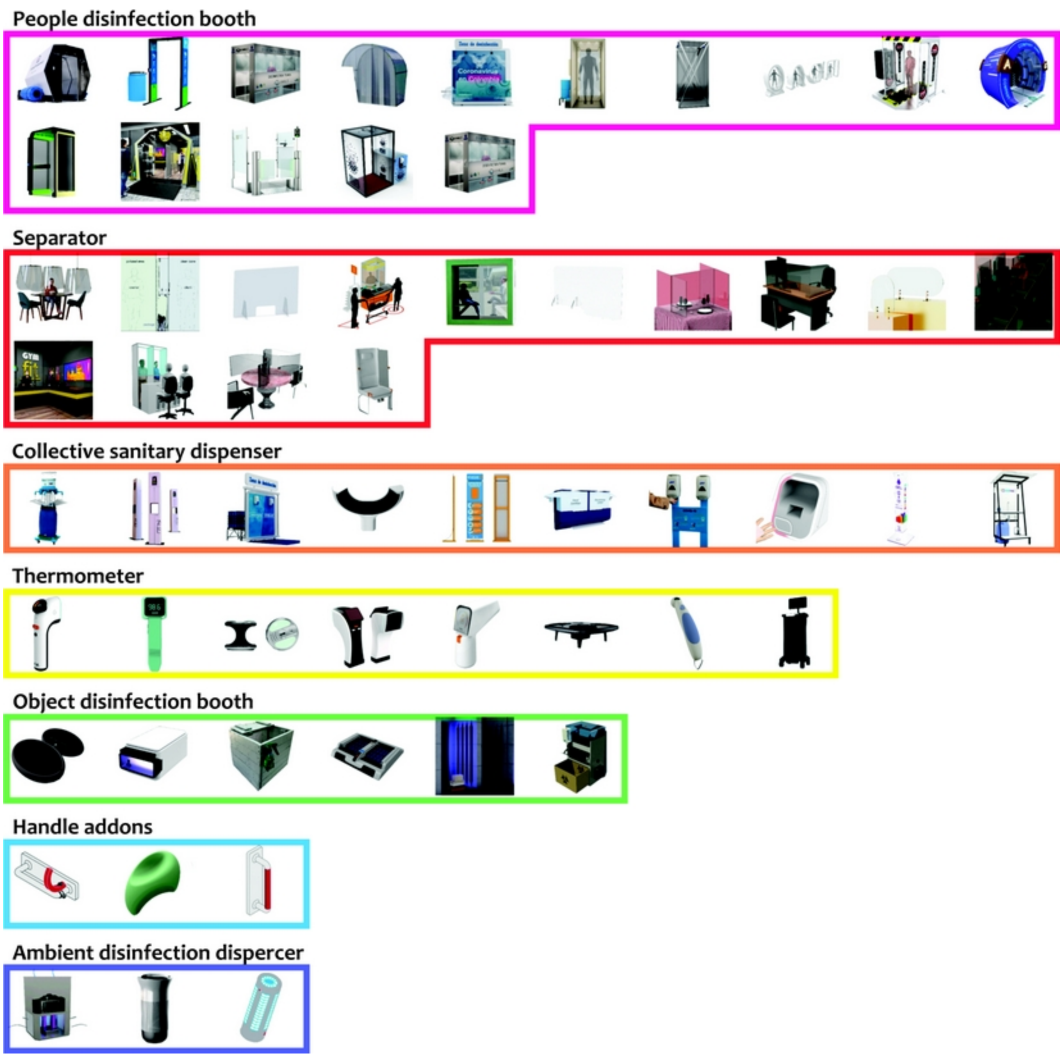


Figure 1. 59 Collective safety solutions by type.

Sierra, I. S. & Catapan, M. C. (2021). Designing for the pandemic: individual and collective safety devices. *Strategic Design Research Journal*. Volume 14, number 01, January – April 2021. 264-274. DOI: 10.4013/sdrj.2021.141.22

The individual safety solutions (Figure 2) were largely geared to wearables such as masks, face shields, and wrist and finger bands for different purposes, as the necessity of safety is especially important in public spaces, this is understandable because the individual needs to be protected *en route*. These solutions are also more susceptible to individual taste and this can be perceived by the large number of solutions for masks and face shields that have similar purposes but differ aesthetically.

Figure 2. 99 Individual safety solutions by type.

Finally, for the hospital safety solutions (Figure 3) the concerns were mass and rapid production, which is also understandable due to the urgent need of these products for the safety of doctors and other users of the hospital, for the proper sorting and handling the diseased and for the accommodations of those with the disease in filled UCIs.

Sierra, I. S. & Catapan, M. C. (2021). Designing for the pandemic: individual and collective safety devices. *Strategic Design Research Journal*. Volume 14, number 01, January – April 2021. 264-274. DOI: 10.4013/sdrj.2021.141.22

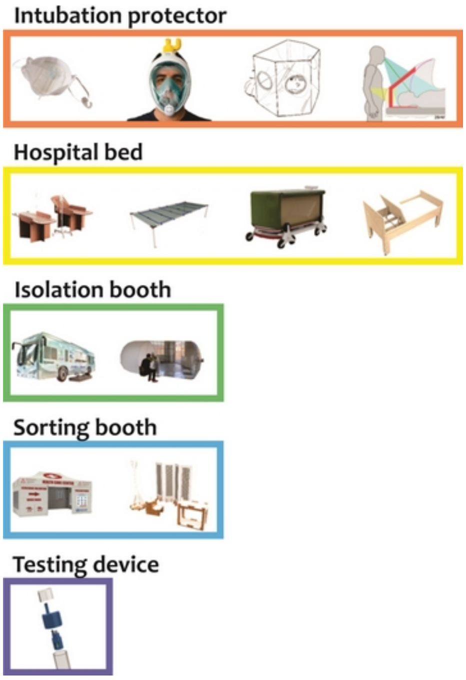
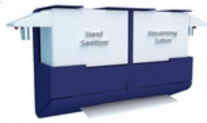
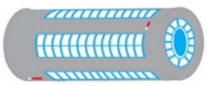
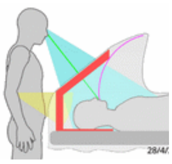


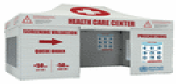
Figure 3. 13 Hospital safety solutions by type.

Having divided the products by type we described and distributed them (Table 1). Also, in the table, we compiled all of the identified problems for the specific products. This compilation is based on the report of the designers and the added features of the solutions. So, in general, product types that have more examples also have overall more identified problems.

Table 1: Categorization of the Individual and collective safety solutions generated in the COVID-19 pandemic.

Individual solutions				
Product	**Quant.**	**Description**	**Example**	**Problems found**
Face Shield	38	Face protection, attached to the head in a transparent material. Protects at least eyes, nose, and mouth.		Aesthetics. Cleaning. Comfort. Coverage of sides and top of the head. Efficiency. Fabricability. Fixing to the head. Integration with other equipment. Marketability. Stability. Sizes. Visibility.
Mask	37	Nose and mouth protection.		Accessibility. Aesthetics. Comfort. Correct coverage. Efficiency. Fabricability. Face shield integration. Fixation to the face. Maintenance and cleaning. Marketability. Prolonged use. Transportability.
Pressing tool	8	Tool that allows you to press buttons and open doors without having to touch your fingers.		Comfort. Material. Multifunctionality. Transportability. Usability.
Individual sanitary dispenser	7	Individual dispenser of sanitary products such as alcohol gel and soap and water for hand hygiene and other objects.		Aesthetics. Dosage. Integration with daily life. Transportability.
Individual isolation booth	4	Cabin for isolation of people with the virus or protection against the virus. Sterile environment.		Activities performed and equipment supply. Isolation. Sterility. Transportability.

Product	Quant.	Description	Example	Problems found
Individual solutions				
Surface protection	2	Materials and other products that create a physical barrier between products of great handling and the person.		Adhesion to the surface. Ergonomics. Transportability. Usability.
Kit	2	Kit that includes a variety of equipment and tools for a specific purpose such as testing or protecting the individual.		Completeness.Presentation. Sequentiality.
Distance Alert	2	Social distancing alert device.		Direction indication. Methods of drawing attention. Transportability. Usability.
Collective solutions				
People disinfection booth	15	Cabin or space where measures for the destruction of the virus are applied on the surfaces of people.		Aesthetics. Chemical isolation. Dispersion method. Ergonomics / anthropometry. Installation. Location. Process control.
Separator	14	Transparent physical barrier for separating people in collective environments.		Aesthetics. Cleaning. Format. Interaction. Transport. Usability.
Collective sanitary dispenser	10	Collective dispenser of sanitary products such as alcohol gel and water and soap for hand hygiene and other objects.		Chemical action indication. Chemical type. Installation location. Number of people at a time.
Thermometer	8	Thermometers for checking the temperature at a distance.		Aesthetics. Ergonomics. Indication of information. Usability.
Object disinfection booth	6	Cabin or space where measures for the destruction of the virus are applied on the surfaces of objects.		Aesthetics. Installation. Indication of the chemical agent's action. Usability. Transportability. Type of object for disinfection.
Handle addons	3	Additions to existing handles to reduce the contact with hands, or to disinfect the handle before touching.		Contact with the body part. Format. Installation.
Ambient Disinfection disperser	3	Disperser for the destruction of the virus on surfaces in spaces.		Aesthetics. Place of performance. Type of agent. Usability.
Hospital solutions				
Intubation protector	4	Transparent surface for creating a physical barrier between doctor and patient during intubation.		Cleaning. Installation and uninstallation. Patient access. Sterility. Viewing angle.
Hospital bed	4	Beds for fast and large-scale production to increase the number of beds in hospitals and for campaign hospitals.		Assembly. Comfort. Fabricability. Material. Transportability. Usability.

Hospital solutions				
Product	**Quant.**	**Description**	**Example**	**Problems found**
Isolation booths	2	Physical barriers between doctors and patients for medical tests and examinations.		Fabricability. Durability. Installation. Transportability. Usability.
Sorting booths	2	Spaces for patient screening and referrals,		Assembly. Size. Transportability.
Testing device	1	Tool for transporting and testing tests for COVID.		Fabricability. Transportability. Usability.

From the descriptions, we noticed 4 major themes. 1. Protection from the infection by avoiding contact using **isolation**; and 2. **Physical barriers**, that are used in various products to enable safe interaction; 3. **Disinfection**, of people, objects and rooms, associated with chemicals and/or technologies such as ultraviolet light; and 4. **Testing.** These themes are in accordance with WHO guidelines for the protection of the population.

In the "problems found" column that were questions proposed by the designers on the product development stage, we also found some recurrent themes such as usability, transportability, aesthetics, fabricability, ergonomics/anthropometry, and information design. The usability, ergonomics, and anthropometry questions were proposed across all the types of products and permeated several of the core problems of the developed products, none the less, few indicated actual usability and ergonomics testing.

Transportability was posed as a factor for individual and collective products for different reasons, for the individual products, transportability was related to the ability to integrate the product in daily life. For the collective solutions, transportability was correlated to the ability to transport and install these products in various locations. Since the pandemic is a global question and needs to be addressed in multiple locations at the same time, this was also connected to the fabricability question. The ones that were preoccupated with fabrication turned to rapid prototyping and rapid fabrication as a means to make these newly developed products readily available.

Concerning aesthetics, it was related to the products that were meant to be worn and carried with the person in daily routine. Some went as far as appealing to fashion to convince people to wear the products. Finally, we perceived interest in information design, especially, but not exclusively, in collective solutions that meant to guide the user through the experience and to inform the population of the results of the information gathered such as, for example, the measured temperature or the finalization of the disinfection process.

3. DISCUSSION

Considering the context for which these products are being developed, and from the results above described, we suggest four overall strategic approaches for their development: the first is rapid development, the second is benchmarking the third is active testing and the fourth is planned distribution.

From rapid development, we mean the actual shortening of the designing time and the shortening of the production phases. The designing time, which is usually a long process that

Sierra, I. S. & Catapan, M. C. (2021). Designing for the pandemic: individual and collective safety devices. *Strategic Design Research Journal.* Volume 14, number 01, January – April 2021. 264-274. DOI: 10.4013/sdrj.2021.141.22

involves several phases, needs to be condensed. For this, the execution of fast and agile methodologies can help in the process of developing better and more robust solutions. Based on the urgency, we saw that several designers planned and produced their products using rapid prototyping and rapid fabrication tools which are possible solutions for the necessity of the required accelerated timeline.

Another strategy, that can be especially useful in the development of products that have similar multiples, such as the masks, face shields, and disinfection booths, is the use of benchmarking to 1. improve upon existing products, also helping to short development time and 2. to discover design gaps. For example, in this sample, some of the underdeveloped areas and that have more market space are solutions related to the protection of surfaces, for individual and collective solutions and also in disinfection technology, since most of the solutions use the same three principles: soap, alcohol, and ultraviolet light.

The third proposed strategy is the actual testing of the products for ergonomics, efficacy, comfort, and usability since the beginning of the development process, which could help with innovation, faster development, and quality products with lower development costs. For this testing, some different strategies may be employed such as opting for digital simulations or 3D printing the products to be tested directly by the testers in their homes. Since 3D printers are increasingly popular and accessible, getting a sample of testers that own 3D printers shouldn't be so difficult.

The last strategy is to plan for the distribution of the equipment. Since the problem we are handling is global, some questions arise on the access people can have to these safety solutions. In this condition, we believe that making use of rapid fabrication using materials and systems that are readily available in fab labs, for example, could be one solution. Another is the selling of production plans and DIY (do it yourself) kits that can reach large groups of people with little industrial production time and low or none shipment costs.

In this sense, the adoption of an agile methodology (SINGH, 2008) that involves the use of usability tests (NIELSEN, 1994) and rapid prototyping (ALCOFORADO, 2014) seems appropriate to achieve solutions that are more appropriate to the contexts of use, such as verified in Mostaghimi et al. (2020) who used rapid prototyping and usability and effectiveness tests to develop a face shield.

Here we refer to rapid prototyping as the set of activities carried out for the development of functional prototypes, that is, that can be tested as if they were the final product, using digital technologies such as 3D printers, 3D scanners and software digital modelling, etc. (FERREIRA, 2007). These developed products can then be produced using digital manufacturing techniques. The method of developing this equipment using these digital manufacturing tools can be detailed in: identification of a need, generation of alternatives, digital modelling, development of functional prototypes, testing of functional prototypes - tests of functionality, usability, and adequacy to the problem-, redesign of prototypes until they are adequate and finally production of the equipment, manually or industrially, and distribution of the equipment. These technologies also allow mass customization or personalization (BERETTA, 2011) as they are systems that produce directly from digital models that can be easily changed to suit individual users' characteristics.

Among the digital manufacturing equipment, the most common ones that can be adopted for the development of functional products and prototypes are 3D printers, laser cutting

Sierra, I. S. & Catapan, M. C. (2021). Designing for the pandemic: individual and collective safety devices. *Strategic Design Research Journal.* Volume 14, number 01, January – April 2021. 264-274. DOI: 10.4013/sdrj.2021.141.22

machines, CNC milling machines, and 3D scanners that are especially important in the context of developing customizations (BARROS, 2011). The main benefits related to the use of these digital manufacturing tools for rapid prototyping and product development are:

- Accessibility: due to shorter production and development time, more people can be provided with access to the necessary products and the cost of machinery and tools is lower than the cost of industrial tools, allowing them to be more widely used.
- Customization: the products developed can be customized individually or for groups, in addition to being able to create modular fitting components to add to massive manufactured components.
- Sustainability: in this type of production there is less material waste as well as greater planning and optimization of materials for production.
- Distributed manufacturing: since it is based on digital models, any entity that has the necessary machines can use the same digital model for the production of the product, thus, it is possible to produce in the locality where the product is used, reducing transportation costs. Besides, for emergencies, this productive network can be used for accelerated production of equipment, with several machines working simultaneously.

Another factor that we wanted to discuss is the marketing gap that exists within these products. First, there is a trend of the wearability aspect of the majority of developed products, this leads to the knowledge that besides the fact that the product needs to be speedily produced and distributed to mitigate the problems of the ongoing pandemic, they are also subjects to desires, self-expression, and personal taste, that are common in fashion and consumer goods. This also creates an aspect that as the use of masks becomes more common, they transform into fashion accessories and become desirable items, and this feedback loop is a marketing opportunity.

Secondly, these products are so new that some of them don't even have standardized norms, descriptions, or even designations, here we opted to name some of them as "pressing tools" and "disinfection booths" but these are descriptors of function and not product names. This is another opportunity to innovate and make purposeful choices about people's needs, and the management of a new life in society in the face of the emergency we find ourselves in and to plan for the future.

4. FINAL CONSIDERATIONS

In this paper, we identified, presented, and discussed collective and individual solutions created as a response to the 2020 pandemic of COVID-19. From it we propose some recommendations for the development of new safety solutions that are bound to be developed in the following months.

The first recommendation is that the development has to solve four main problems that are directly related to the pandemic: protection, isolation, separation, and disinfection. This is true for all of the products that are to be developed, for example, a mask needs to protect the user and those around form the virus, needs to isolate the droplets from the user to others, needs to separate or create a barrier between the user and others and finally needs to be able to disinfect or be disinfected.

Sierra, I. S. & Catapan, M. C. (2021). Designing for the pandemic: individual and collective safety devices. *Strategic Design Research Journal*. Volume 14, number 01, January – April 2021. 264-274. DOI: 10.4013/sdrj.2021.141.22

Furthermore, besides these specific problems, the developed products need to comply with ergonomic, usability, safety, and marketing concerns, even if the development is fast-paced for urgent needs. The designers have the responsibility to deliver the products that not only look like it is accomplishing the set objectives, but that it is actually doing so, and this can only be true if these products are tested and evaluated in the development process.

To arrive at these conclusions, we used as a basis the adaptation of a systematic review research method using the same techniques and principles but focusing on the search for products and not scientific articles and texts. Using this systematic technique, it was possible to find and classify specific groups of products that could then be analysed. Therefore, the use of the classification method and the compilation and exhaustive analysis of these compiled products was crucial so that we could offer a holistic and global view of the products being developed in an attempt to solve emerging, complex, wicked and urgent problems.

In uncertain times and for solving wicked problems such as the one we are experiencing today with those related to a Pandemic, the importance of analysing and considering what is being done and what has already been done to achieve a more appropriate and safe final result is imperative. The more complex a design problem is, the greater the importance of working with tangible data so that it can be used as a basis for creating and innovating.

The paths registered in this article both in relation to the main requisites that must be considered such as protection, isolation, separation and disinfection, also taking into account traditional design issues such as ergonomics, usability and safety, and new technologies such as rapid fabrication are essential for the development of new and improved products that will help fight the pandemic.

Lastly, we finalize this paper indicating that the pandemic has surfaced some designing needs that have to be further investigated that are: the efficiency of the current design process, the influence these new technologies and fabrication methods have in the process and how do we conciliate needs, desires and individual preferences of users with safety.

REFERENCES

Alcoforado, M. G. (2014). *Metodologia de Design Mediada por protótipos* [Prototype-Mediated Design Methodology]. (Doctoral dissertation). Universidade Estadual de São Paulo, Bauru, Brazil.

Barros, A. M. (2011). *Fabricação digital: sistematização metodológica para o desenvolvimento de artefatos com ênfase em sustentabilidade ambiental* [Digital manufacturing: methodological systematization for the development of artifacts with an emphasis on environmental sustainability]. (Masters Thesis). Universidade Tecnológica Federal Paraná, Curitiba, Brazil.

Bashawri, A., Garrity, S., & Moodley, K. (2014). An overview of the design of disaster relief shelters. *Procedia Economics and Finance*, 18(1):924-931. DOI: /10.1016/S2212-5671(14)01019-3

Beretta, E. M. (2011). *Tecnologia assistiva: personalização em massa através do design e fabricação de assentos customizados para cadeiras de rodas* [Assistive technology: mass customization through the design and manufacture of customized wheelchair seats]. (Masters Thesis). Universidade Federal do Rio Grande do Sul, Rio Grande do Sul, Brazil.

Dorst, K., Cross, N. (2001). Creativity in the Design Process: Co-Evolution of Problem–Solution. *Design Studies,* 22(5): 425-437. DOI: /10.1016/S0142-694X(01)00009-6

Fadhil, A. (2019). Beyond technical motives: Perceived user behavior in abandoning wearable health & wellness trackers. *arXiv preprint*, arXiv(1904.07986):1-11. Retrieved January 5, 2021, from https://arxiv.org/abs/1904.07986

Ferreira, C. V.; Santos, J.; Silva, J. (2007). Exemplos de aplicações da prototipagem rápida [Examples of rapid prototyping applications]. In: *Prototipagem rápida: tecnologias e aplicações* (pp. 195-224). São Paulo, BR: Edgard Blucher.

Sierra, I. S. & Catapan, M. C. (2021). Designing for the pandemic: individual and collective safety devices. *Strategic Design Research Journal.* Volume 14, number 01, January – April 2021. 264-274. DOI: 10.4013/sdrj.2021.141.22

Ham, S. (2020). Prevention of exposure to and spread of COVID-19 using air purifiers: challenges and concerns. *Epidemiology and Health*, 42(1):e2020027. DOI: 10.4178/epih.e2020027

Hitchcock, D. R. et al. (2001). Third age usability and safety—an ergonomics contribution to design. *International Journal of Human-Computer Studies*, 55(4):635-643. DOI: /10.1006/ijhc.2001.0484

Ishack, S.; Lipner, S. R. (2020). Applications of 3D Printing Technology to Address COVID-19 Related Supply Shortages. *The American Journal of Medicine*. 133(7):771–773. DOI: .10.1016/j.amjmed.2020.04.002

Javaid, M. et al. (2001). Industry 4.0 technologies and their applications in fighting COVID-19 pandemic. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 14(4):419-422. DOI: /10.1016/j.dsx.2020.04.032

Kim, S. I.; Lee, J. Y. (2020). Walk-Through screening center for COVID-19: an accessible and efficient screening system in a pandemic situation. *Journal of Korean Medical Science*, 35(15): e154. DOI: /10.3346/jkms.2020.35.e154

Mostaghimi, A. et al. (2020). Rapid prototyping and clinical testing of a reusable face shield for health care workers responding to the COVID-19 pandemic. *medRxiv*, DOI: /10.1101/2020.04.11.20061960

Nielsen, J. (1994). *Usability engineering*. Morgan Kaufmann.

Perić, R., & Perić, M. (2020). Analytical and numerical investigation of the airflow in face masks used for protection against COVID-19 virus--implications for mask design and usage. *Journal of Applied Fluid Mechanics*. 13(6):1911-1923. Retrieved January 5, 2021, from https://arxiv.org/abs/2005.08800

Persson, J. G. (2016). Current trends in product development. *Procedia CIRP*, 50:378-383. DOI: /10.1016/j.procir.2016.05.088

Reim, W., Parida, V., & Örtqvist, D. (2015). Product–Service Systems (PSS) business models and tactics–a systematic literature review. *Journal of Cleaner Production*, 97, 61-75. DOI: 10.1016/j.jclepro.2014.07.003

Rocha, B. M., & Venancio, L. V. (2017). Impressão 3D e processo de projeto paramétrico aplicado ao design emergencial [3D printing and parametric design process applied to emergency design]. *Blucher Design Proceedings*, 3(12), 269-274. DOI: /10.5151/sigradi2017-043

Singh, M. (2008). U-SCRUM: An agile methodology for promoting usability. In: *Agile 2008 Conference* (pp. 555-560). IEEE. DOI: /10.1109/Agile.2008.33

Suri, J. F. (2003). The experience of evolution: developments in design practice. *The design journal*, 6(2): 39-48. DOI: /10.2752/146069203789355471

UNA-SUS. (2020). *Organização Mundial de Saúde declara pandemia do novo Coronavírus Mudança de classificação obriga países a tomarem atitudes preventivas* [World Health Organization declares new Coronavirus pandemic Change in classification obliges countries to take preventive action]. Retrieved June 10, 2020, from https://www.unasus.gov.br/noticia/organizacao-mundial-de-saude-declara-pandemia-de-coronavirus

Sierra, I. S. & Catapan, M. C. (2021). Designing for the pandemic: individual and collective safety devices. *Strategic Design Research Journal*. Volume 14, number 01, January – April 2021. 264-274. DOI: 10.4013/sdrj.2021.141.22