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Challenges of the Covid-19 pandemic and design responses in public space: Towards strategies for resilient post-Covid cities

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Abstract

The Covid-19 pandemic triggered governments and designers to revalue and redesign public spaces. This paper focuses on the various design responses to Covid-19 proposed and implemented in public spaces. In particular, we identify the kinds of challenges that such design responses address and the strategies that they use. We selected 56 design examples, largely collected from internet sources. By analyzing the design examples we identified five Covid-related challenges that were addressed in public space: *sustaining amenities*, *keeping a distance*, *feeling connected*, *staying mentally healthy*, and *expanding health infrastructures*. For each challenge, we articulated 2 to 6 design strategies. The challenges highlight the potential of public space to contribute to more resilient cities during times of pandemic, also in the future. The design strategies show the possible ways in which this potential can be fulfilled. In our next steps, we will use our findings to develop a *program of possibilities*; this program will contain a wide range of design strategies for responding to future pandemics and will be made publically accessible in an online database. The program contributes to more resilient post-Covid cities, by offering a variety of possibilities for coping with, and adapting to, pandemic-related shocks and stressors.

Keywords: Covid-19 pandemic; public space design; neighbourhood resilience; program of possibilities; database.

1. INTRODUCTION

Public spaces play a crucial role in servicing various infrastructural needs in densified cities. They are also crucial for a city's public realm, accommodating the production of its social fabric, identity and urban culture. During the early phases of the Covid-19 pandemic, these crucial processes decreased and increased simultaneously. They decreased as people had to keep a proper distance from one another, which radically changed the way people interact. Simultaneously, they also increased as lockdowns shrunk people's outside world to the public spaces in their direct surroundings, resulting in people becoming more locally engaged.

As a result of these changes, the pandemic triggered citizens, governments and urban designers to use, value and design public spaces differently. For example, in various countries, a temporary shift from 'hard' to 'soft' mobility occurred at the neighborhood scale, prioritizing biking and walking as a way to commute and relax (1). Also, on a wider metropolitan scale, Covid-19 encouraged such changes in urban transport (2). The decrease in car traffic supported municipalities like Barcelona and Milan to re-imagine the urban spaces with greater emphasis on non-motorized mobility: some major roads got closed for the benefit of cyclists and pedestrians (3).

Another shift has taken place in public green spaces, which were used in new and versatile ways (1). A more diverse group of people started using these spaces in terms of social-economic status. Green spaces supported residents' mental health, helping people to cope with social isolation. Many

activities moved outdoors; for example, there was more open-air dining in colder months and gyms relocated their training sessions to outdoor natural areas. Furthermore, large green spaces played a crucial role in providing space for emergency health infrastructures (4). The above illustrates how public space has played an important role for cities to be resilient in the face of Covid-19. An important task of today is to take lessons from this in order to be better prepared for future pandemics. Future pandemics are often considered inevitable, or at the very least highly probable, where 'failing to prepare means preparing to fail' (5). Therefore this paper focuses on the various design responses to Covid-19 proposed and implemented in public spaces. In particular, we identify the kinds of challenges that these design responses address and the design strategies used to tackle these challenges. The underlying goal of this inquiry is to start articulating a *program of possibilities*, which will contain a wide range of design strategies for responding to future pandemics. Such a program can contribute to more resilient post-Covid cities by having a wide variety of possibilities to cope with and adapt to pandemic-related shocks and stressors.

2. METHOD

The study consisted of three main phases: i) collecting and selecting design examples from online sources; ii) analyzing the selected examples in order to identify the challenges they address; and iii) articulating design strategies based on how the design examples attempt to tackle the challenges.

Collecting and selecting design examples

We selected 56 design examples, of which the majority were collected from online sources and partners in our community of practice contributed two. Different search engines were used for the internet search, including Google, Duck Duck Go and Ecosia, using keywords such as 'public space intervention', 'Covid-19 and public space', 'pandemic and urban design'. We also used search functions on online design and architecture platforms, such as ArchDaily, Dezeen, Designboom and Architectural Digest. All the selected design examples were gathered in Notion - project management and note-taking software, of which databases are a core feature. Design examples were selected based on the following criteria: they are design responses to Covid-19; designers or other professionals conceived them during the pandemic; and they have a solid link to public space. Furthermore, we included only specific design solutions (e.g., a parklet implemented in a particular location) while excluding guidelines or manuals (e.g., construction guidelines for parklets).

Analysis of the design examples

Next, the design examples were analyzed to understand what Covid-related challenges they address. Three researchers were involved in this step, using an online Miro board that allowed for collaboratively performing the analysis while working at a distance due to Covid-related restrictions. For each design example, we asked *what* Covid-related issue or challenge it addresses, *who* is affected by the challenge, and *where* and *when* the challenge occurs. These descriptions were made based on the claims and wording of the initiators or designers of the intervention. Together with images of the design examples, these descriptions were turned into vignettes on an online whiteboard of Miro (see Figure 1). For some design examples, we identified two Covid-related challenges, resulting in two vignettes.

Next, we analyzed the vignettes on the Miro board, following a process similar to affinity diagramming (6): one by one, vignettes were positioned, asking what Covid-related challenge was addressed and whether it was different or similar to previously placed vignettes. This eventually led to a first set of clusters, which we gave provisional title. Afterwards, the researchers critically revisited the clusters to check consistency with the vignettes and discuss potential overlaps between the clusters. This resulted in two smaller clusters being merged. The final clusters were given a final

title as well as a short description of the set of challenges they represent. We will refer to these clusters as 'challenges' from now on.

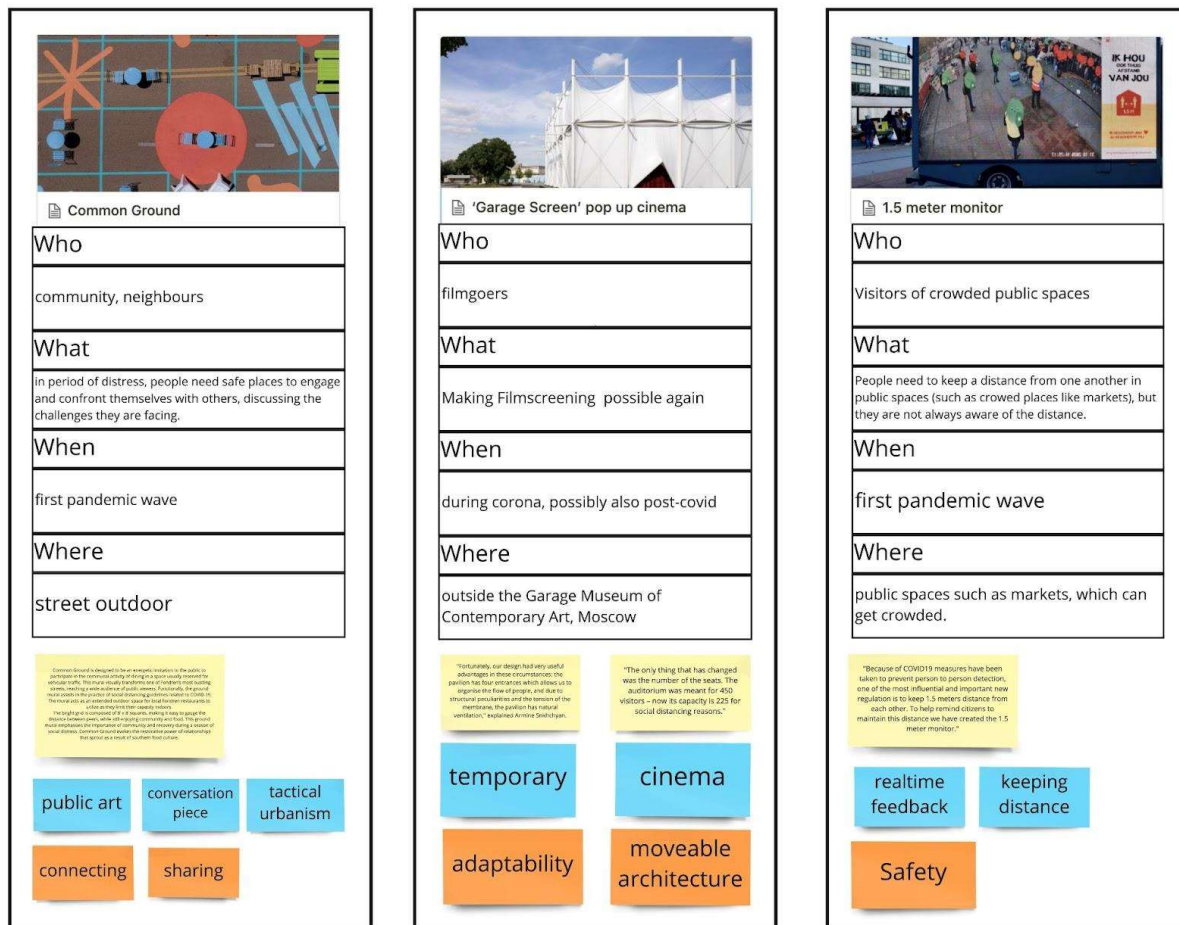


Figure 30. Examples of vignettes for the analysis of Covid-related challenges.

Finally, we analyzed and described *how* the design examples addressed the challenges, in line with our goal to articulate design strategies. We define 'design strategies' as concrete ways to achieve a goal or address a challenge (7). They are a generative form of intermediate-level knowledge, meaning they are more abstract than the design examples they are derived from for reasons of transferability, while they do not aspire to the generality of a theory (8), (9). Similar to Boon et al. (2021) (10), we organized our analysis hierarchically according to the level of abstraction of the generated knowledge (see Figure 2): at the top level, we positioned the challenges that we identified in the first phase. At the bottom, we placed the vignettes corresponding to the challenges and wrote short descriptions of how they specifically address the challenge. On the in-between level, we articulated design strategies that describe on a more abstracted level how the design examples address the challenge in question.

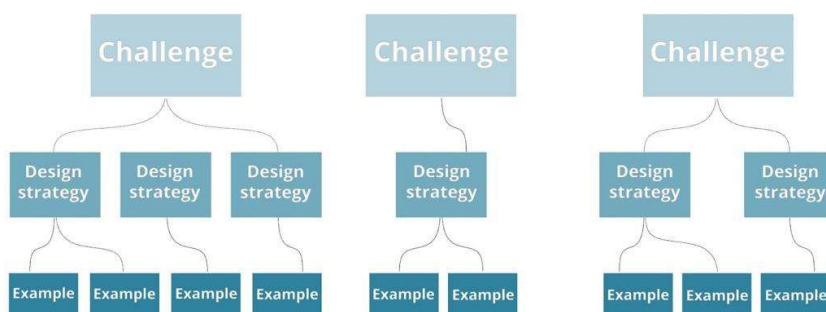


Figure 31. Abstract representation of the conducted analysis according to the level of abstraction of the generated knowledge.

3. RESULTS

Five Covid-related challenges were identified (see Figure 3). For each challenge, 2 to 6 design strategies were articulated. Below we describe each challenge and the accompanying strategies in more detail while referencing selected design examples.



Figure 32. Our analysis design responses to the Covid-19 pandemic resulted in five challenges that were addressed in public space.

3.1 Covid-related challenges

Below, we describe the five identified challenges, including the design strategies that we articulated. The challenges are ordered according to the size of the clusters, starting with the largest.

3.1.1 Sustaining amenities

Due to Covid-19, people needed access to certain goods and services while not running a limited risk for contamination. For example, designers described how children needed to continue their education, how workers required access to a safe workspace, and how restaurant owners required alternative ways to continue their business. How did interventions in public space make these goods and services accessible while avoiding contamination between people?

Design strategies:

- Relocating an activity or service to an outdoor space
Many activities can be temporarily relocated to public outdoor spaces by using or creating adaptable and flexible structures. Designing these structures to allow for good ventilation, will reduce the risk of contamination. For example, the Open air theater of New York, designed by the Architecture firm Marvel, uses shipping containers as a stage for performances in public space for people to enjoy outdoors during the pandemic.
- Redistributing or repurposing functional places
Public places that serve particular functions, such as a market or play area, can be temporarily repurposed or spatially reorganized in order to facilitate services in a specific location where it is most needed. One example is the intervention put in place by the city of Kalaw (Myanmar), which allowed local sellers to continue their daily business by redistributing and repurposing a road for an open-air market, dividing the street into sections with painted lines.
- Decentralizing services
Particular services can be decentralized, decreasing the amount of travel or the number of people gathering in one place, thereby reducing the risk for contamination. Amsterdam arts center Mediamatic set up a series of small greenhouse structures along the adjacent canal for a socially distanced dining experience. To couples or groups from the same household, food was served in one of the greenhouse spaces, allowing them to have an intimate dinner while reducing the risk of contamination.
- Offering services without the need for human contact
People can be given access to services without the need for human contact. For example, the Creator restaurant in San Francisco found an alternative to serving people more safely and hygienically. Designed by a group of engineers, the 'Creator Transfer Chamber' consists of 'a unique takeout window that transfers food from restaurants to delivery people with no hand-to-hand contact.'
- Enabling support for the vulnerable
People can support the most vulnerable by sharing or donating relevant goods or resources that are difficult to access during a pandemic. For example, residents of New York started volunteering activities to tackle the increasing food insecurity among vulnerable people in their community. By installing and replenishing publicly accessible community fridges, New Yorkers offered a steady supply of food to whoever needed a free meal.
- Making spaces attractive again
In order to invite people to use public spaces and local amenities after a period of lockdown, an attraction or landmark can be created in a designated space or area. The architecture firm MVRDV designed an intervention in the commercial center of London that attracts and invites people to revisit the surrounding shopping area after a period of crisis. The Marble Arch Hill intervention consists of a temporary landscaped viewpoint, in the form of a 25-meter-tall construction overgrown by vegetation.

3.1.2 Keeping a distance

To prevent Covid-19 from spreading, people needed to keep a physical distance from one another and be able to move through public spaces. For instance, designers described how people needed "to ensure that cycling is safe for everyone during the Corona crisis" and that visits to parks felt unsafe due to crowdedness. How did interventions in public space enable people to make use of it while encouraging people to keep proper distance?

Design strategies:

- Creating space for pedestrians and cyclists
To enable people to move through the city by foot or by bike, road space, originally intended for car traffic, can be repurposed for cyclists and pedestrians. For instance, the collective of artists from London, Urban Activistas, with the #StreetsForPeople intervention, used water-acrylic paint, tyres, and potted plants to appropriate road space for non-motorized mobility.
- Enabling people to demarcate their own space
By offering users of public space simple tools, they can demarcate their own safe space. For example, the design collective JAJAxD developed a simple idea for people to enjoy public beaches during the Covid-19 pandemic. By using a colorful nylon ribbon and three to four pegs, the design enables people to define their own temporary safe space on the sand.
- Spatially indicating proper distance
Proper distance can be indicated by drawing lines, dots, and other shapes using tape, stickers, chalk, paint, or other materials. An example is an intervention in Dominos Park, New York, where circles were painted on the grass to visually indicate where people may settle down.
- Offering real-time feedback about proper distance
In crowded areas, responsive installations can offer real-time feedback about proper distance to multiple people simultaneously. For example, the city of Amsterdam developed a digital system that shows people when proper distance is respected in public spaces and when it is not. It consists of a mobile truck that carries a screen with a live camera feed of the square in which it is positioned. It provides real-time feedback by marking pedestrians in the feed with coloured smileys or frowns.
- Informing about rules and appropriate behavior
Information about rules and appropriate behavior can be communicated via signs, banners or other media in public spaces. During Covid-19, many cities started to implement banners in public spaces to inform people about the social distancing rules.

3.1.3 Feeling connected

Due to Covid-19, people came to live more isolated lives, and their ability to connect with others and with nature became limited. For example, designers described how people lacked places for gathering and opportunities to "socialize safely", while also having little opportunity to be in nature. How can designers enable people to reconnect with one another and with nature in public space?

Design strategies:

- Affording people to gather
People can be afforded to gather by offering temporary outdoor meeting spaces or other 'safe zones', in which they can meet, hang out, and catch up with one another. For example, due to the restrictions, all restaurants and bars in Tel Aviv were closed overnight, and many locals started meeting each other outdoors. The Open Café intervention by Humankind and Nadel Roizin Architects transformed benches into terraces for people to safely meet and play in a healthy space.
- Symbolizing the need to socialize
The need to socialize can be symbolized through artistic interventions, representing the possible relations between people. For example, the temporary art installation 'Together apart' by architecture office Behin H, consists of 375 coated mesh fabric ribbons stretched between the roofline of the Billund community building and the ground. The ribbons, connected to the ground along an undulating line, create a series of cellular spaces,

representing the possible physical and emotional interaction between people coming together while remaining apart.

- Affording people to be close to nature

The need to connect with nature can be facilitated by offering people safe routes or places to gather in natural outdoor environments. 'Parc de la Distance' by studio Precht is a concept that consists of green circular routes in a 90-centimeter-wide path, where individuals have the chance to connect with nature and escape the noise of the city while keeping appropriate distance.

3.1.4 Staying mentally healthy

During Covid-19, people needed to cope with various stressors in order to safeguard their mental health and emotional well-being. For instance, designers described how people "need[ed] to deal with intense hardship and loss" and needed "light and fun" moments in order to endure a period of difficulties. How can interventions in public space support people to cope with the emotional impacts of the pandemic?

Design strategies:

- Creating a place for relieving stress

In order to allow people to relieve stress, designers can create experiences that relieve people's stress through the use of light and sound. For example, the 'Breathing pavilion' of Brooklyn, New York consists of a circular installation of pillars with white and orange LED pulsing lights, offering the possibility for people to group and breath in sync.

- Creating a light and fun experience

Social distancing measures can be turned into a light and fun experience. An example is 'Social Harmony' by design agency NOSIGNER, which makes waiting in line a playful experience. The design consists of markings in the shape of a musical notation, where the notes indicate where one can stand. Each time people move from one note to the next, they together create a short piano tune.

- Sharing positive messages or thoughts

Positive messages and thoughts can be shared through interventions that enable people to communicate and receive gratitude and appreciation in public space. For example, as part of the #DearHeroes campaign, messages were projected large on the building of the Mater Hospital in Dublin, thanking frontline health workers.

- Creating a place for commemoration

Places can be created in public space for people to commemorate those who were lost during the pandemic. For example, architect Angelo Renna proposed to repurpose the old structure of the San Siro stadium in Milan and cover it with 35,000 cypress trees in memory of the victims of Covid-19, thereby creating a place to acknowledge and reflect on the crisis and its violent consequences.

3.1.5 Expanding health infrastructures

The Covid-19 pandemic required the existing health infrastructure to be expanded, creating new facilities for testing, hand hygiene, vaccination, and treatment. For example, designers described how there is the necessity "to [...] ease the pressure on healthcare systems treating patients infected by coronavirus" and to speed up treatments, vaccination and testing procedures. In what ways was public space used to expand existing health infrastructures in order to ensure people's physical health during the Covid-19 pandemic?

Design strategies:

- Offering temporary infrastructure for hygiene
Temporary infrastructures can be installed to facilitate hygiene and reduce the risk of contamination. A unique example is the 'Urban Sun' by Studio Roosegaarde, which is an urban installation that offers people a temporary clean (covid-free) space to meet, by purifying the air. The technology used for the 'Urban Sun' design required an in-depth study with experts from different disciplines, who state that this application can reduce the contagion by almost 100%.
- Offering temporary medical infrastructures
Temporary medical infrastructures can be installed in order to offer space for treatment, vaccination, and testing. For example, 'CURA' (Connected Unit for Respiratory Ailments) by Carlos Ratti Associati, is an open-source design of a temporary ICU-unit that turns shipping containers into fully equipped ICU units designed for respiratory care and employs a negative pressure system for biocontainment.

4. DISCUSSION

The challenges identified in this paper indicate how designers have responded to the Covid-19 pandemic in public space. Most design examples that we found were related to urgent measures to prevent the virus from spreading in public spaces (*Keeping a distance*), as well as to find alternative ways for people to have access to essential goods and services (*Sustaining amenities*). The design examples that tackle these challenges, as well as those that address the challenge of *Expanding health infrastructure*, may be considered urgent design responses to keep society running from an economic and health perspective. The final two challenges, *Feeling connected* and *Staying mentally healthy*, show how designers aimed to support social and psychological forms of coping with stressors of the pandemic.

The challenges highlight the potential of public space during times of pandemic, also in the future. The design strategies articulated for each of the challenges show the various possible ways to fulfill this potential. The strategies provide concrete directions that designers and other professionals can use to develop new design solutions. While design examples in and of themselves can serve as precedents in design processes (e.g., see (11)), the design strategies assemble an extensive collection of examples accessible through a particular lens, namely the identified challenges. We took care to articulate the design strategies so that they could result in different kinds of solutions. In other words, each design strategy demarcates a particular solution space for a particular challenge. We suggest that each of these solution spaces can be further saturated with additional design examples. Furthermore, new design examples are likely to result in new design strategies and new challenges. In this light, our study is only a first step in an effort that may continue, whether now or in future pandemic situations.

It is important to note that the design strategies should not be considered 'guidelines' or 'best practices'. Our analysis is based on design examples of which some are conceptual proposals, while others that were implemented in public space have not been evaluated for their effectiveness. The design strategies thus indicate *possible ways* to tackle challenges relating to the Covid-19 pandemic and as mentioned above, potential future pandemics. This is in line with our goal, already mentioned in the introduction, to develop a *program of possibilities*. This program is intended to show a *variety* of ways in which to respond to pandemics, but there is an important role of urban designers or other decision makers to select and operationalize these strategies in ways that fit the particular contexts they are designing for.

4.1 Next steps: towards an open access database

By articulating challenges and design strategies in this paper, we have attempted to generate knowledge that is actionable to designers and other professionals. A next step is to make these challenges and strategies easily accessible. For this reason, we are currently developing a public database with the help of professional web developers. This database will be the concrete articulation of our program of possibilities: it will contain the design examples used for our analysis and allow users to filter these examples according to the challenge they address and the design strategies they represent. With the database, we are building a concrete tool for responding to future pandemics, focusing on the potential roles that public spaces can play in post-Covid cities.

While the database we are building can soon serve as a tool for action and resilience, we consider it a continuous work in progress. We see several directions for further improving it. First, we are interested in collecting additional design examples to expand the database. These new additions may reconfirm design strategies and demonstrate them in new ways. They may also result in new design strategies and challenges that expand our understanding of what design can do in public space during times of pandemic. Second, it would be valuable to seek out empirical insights that others may have collected when implementing and evaluating the design examples. This will allow us to say something about the effectiveness of the design examples, or about the particular considerations or conditions that were important for its implementation. Third, we would be interested in collecting more details about the phases of the pandemic in which the design examples were proposed or implemented. Understanding the design examples on a timeline allows the database to give better suggestions concerning 'when to do what'. Finally, in the unfortunate case of a new pandemic, it would be valuable to track and evaluate the use of the database and see how it actually can help when solutions are needed.

5. CONCLUSIONS

Public space can play an important role in the resilience of cities in the face of pandemics. In this paper, we highlighted the kinds of challenges that design has attempted to tackle during the Covid-19 pandemic while articulating a range of design strategies that can inform concrete action. By integrating our findings into a publicly accessible database, we are carrying lessons from the Covid-19 pandemic into the future, enabling future governments and urban designers to rapidly respond to future pandemics.

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