Realdania

Architecture for Public Health

Insights, design provisions and examples from the built environment in Denmark in the light of the COVID-19 pandemic

Architecture for Public Health

Insights, design provisions and examples from the built environment in Denmark in the light of the COVID-19 pandemic

Contents

Architecture for Public Health

On 5 May 2023, the World Health Organization (WHO) marked a turning point in our global health history by declaring that COVID-19 was no longer a public health emergency of international concern. This announcement signalled a return to near-normal life, but it also represented a critical moment in which the international community had to reflect on our experiences during the pandemic. Because we should not pass up a unique opportunity to learn from the pandemic period, and retain experiences and lessons learned that can also be applied today. We need to understand the nudge the pandemic gave us and the built environment, and take what we learned on board and going forward.

This was the background to the launch in 2022 of the Realdania initiative entitled 'RESPOND – a new framework for everyday life'. This initiative focuses on how COVID-19 changed the Danish public's behaviour at home, at work, in childcare, schools and in eldercare, during leisure, and in public spaces. In partnership with researchers, innovation leaders and civil society, the aim is to identify and communicate the sustainable solutions that came out of the pandemic, not only the interim solutions, but also solutions for promoting health, well-being and quality of life over the long term.

The present publication builds on *Architecture of the Pandemic* published in 2022 in association with the Royal Danish Academy in which we explored how the built environment adapted to infection-control measures.

The purpose of the present publication is two-fold: firstly, to give a wide range of researchers studying the COVID-19 crisis in the context of public health an opportunity to shed light on what was learned in Denmark in relation to their research and general societal predicaments, and secondly, to present real-world examples of urban spaces, open spaces and buildings that served society well before, during and after the pandemic. These examples show how we can design a more resilient,

healthier built environment focused on quality of life. The aim is for these examples to inspire discussion of what we should remember to do more of when we transform, renovate and new-build.

As a global community, we will be better placed to tackle future emergencies if we remember to take on board and implement the experiences gained. It is my hope that this publication will inspire developers, architects and planners to apply the new insights in addressing how open spaces, our cities or buildings should be designed from the outset in order to enable a better everyday life and build resilience to future emergencies. This might consist of something as simple as building childcare, schools and eldercare facilities that provide exits from all rooms. Or of incorporating more green spaces when planning new urban districts. Or of envisaging spaces and zones facilitating informal meeting places and community interaction.

Thank you to each and every one of you who contributed your insights and experiences through your involvement in this publication.

Happy reading!

Jesper Nygård
CEO, Realdania

Access to amenities: Access to private and public amenities and essential infrastructure such as water and sanitation is a determinant of both physical and mental health.

Photo of mobile public conveniences.
Allinge, Natalie Mossin.

Introduction

Architecture and health have always been inextricably linked. People's living conditions affect their well-being and quality of life – and when the health of the general public and of the individual is threatened by crises such as the COVID-19 pandemic, this impacts how we develop architecture and the built environment in the time to come.

This publication was compiled with the aim of making building industry operators aware of the influence of architecture and planning on public health, and the design provisions we can make in order to promote public health through the built environment, especially in the light of the COVID-19 pandemic.

The pandemic revealed vulnerabilities in the way we build and use our cities and our buildings. Some homes could be adapted to the circumstances; others could not. Some people could move around freely and safely in their outdoor surroundings, while others had to take turns in enjoying the same freedom and safety. Some senior citizens could receive visitors at their eldercare facility, while others had to make do with phone or video calls. Vulnerabilities and inequalities such as these became more evident during the COVID-19 pandemic, and we can learn from these disadvantages in developing our built environment.

To deeper understand these learnings we've spoken to a number of researchers who view the pandemic and its lockdowns from the perspective of their particular field. They analyse and reflect on the implications of this scale of health crisis for society at large and for individual members of the public, and on the design provisions planners and architects can or should make for emergency preparedness in the built environment. The researchers also propose likely post-pandemic implications for urban areas and buildings going forward.

To underpin the insights reported by the researchers, we propose three design provisions for achieving resilience in the built environment in the event of a public health crisis. We call these *Access, Reorganisation and Control*. We need to incorporate flexibility and increase the resilience of buildings and facilities in order to sustain quality of life even in the face of disease and other health hazards. To do so, we have to ensure that users such as occupants, school children or staff have access to resources such as nature, community and privacy through the environments we create. We also have to develop viable options for reorganising

the use of buildings and facilities and incorporate capacity for controlling what and whom we encounter upon entering buildings.

We also visit built examples, realised architecture, demonstrating how the design provisions are already in play. These examples indicate that we should revisit buildings and urban infrastructure that have proved their worth and their resilience over time and through public health emergencies.

The publication also includes a theoretical essay linking the topic of architecture for public health with adjacent disciplines such as urbanism, the history of ideas, the humanities and health science.

We chose to entitle this publication *Architecture for Public Health* because in interviews and examples we examine the architecture and building design that promote the general health of the entire population, both physical and mental. The concept of public health has preoccupied our society interest since the 1700s because the health of the population impacts everything from the economy and productivity to reproductivity and generally perceived quality of life.[1]

In many respects, a health emergency on the scale of the COVID-19 pandemic can be seen as a prism revealing gaps in public health, blind spots in a welfare society, or inequalities in access to health and quality of life. This also underlines the importance of architecture and urban planning for public health in that physical settings impact the individual's means of maintaining good health. If the physical setting cannot be adapted to individual needs, if access to resources such as nature or social interaction is unequal, or if the individual citizen's means of securing protection depends on their personal finances, then this affects not only the health and well-being of the individual, but our public health and societal cohesion as a whole.

We hope that this publication will be of interest to building industry stakeholders, and that it will contribute inspiration on how we can develop the built environment so that it supports improved well-being, quality of life and public health.

On behalf of the editorial team,
Natalie Mossin and Ingeborg Hau
The Royal Danish Academy – Institute of Architecture and Technology

From the Connectedness exhibition curated by Marianne Krogh in the Danish Pavilion, 60th International Art Exhibition – La Biennale di Venezia 2024
Photo: Natalie Mossin

COVID-19 and behaviour

The COVID-19 pandemic was not only a health emergency, but also a pervasive social crisis that disrupted many elements all at once. The crisis affected the behaviour of the public, their trust and action competence in relation to their close others and to the wider structural communities that make up society.

In this interview, researcher Michael Bang Petersen discusses how a crisis of this nature impacts both individuals and society at large, and the reasons why some crises spur action, while others do not.

Learning from the COVID-19 pandemic

The COVID-19 pandemic is possibly one of the greatest crises we have faced in modern times. On 5 January 2020, the World Health Organization [WHO][2] alerted the world to an outbreak of pneumonia of unknown cause in China. Within a few weeks, the virus had already spread across national borders and claimed its first victims. By 30 January 2020, WHO declared the emergence of the novel coronavirus [2019-nCoV] a *public health emergency*[3] of international concern and we now faced a new and unknown enemy. For just under two years, life in Denmark, as elsewhere, was severely impacted by the COVID-19 pandemic[4] – so how did we actually make it through this difficult time, and can we learn anything from what is often termed the *COVID-19 crisis*? Professor Michael Bang Petersen, who conducts crisis research, believes we can. Because crises tell us more than we may realise about the society we live in. A crisis of pandemic proportions impacts not only public health but society in general.

"This meant that the government could not rely solely on medical experts, but had to consult a wide range of disciplines. In that way, crises serve as a photographic developer solution, revealing the society we live in."

During the crisis, the general public's vocabulary expanded dramatically in a short space of time in order to be able to describe new situations that were unprecedented for our generation. Terminology like *infection rate, face mask,*

Michael Bang Petersen is a professor at the Department of Political Science, Aarhus University.

He has a PhD in political science from Aarhus University, and his research focuses on political and evolutionary psychology. He is also the director of the HOPE research project, which studied and analysed the behaviour of the Danish public during the COVID-19 pandemic.

Press conference following Denmark's COVID-19 lockdown in 2020. At the press conference, the Danish government presented the measures to be implemented in connection with the lockdown, including the closure of schools, workplaces and cultural amenities. Photo: Scanpix.

support bubble and the Danish coinage *samfundssind* ('community mindedness') became part of everyday language in Denmark. The new collective language was just one of the resources we had for dealing with the COVID-19 crisis, and parameters such as *crisis management* and *threat perception* were topics of intense public interest. This is the whole focus of the HOPE research project – How Democracies Cope with COVID-19.[5] Because what have we learned from the COVID-19 crisis, and how did a two-year period of crisis behaviour affect society?

Times of crisis

Throughout human history, we have undergone various crises. Energy and economic crises have impacted the international community since the early 1900s and industrialisation.[6] The Wall Street Crash in 1929, the oil crisis in 1973 and the severe recession of the 1980s, to name but a few, are all historic crises that came and went. But these crises left their mark on society and the built environment, and our faith in authorities was also tested during these crises, such as the 1980s recession, which resulted in the birth of punk and the squatters' movement from a fundamental distrust of authorities and a rebellion against conservative values.[7]

Crises such as these and the COVID-19 crisis impacted and originated in society in diverse ways. But what is a crisis? Because crises take many forms. Someone might, for example, have a *personal crisis*, which is likely to affect them personally, and their loved ones. If say, your dad buys a red Ferrari, quits his job and dyes his hair orange, he may be having a *mid-life crisis*. This type of crisis may be triggered by personal reflections on the transition from being in the prime of life to facing incipient old age.[8]

But the type of crisis Professor Petersen specialises in is what we would define as a societal crisis. The HOPE project researchers are using *big data*[9] to survey how the public and the government in democracies respond to societal crises.[10]

"Obviously, there are all kinds of crises, be they personal crises or neighbourhood crises, but those that interest me are society-wide crises. As in crises that impact the general public, and thus have to be addressed by national policy-makers," explains Petersen in reference to the research conducted within the HOPE project.

And although an *oil crisis* and a *mid-life crisis* may affect us equally, but in very different ways, this begs the question of 'What does it take for us to refer to something as a crisis?' [11]

According to Petersen, three criteria have to be met for something to be termed a *societal crisis*.

"In one sense, a societal crisis is something that changes how society works. So, for us to call it a crisis, it has to be causing some kind of change. And before we can refer to it as a major societal crisis, the change has to have great impact on society and on those of us who live in it," he explains, adding: "You could also argue that for it to be a crisis in the conventional sense, the change has to be rapid. So I would say that a crisis involves something that causes change, something rapid and something impactful."

In sum, according to Petersen, three key elements have to be present for something to be termed a societal crisis: change, rapidity and impact are all three elements that characterised the COVID-19 pandemic.

But what can we do as citizens to get through a crisis both as individuals and as a society? Because if the crisis is an external threat, then surely our reaction to the crisis is as important as the threat itself? The HOPE project report defines the way in which we view a threat personally and as members of the public as a threat perception.[12] At the same time, our threat perception ties in with our

self-efficacy, explains Petersen, as both terms are used for shedding light on the circumstances that make citizens willing to accept advice and recommendations from authorities on how to protect themselves from a given threat.

"Threat perception means sensing the threat – being aware that a threat is present that both has a significant impact on society and involves personal exposure," Petersen explains, adding, "But in order for someone to engage in protective behaviour they also have to have a sense of self-efficacy. Self-efficacy, or agency, is the sense of knowing what to do and of feeling capable of doing it. You have a sense that your actions will help to mitigate the threat, and that the cost of taking those actions will not be too high."

According to Petersen this set of perceptions makes up our self-efficacy, and is what helps us feel that we can cope with a threat. This point is made in the HOPE report "*Hvad kan vi lære om kriseadfærd fra corona-pandemien?*" [What can we learn about crisis behaviour from the COVID-19 pandemic?][13] – which included a survey of perceived self-efficacy among Danes during the COVID-19 pandemic. The report presents the findings of a survey indicating that: 'an exceptionally large majority of the public state that they have adequate knowledge about how to deal with COVID-19, and a large majority state that they are capable of doing something to deter COVID-19 contagion.[14] This testifies to a high level of self-efficacy in the Danish population in relation to COVID-19 transmission.'

In other words, the Danish public feel that they have adequate knowledge concerning COVID-19 as a threat, and also the conviction that their actions make a difference. If we compare this finding with a similar survey in which the threat of COVID-19 is replaced by climate change, the public's perceived self-efficacy differs significantly:

'Just under half of the population feels capable of doing anything to counteract climate change,' which, the HOPE report states, indicates a low degree of perceived self-efficacy among citizens in relation to climate change compared to COVID-19.[15] The report goes on to assert that 'the lower self-efficacy may reflect that climate change is a collective action problem that cannot be halted by personal behavioural change. Infection control behaviour during the COVID-19 crisis, however, did have a directly and personal protective effect.'

This then reveals an important point made in the report and in Petersen's assertion: our self-efficacy in the face of a given threat can be exercised by means of either personal or society-wide initiatives. To illustrate this, Petersen reverts to the example of the COVID-19 crisis because it involved support for both personal and societal agency.

"The COVID-19 crisis called for both. People were concerned about getting infected, and they could protect themselves against getting infected by staying at home. But a lot of that concern was actually more about society generally, about hospital capacity and that kind of thing, rather than concern about their own personal health risk. This is why there was high support for society-wide disease control and a perception that this was a collective problem."

Some of what Petersen describes here would come under the Danish coinage *samfundssind*, a uniquely Danish term dating back to 1936, and roughly translating as 'community mindedness', which was reintroduced in an appeal for public solidarity by Prime Minister Mette Frederiksen in her first COVID-19 press conference. The majority of Danes heeded this call in complying with *COVID-19 crisis* restrictions not only for the sake of their own personal health, but also for the greater good. Denmark itself defines *samfundssind* as 'favouring the public good over own interests' – as manifested by non-attendance at social events for fear of infecting other people.[16] Or when people queued up for hours several times a week to have a swab test so they had the peace of mind to visit clinically vulnerable members of the public or attend social events. "In many respects, the COVID-19 crisis showed that the Danish public is incredibly willing to alter its behaviour," says Petersen.

"Looking at the things people willingly complied with during the pandemic, I would never have believed they would have been so willing pre-pandemic. Looking back, it does seem astonishing. Take for example the ban in Denmark on social gatherings of more than five people. That was a radical infringement of our universal rights. And people accepted that because they were told it was necessary," explains Petersen, adding: "That's a very strong indicator of the level of trust in a society such as Denmark, where people were saying: 'Well, if that's what the authorities are saying, then we believe it's the right thing to do, so we'll do it even if it's a drastic measure.'"

Professor Petersen also says that he believes that in many respects, young people were the ones who sacrificed the most during the COVID-19 restrictions. Basically, it was the young demographic that had to refrain from attending their

many social events, whereas older people in society generally have fewer social contacts. A study conducted by the Department of Public Health at the University of Copenhagen in 2020 revealed that some 22% of young people in the 16-29 age group felt lonely.[17] Meaning that almost one in four of the younger generation felt lonely during that period compared with 9% in the 65-79 age group who reported feeling lonely during the COVID-19 pandemic.

Petersen also explains that the virus had unequal impact in that the older generation was the most vulnerable group. In other words, he makes the case that young people showed more community-mindedness, whereas older people stayed at home to protect their own health.

That form of altruism may even be comparable with public behaviour during the Danish cholera epidemic. Many of the personal protection measures faced during the COVID-19 crisis, such as staying at home, physical distancing and hygiene had been complied with during the cholera epidemic[18] when the collective concept of community-mindedness was likewise prioritised by the slogan of the day: 'Wash your hands. Air your home. Keep your Distance'.[19] As such, the COVID-19 pandemic was reminiscent of the Danish cholera epidemic of the 1800s.

Climate and the collective action problem

As evidenced by the COVID-19 crisis, some form of societal intervention is required in order to tackle this form of emergency. Historically, we have witnessed how society was capable of collective mobilisation in the face of a given crisis. Meanwhile, crises arise which the government can deal with itself, and which require less support for societal interventions, explains Petersen, citing the financial crisis in 2008 as one example.[20]

Some types of crisis can be managed unaided by policy-makers, the 2008 financial crisis being an example in which they said: "If you just go about life as usual, everything will basically be fine; we'll do our best to deal with banks that go bust, and whatever else turns up." Another example of this was the British government during World War II and its 'Keep Calm and Carry On' poster campaign reassuring the public that if they didn't fret and kept up the good work, the authorities would do their best to bring things under control.

Conversely, there have been other crises where we were unable to just hand over control to the authorities. The COVID-19 crisis was an example of this, but another example of what Petersen calls a purely *collective action problem* is the climate crisis. The climate crisis differs from the COVID-19 crisis in that the individual does not stand to gain from protective behaviour in the same way. Because in this arena it is is clear that we will achieve nothing without a collective effort.

"No matter how much an individual recycles, or how many meat-free days they have, they will basically gain no further protection against the consequences of climate change. This can be achieved only if we solve the problem collectively," explains Petersen, adding, "By staying at home during a lockdown, you were protecting the greater good, but also protecting yourself. It's not the same dynamic as for climate behaviour because in reducing your carbon footprint, you're also protecting the greater good, however, your actions do not affect your personal risk. Instead, you can do all kinds of other stuff, like protecting your home against increased flooding risk, but that's a different type of behaviour."

A more striking difference between the COVID-19 crisis and the climate crisis is the temporal aspect of the crises. During the COVID-19 epidemic, people could tune in for the latest updates on TV and use COVID-19 apps to track the dreaded epidemic curve.[21] Because during the lockdowns we could watch waves of infection ebb and flow, spurring people to act fast. We were also able to see the immediate effect of the Danish public staying at home for a week or a fortnight because then the curve of new cases actually flattened out. According to Professor Petersen, there was a clear sense that actions taken made a difference. Regrettably, the climate crisis is quite a different matter because the time perspective is much slower for the individual citizen.

"The climate crisis has a much, much slower dynamic, so even when climate experts and politicians urge 'We have to act now!', strictly speaking, it doesn't matter whether 'now' is today, in a week or in a fortnight, meaning it doesn't make much difference. But that dynamic makes it all the more difficult to achieve a change in actions. And it's also much more difficult to spot the positive effects of the behavioural changes people actually make," Petersen explains.

The urgency and momentum of the crisis is thus decisive for the individual's agency; their ability to take impactful action. We have to act on the climate crisis as we did on the COVID-19 crisis because, according to Petersen, the dramatic switch is imperative, although it is equally imperative to sustain behavioural change over time.

Crises as a prism

Looking at some of the greatest global crises, we find that they have a unique property. They can reveal less visible factors that may be hidden in society. This might, for example, be how natural it feels for the average citizen to show up for work physically. Petersen explains that in post-COVID Denmark, some organisations are still struggling with a no-show tendency among colleagues and students, at least in domains where work tends to be unsupervised such as in academia. So although the knock-on effects of the crisis may be more subtle, they can have a long-term impact on our society. "Whether crises are long- or short-lived, or whether they impact public health or the national economy, crises help us better understand the society we live in," says Petersen.

"Crises have a revolutionary potential. A crisis with the ramifications of the COVID-19 pandemic can disrupt fundamental aspects of society. That's why it's important to understand how to best overcome a crisis, as that insight is crucial in mitigating its potential impacts," Petersen explains.

He equates a crisis with a prism, which in many respects reproduces or reinforces the intrinsic attitudes that exist in society. If there was mistrust of authorities pre-crisis, then it is all the more difficult to mobilise a population. And this then makes it impossible to generate the collective solutions required for getting through the crisis unscathed. Professor Petersen asserts that Denmark actually fared relatively well during the crisis.

"I think a lot of people in Denmark emerged from the pandemic with a renewed faith in Denmark's and their own personal resilience in the sense of 'Hey, we got through this, so we'll be able to cope with many other crises,'" he says, adding:

"Meanwhile, the small minority who mistrust the authorities increased during the pandemic. So although the general public or the average citizen came out of it with a renewed faith in Denmark's public institutions, the group that have no faith in them also increased. You could say that trust has become more polarised today."

The idea is that crises can serve to reveal latent attitudes in society and the proportion of the general public who mistrust authorities. We also saw that in the vaccine discourse in Denmark, which was very polarising for many people in our society.[22] But in general, the HOPE project produced insights confirming that the vast majority of Danes believe that the government adopted the policies that were needed for dealing with the pandemic. And although the outcome of the study indicates that people would prefer to avoid similar lockdowns, a majority advocate similar restrictions in the interests of protecting extremely vulnerable citizens.[23]

Restrictions imposed in response to COVID-19 included signage depicting collective conduct in public spaces to both exemplify conduct and advise visitors. Photo: Dorthe Chakravarty.


Corona-virus
Forebyg smitte
med ny coronavirus
Coronavirus
Corona-virus
RÅDHUSET
ER LUKKET
HENVENDELSE I VAGTEN
CITY HALL IS CLOSED
RATHAUS IST GESCHLOSSEN
EL AYUNTAMIENTO ESTÁ CERRADO

Reorganisation of distribution: During the COVID19 pandemic, the Danish public experienced unequal access to essential services, including access to COVID-testing and healthcare. Photo of Copenhagen Medical Test tents, Allinge, Natalie Mossin.


COPENHAGEN MEDICAL

Indoor to outdoor reorganisation: The value of zones between indoors and outdoors became evident during lockdowns when the option of relocating services outdoors made it possible to maintain public access. Photo from Noma, Copenhagen, Natalie Mossin.

Interviews on architecture and public health

The following five articles are based on interviews with researchers who address the relationship between architecture and public health in the light of the COVID-19 pandemic from the perspective of their particular discipline and field of research.

In the first article, Jakob Brandtberg Knudsen talks about how architecture and public health are mutually dependent disciplines. Next, Claus Bech-Danielsen discusses how past public health crises changed the built environment. Marie Stender outlines how neighbourhoods and urban spaces changed significance during lockdowns, while Sidse Grangaard and Rikke Skovgaard Nielsen share their insights into how Danish childcare facilities, schools and eldercare facilities dealt with their everyday responsibilities during the COVID-19 pandemic. In the final article, Mette Mechlenborg explains how the home and domestic functions change during a public health crisis.

The city and the built environment as a health factor

The COVID-19 pandemic revealed how the built environment can influence our physical and mental health. But can we design buildings based on parameters that impact public health, and if so, what would they look like? This is the field investigated by Jakob Brandtberg Knudsen in his research on homes for health and disease prevention for the global population. He asserts that health is an inseparable element in advances in the built environment, and that we have been addressing public health in architecture for centuries.

"We've gained all the things that support a safe and secure existence such as better housing, piped sewage and clean water supply. Architects play a major role in developing the physical components of our world," he says.

But working with public health in the built environment is complex because the healthy solution and the sustainable solution are not always the same. Striking the balance between sustainable and healthy architecture is focal in Knudsen's research at the Royal Danish Academy. The research is centred around how architecture and urban planning can protect people most at risk of contracting a disease, while protecting them sustainably. Before he graduated as an architect, Knudsen studied medicine, and he has subsequently collaborated with health professionals on disease-related projects that offer a unique perspective on the built environment as a health factor.

Jakob Brandtberg Knudsen is the Dean of Architecture at the Royal Danish Academy, where he also conducts research in and teaches the relationship between human health and architecture.

In his own practice, Ingvartsen Arkitekter, he undertakes projects in countries like Singapore, the Philippines and Tanzania.

He graduated as an architect from the Royal Danish Academy and holds a bachelor's degree in medicine.

The efficient residential architecture of the Modernist movement raised the general standard of living by offering affordable housing outside built-up, typically polluted city centres. The new homes offered improved hygiene, sanitation, water on tap, daylight and fresh air to the masses. Pictured here, Unité d'habitation, Marseilles, France, from 1945, by the architect Le Corbusier, one of the pioneers of Modernism. Photo: Cemal Emden

Buildings as machines for health

Within the last 150 years, life expectancy in the west has doubled. This is commonly attributed to advances in medicine and clinical medical practice, but according to Knudsen improved health is not only attributable to standards of modern healthcare. He believes that architecture, the natural sciences and engineering science are key health determinants because health is an intrinsic component of these disciplines and addressed by them all in one respect or another. The history of architecture gives us many examples of health playing a crucial role in the built environment. In other words, improvements in public health are also a natural consequence of advances in the built environment. We are not as affected by wind, weather and disease as we used to be, which, combined with a generally increased focus on maintaining a healthy lifestyle has served to increase our life expectancy.[24] Human health is latent in the way we design the built environment, and may be completely unobtrusive, unlike in the Modernist era, which was partly a reaction to sub-standard urban housing conditions in the early industrial era, Knudsen explains.

One of the pioneers of Modernist architecture who addressed human health in buildings was the Swiss-French architect Le Corbusier, who led a backlash against the squalid urban living conditions in his day.[25]

"Our principles of public health shaped architecture and our aesthetic. Examples of this would be the Modernist movement pioneered by Le Corbusier who proposed razing large parts of Paris to the ground and building new, clean, hygienic urban districts full of daylight and fresh air, inspired by industrial and hospital architecture. Or the Finnish architect Alvar Aalto's sanatorium in Paimio, Finland, as a trail-blazing example of how architecture can accelerate the healing process. Aalto saw the sanatorium as a 'machine for health' in combating tuberculosis."[26]

Although these ideas may seem radical, they helped us on our way towards a common standard for clean, healthy cities. In the past, health-promoting architecture was achieved by optimising the choice of structural materials, the number of windows and the layout of interiors. According to Knudsen, these legacy elements are still with us; the architectural principles of the likes of Aalto and Le Corbusier are fully integrated into our society and legislation.

"This is why we have national building regulations containing so many sections to safeguard human health, meaning elements for achieving healthier homes and offices, such as ventilation, daylight, materials and so on," Knudsen explains.

If you ever worked on a large-scale construction project in Denmark, you're very likely familiar with BR18, the current Danish Building Regulations. The regulations set out clear guidelines for spaces for short-term or long-term occupancy. They constitute a number of health criteria such as ceiling height, daylight, ventilation and acoustic levels. A space must meet all these criteria to qualify as being suitable for residential occupancy.[27]

Homes to combat disease

In this way, over time, our built environment has evolved in order to promote public health. And this often happens unobtrusively, as the elements today are seamlessly integrated in our building aesthetic, construction methods and legislation. Meanwhile, architecture can also operate with a preventive focus on combating specific diseases. The Star Homes project in Tanzania described on page 106 of this publication is a good example of design to deter disease. Based on Knudsen's medical background, this project develops new methodological approaches to

architecture, and is geared specifically to combating the three main causes of child mortality in the region: malaria and respiratory and diarrhoeal disease. All of these diseases are directly linked to the built environment.

"Health science projects are subject to documentation requirements. Accordingly, in the Star Homes project we built 110 homes which we test on a continuous basis. This is conducted via a clinical trial in which we work with clinical doctors and biologists to carry out weekly follow-up of 1,500 children living in either a new or an existing home to see if living in a sound home promotes health. In this way, we are complying with strict clinical trial criteria to document the effect of housing on the three diseases. To our knowledge, this is unprecedented in architecture," says Knudsen.

The Star Homes project is building trial homes and using them to test their hypotheses of what works in combating the diseases. However, the trial homes are not only scientific experiments, but also real homes. The project employs an evidence-based methodology known in Denmark from the 1800s[28] when the Danish Medical Association [DMA] housing was used in the efforts to halt the cholera epidemic. The DMA homes, like the Star Homes project, demonstrated how diseases can be prevented by hygiene and a healthy indoor climate.[29]

And according to Knudsen, research in indoor climate and respiratory diseases has only become more relevant since the COVID-19 pandemic directed focus at the criteria for effective ventilation and how disease particles spread. In that sense, the Star Homes project has changed since the initial pilot trial in 2008, and is still evolving.[30]

Design promotes health

Clearly, design can promote health and even help prevent disease and contagion. But evidence-based design has huge potential not only at building-unit scale, Knudsen explains. Because the way in which a whole city is designed can also promote public health. A city in which people can engage in physical activity, or urban green spaces for timeout from the pace of life, may reduce the risk of diabetes and other lifestyle diseases. Equally, the ability to move safely around in a city benefits our mental health. In other words, a number of parameters in the built environment serve to promote public health. But more often than not, conflicts of interest between sustainability and public health arise in the development of cities and buildings," Knudsen explains, adding:

"Urban planning poses a conflict of interest when we insist that high-density housing is sustainable, but assert that for hygiene, low-density is healthier. This is further complicated by conflicting interests in health alone. If, say, it is healthy to take the stairs to the 4th floor, how do we make sure we do that without excluding people

who are mobility impaired? Or if we compare the rural west coast of Denmark with the capital region, we see that the rural population has 50% more living space than city-dwellers because they live further apart. This benefits hygiene, but means much higher construction and transport costs."

Meaning that building design has to address solution-specific conflicts of interest, too. As Knudsen points out, there is no universal solution that can meet every single criterion. And all of the conflicts of interest extend right down to the level of materials. Because modern materials science is embedded with a hygiene criterion.

"In many cases, we think of materials as being largely aesthetic options, yet those materials have been refined and incorporated on the basis of centuries of tried-and-tested experience. For example, when people go to their local DIY store, not many of them will have any idea that tiles were a hygiene-driven intervention or that those smooth, chrome finishes are great for spotting contaminants," says Knudsen.

The kitchen is an important element in the Star Homes project. It has hygienic, easy-to-clean surfaces, and the functional solutions such as access to clean water and a non-fuming stove are adapted to the local climate, culture and building practices. Star Homes project, Mtwara, Tanzania, 2021 by Ingvartsen Arkitekter.
Photo: Julien Lanoo

Public transport services, such as the Copenhagen Metro (a driverless light rapid transit system), impact public health in various ways. Mobility is increased, but exposure to communicable respiratory disease also increases inside airtight indoor modes of transport, and the incidence of lifestyle disease like diabetes may increase if the public favours passive conveyance over active modes of transport like cycling or walking. Photo: The Copenhagen Metro/Büro Jantzen

According to Knudsen, Denmark is very advanced in terms of incorporating sanitary building materials. But as a result of climate change, we may be facing a future in which malaria and other mosquito-borne diseases are reintroduced to northern Europe.[31] This means that although malaria is not currently a problem in our part of the world, much of the western world could be facing the threat of malaria in future.

"It's only 50-70 years since they had malaria in the USA, Italy and Greece, and the disease can quickly return as a result of the climate change we're seeing now. But you could say that although much of our work and research operates with fundamental and universal hygiene and health principles, where effective ventilation and a healthy indoor climate are priorities, there is still a difference in where solutions are found in terms of the context."

Although the solutions are not universal, but rather local, and are based on the given location and site-specific resources, they all address the indoor climate essentials. That said, solutions for indoor ventilation and climate control will differ depending on how hot or cold the surroundings are, Knudsen explains.

"Fresh air is essential whether you're in an Arctic or tropical climate. And the same goes for hygienic surfaces and clean water, along with safe waste management. Because many of the unhealthy factors are exactly the same. But the solutions have to be adapted to local building practices, the climate and the culture."

A special language

Another key factor for a good indoor climate is daylight. There is evidence that daylight affects our well-being.[32] But nowadays, the many rules we have laid down for the indoor climate limit us in that we may end up creating more problems than we solve by using high-tech solutions, explains Knudsen:

"To my mind, the way we build office buildings these days is verging on criminal. We lock people up behind triple glazing but they can't open a window. That's at odds with the human instinct for what is good for us. Another thing is that when we create those artificially conditioned interiors, the occupants require them to be very precisely controlled. If the users were allowed to adjust the indoor climate themselves, they wouldn't mind it being it being on the warm side."

In other words, we can make use of certain psychological principles that influence how we perceive our indoor climate, especially when we have the option of controlling the temperature, ventilation, and so forth. According to Knudsen, people tend to feel distressed if they have no influence over their indoor climate. Automated ventilation or lighting can easily become a nuisance at work.[33] In many cases, the problem is that we have trouble describing the function and metrics of the indoor climate, he explains.

"Indoor climate is difficult to put into words if you don't know the terminology. It's like having to describe a wine. Daylight is not that easy to describe. It requires attentiveness and very precise language."

He believes we should be mindful of the way in which we perceive phenomenological meanings of materials and architectural design provisions such as daylighting. Part of the Danish culture is to favour natural materials, as this is what we find most comfortable and ascribe most value to.[34] "But we need to bear in mind that this is not a universal preference," says Knudsen.

"It's something favoured by an exclusive part of our world. In much of Africa, consumers don't remove the plastic wrap from a purchase, because that way it retains newness value. It's just a different aesthetic."

It is interesting to examine why the Nordic positive perception of all things natural is not universal. Perhaps this is because nature is not seen as dangerous in the same way as it is in continents like Africa, for example.[35]

"In most places in the world, nature holds danger – it can kill. And the materials we appreciate for their naturalness in Denmark, like wood, limestone, soil, etc. are associated with mould and sub-standard housing in other parts of the world."

Danish cities and homes

Post-COVID-19, there has been much talk about how the pandemic would change the face of architecture.[36] Knudsen nods in agreement, citing two factors he believes we need to focus on in the coming years. One is the home, which has undergone a radical change in that for many employees it now doubles as their workplace.

"Couples in small homes with young children, especially ones where both parents have to work from home, are experiencing workspace versus living space problems," explains Knudsen, mentioning that some Danish employees have had no option but to install a shipping container office in the garden. Because when a workplace moves home it can be difficult to find both physical and mental space in family life[37]. But there's a way to go before we can see a positive post-COVID-19 impact on building design, asserts Knudsen.

"On the contrary, as I see it, there are some pretty dull buildings going up right now. There's too much focus on overly technical solutions to ventilation, meaning we're using more resources, more space and mental energy on solving something with highly technical interventions. To my mind, that's the wrong way to go."

But does that mean we should scrap all the high-tech solutions we're using in the Danish construction sector? Not necessarily. Knudsen does mention that the aim should not be to control every factor that makes up the indoor climate, and that it might be wiser to learn more from the past. This is because we need to differentiate between the types of rooms to be built.

"There's no getting around the fact that operating theatres require very controlled air circulation, but, as I see it, taking the same approach to ventilation in ordinary homes is a mistake."

On a completely different scale, Knudsen can clearly see that the COVID-19 pandemic has had another impact. Now, more healthcare professionals have become aware of the impact of urban planning on public health:

"They've become much more interested in urban planning because they were reminded that it has huge implications for general public health in terms of diabetes and heart disease, for example. The awareness that urban mobility promotes health has increased again. We tend to overlook what we did in the past. If we go back to the 1950s, Copenhagen had no pedestrian precincts, for example."

Interest in urban planning during the COVID-19 pandemic concerned infection control, in terms of whether people resided in a built-up district, for example. But urban planning is not only important in infection prevention and control, since, as Knudsen points out, it can also reduce the incidence of lifestyle disease like diabetes. In that way, urban planning impacts whether we go around infecting each other with airborne diseases, but can also cause disease if it does not encourage citizens to get enough daily exercise.

Resilience in the built environment

Urban planning and housing development here in Denmark have made progress, especially given that health professionals can see how much influence the built environment has on our well-being. And although Denmark and the west generally have many urban and housing development dilemmas, the main concern right now is the population growth in many African countries, says Knudsen. Africa is the continent in which the sustainability agenda is crucial.

"The population of Africa is set to double within the next 30 years, meaning that homes will need to be built for two billion people, assuming that a large proportion of existing homes will need to be replaced. These are stark figures. It's the equivalent of regenerating the whole of the North American housing stock every four years for the next 30 years in order to keep up with population growth. The sustainability and public health challenge is consequently to build more with less ressources."

And if we look at a typical Tanzanian village it is essentially fairly resilient. According to Knudsen, there are two types of building for resilience: *armour* or *stealth.*

"There are two strategies for architectural resilience: *armour* and *stealth. Armour* is where the building is like a hardy shield, designed to last 200 years, constructed from heavy-duty materials and very spacious," Knudsen explains.

"The *armour* strategy is the one used extensively here in Denmark and much of the western World. These are buildings constructed using high-grade materials that protect against wind and weather and unforeseen events, but which are not that adaptable. So, this is one way of looking at the concept of architectural resilience," Knudsen explains.

"Alternatively, *stealth* is a strategy of unobtrusiveness or rapid adaptability. We don't always know what we have to prepare for, but we can prepare for the ability to change this building rapidly."

In sum, Knudsen's definition of *stealth* is characterised by rapid adaptability, and even if we do not know what form a future enemy might take, the building in itself will be adaptable. Another way of thinking of this is as 'large and rigid' versus 'small and agile'. Not because one is better than the other but because it could describe the two types of resilience. The focus here may also be that we cannot prepare for every contingency. And although one form of resilience is not necessarily better than the other, he believes we should be concentrating more on one at this time.

"I'd advocate focusing less on the armour type, since this is all about being prepared for any contingency, which I don't believe is achievable. That probably conflicts with the idea that everything has to be built to last forever."

Knudsen believes that in these dilemmas especially, architects and designers have a useful skill, given the need to demonstrate and disseminate different proposals for the future. Architecture is thus uniquely positioned in typically having to navigate conflicting health versus sustainability aspects. Because the choices we make today must also be valid tomorrow.

Armour and Stealth

Armor is a type of resilient architecture where buildings are designed to be extremely robust and durable by using heavy-duty, long-lasting materials and featuring spacious interiors. The type of resilient architecture favoured in Denmark is primarily of the armour type.

Stealth is a type of resilient architecture where buildings are designed to be adaptable. As we cannot foresee what the 'enemy' might be next time, it is important for the building to be rapidly adaptable to new needs, threats or, for example, a change in climate. The stealth strategy recognises that we cannot barricade ourselves against all contingencies.

What we can learn from pandemics? – a historic view

The outbreak of COVID-19 was not the first time humanity witnessed a fateful pandemic. In the past, pandemics and major public health emergencies have had radical impact on the future design of our built environment.[38] But how do pandemics impact our built environment, and can we learn from those in the past? Professor of architecture Claus Bech-Danielsen believes we can. Taking the urban history of Copenhagen as a case in point, another disease had huge impact on the development and design of the built environment: the gastrointestinal disease known as cholera.[39]

"In many respects, the restrictions imposed during COVID-19 were similar to those introduced to combat the cholera epidemic in Denmark in the 1800s. Back then, the infection control measures were also all about quarantine, isolation, distancing, washing hands, etc. and they even had something similar to the digital COVID certificate. The measures in place then were largely the same as during the COVID-19 pandemic," explains Bech-Danielsen, adding: "The difference being that during the Danish cholera epidemic, non-compliance carried the death penalty. Happily, the measures weren't that drastic during COVID-19."

Claus Bech-Danielsen is a professor of architecture and the built environment at AAU BUILD, Department of the Built Environment, Aalborg University.

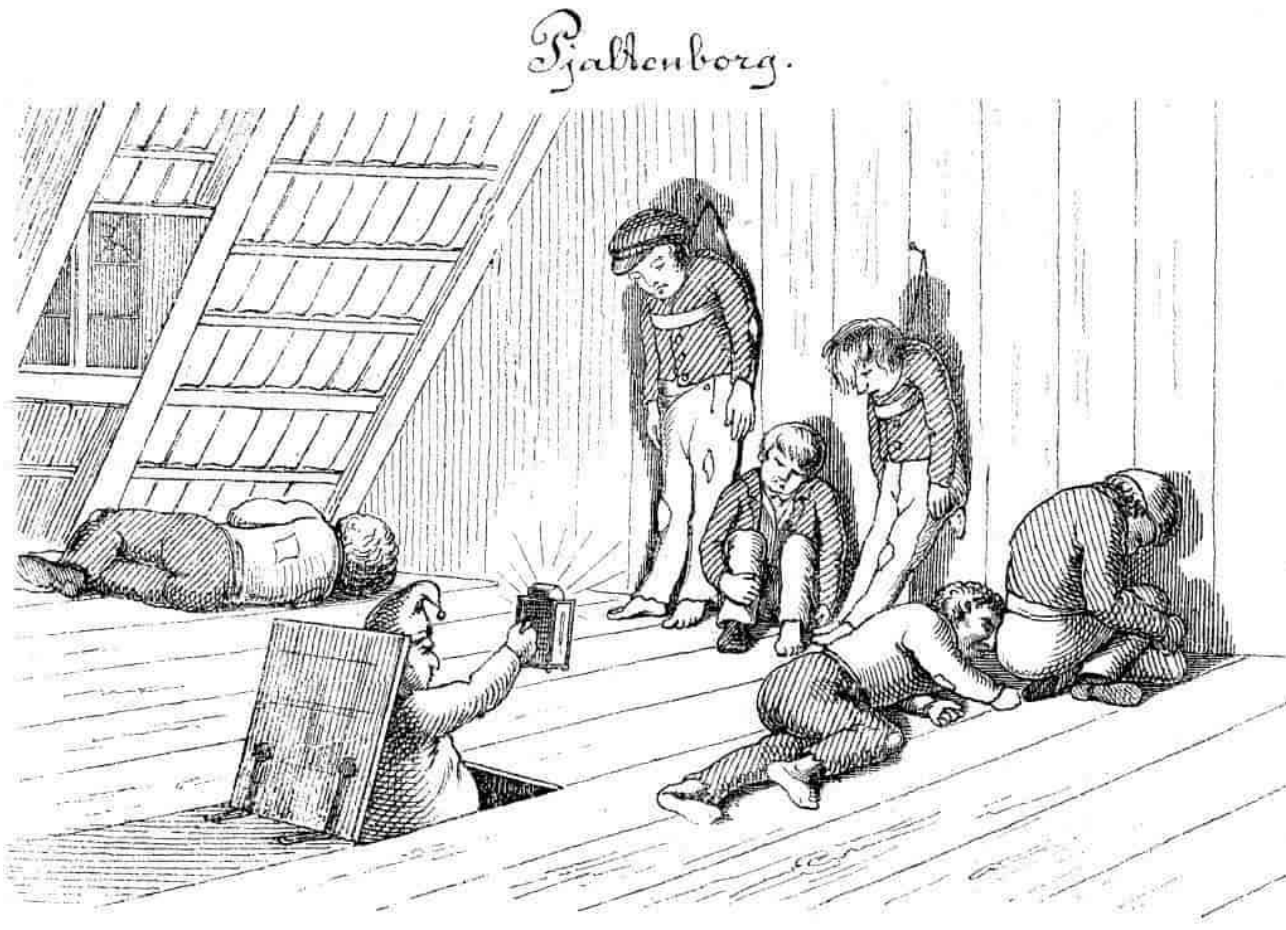
He has a PhD in architecture from the Royal Danish Academy and his research fields include the human experience of domestic life, and urban development.

The population of Copenhagen shot up in the latter half of the 19th century, resulting in housing and general space shortages in the capital. For impoverished migrant workers, lodgings were in short supply save for in 'pjaltenborg' (doss-houses) where workers could rest for the night suspended from a wall-mounted leather strap, which allowed them to sleep upright, cheek by jowl. Drawing of a Danish doss-house by P.C. Klæstrup in 1877. Illustration: Museum of Copenhagen.

Cholera outbreaks in the mid-19th century led to 'the sanitary movement' that revolutionised the layout and structure of cities, urban spaces and buildings.[40] Bech-Danielsen has studied the impact of the Danish cholera epidemic on the built environment, together with similarities and differences between the cholera epidemic and the COVID-19 pandemic. In this interview with Claus Bech-Danielsen, we will be taking a historical look at the impact of pandemics on the built environment, and comparing past public health emergencies to those faced during the COVID-19 pandemic.

The urbanisation of Copenhagen

To understand the situation Copenhagen was in before cholera broke out, we have to understand the colossal growth and urbanisation that took place in the 1800s. The industrialisation of both agriculture and cities resulted in dramatic population growth in Copenhagen. In 1840, the population of Copenhagen was 120,000,



but just 50 years later had increased to 500,000. This era was characterised by national economic growth, and in its wake a modern, class-based society emerged.[41] Copenhagen at this time was affected by extreme housing shortages, and flats in the districts surrounding the city centre were generally small, densely occupied and damp, which factors also accelerated the spread of cholera. The many new city-dwellers had left rural areas for Copenhagen in hope of a job in the capital's new industrialised factories.[42]

This led to the relocation of both industry and housing out of the dense capital. The Carlsberg brewery is just one example of a company that moved out of the city. The relocation happened in 1847 to gain more space, clean water for brewing and generally more sanitary conditions.[43]

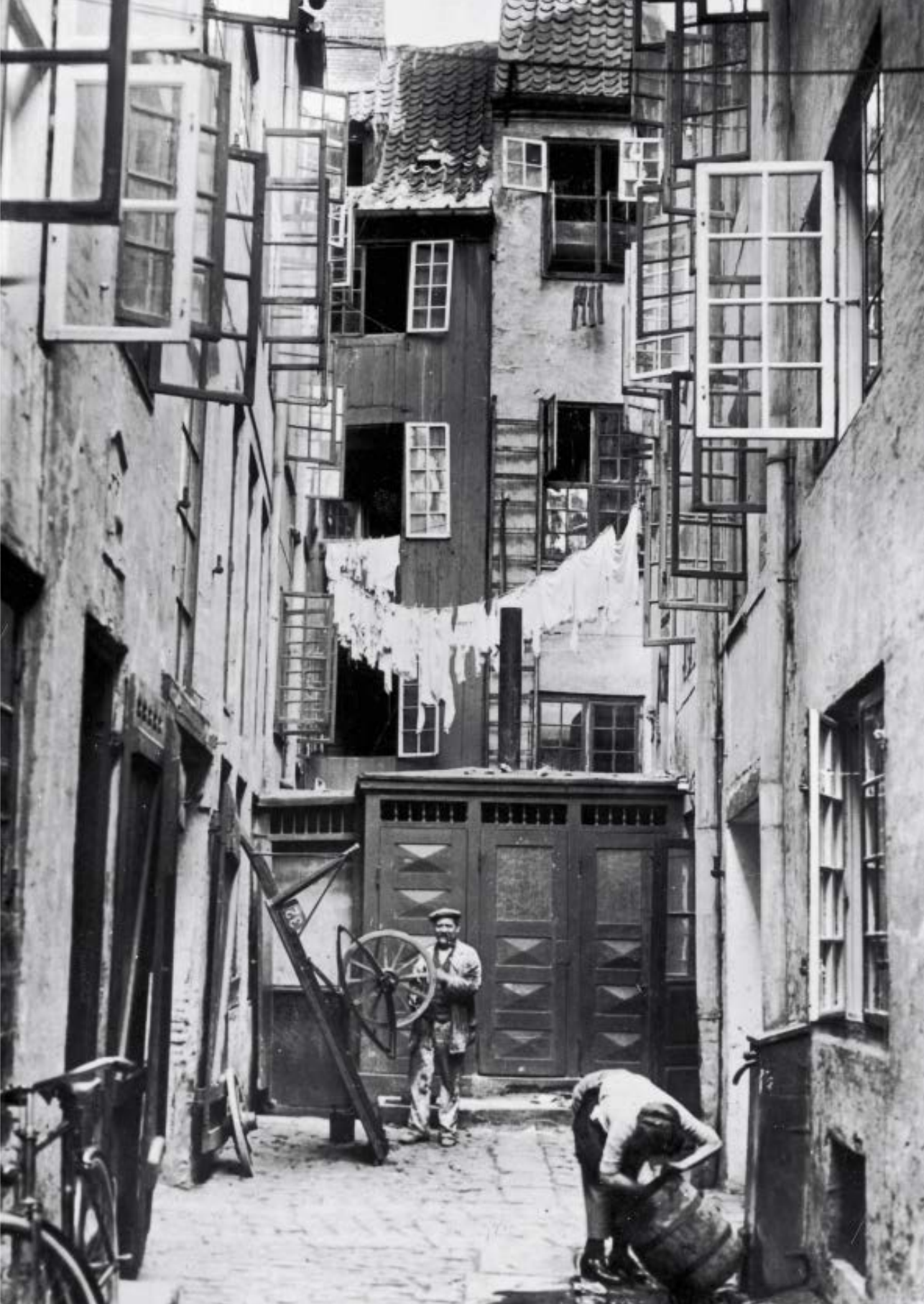
Cholera comes to Denmark

The cholera epidemic in Denmark was one of the landmark events demonstrating that the built environment is a determinant of public health. Outbreaks of the disease ravaged Europe in the 1800s, and although cholera did not reach Denmark until June 1853, the authorities had been preparing for its arrival well in advance by issuing cholera-control recommendations and rules for the public to comply with as early as in 1831.[44] Nonetheless, over the summer of 1853, more than 7,000 inhabitants in the capital were infected, of whom 4,700 perished.[45]

"At that time, Copenhagen doctors created slogans for the public to combat the epidemic. These were virtually the same as those the Danish public heard during COVID-19: 'Soap, fresh air and distancing!' Some 170 years later, we were hearing the same again," Bech-Danielsen explains.

People lived in crowded accommodation, and persons of no fixed abode had to resort to 'Pjaltenborg' (doss-houses) where their loftspace lodgings were so overcrowded that for a small charge they could be hooked to the walls in order to sleep upright.[46] Unsanitary living conditions and high population density were the main culprits behind the cholera epidemic in Copenhagen in 1853. The spread of cholera was accelerated by poorly ventilated housing combined with leaky pipes that allowed clean water and sewage to be mixed. Copenhagen had simply become too hazardous to live in.[47] All of this eventually led to the Danish version of the sanitary movement, *Den Hygiejniske Bevægelse* ('The hygienic movement').

19th-century Copenhagen was densely built up. To save the cost of land lots, Copenhagen's city blocks were utilised in the extreme. Pictured here, a backyard on Prinsensgade in 1914. Photo: Museum of Copenhagen.



"People were urged to spend time outdoors, in fresh air, away from the dense, crowded, city. In that sense, you could say that the city made a 180-degree turn as a result of the cholera epidemic. Prior to the cholera epidemic, the city was a place to seek protection from external hazards inside the ancient ramparts. But suddenly, the danger was inside the city limits, and the most hazardous spots were the backyards in the heart of the city. Now, safety was outside the city – in the fresh air of the outlying countryside!" explains Bech-Danielsen.

The hygienic movement

The Danish hygienic movement, *Den Hygiejniske Bevægelse* arose in response to the cholera epidemic and industrialisation from 1850 onwards.[48] The movement consisted of a circle of doctors and architects led by physician Emil Horneman, and its aim was to promote public health. The doctors and architects had realised that the built environment was a crucial factor in the spread of contagious disease. On study trips to England, the Danish physician, Dr Emil Hornemann [1810-1890][49] had discovered that the cholera epidemic was a consequence of industrialisation.

He then began campaigning for the built environment to be upgraded by various sanitary interventions. This resulted in revisions to the Copenhagen Construction Act of 1873.[50] Empirical studies of the first outbreak of cholera in England had identified the physical conditions in cities as determinants of disease transmission. Health and hygiene arguments now came to determine how buildings were to be designed.

This approach has had great influence on how we view and manage communicable diseases to this day. In the late 1800s, the backyards of Copenhagen tenements were squalid and disease-ridden. The call was now to build spacious, green havens into the city, and suburbs were designed to allow daylight and fresh air to enter the new housing schemes for blue-collar workers. The ensuing information campaigns advised the public on healthy living standards.

The efforts to combat cholera in Denmark started with the creation of tent camps outside the historic ramparts forming the city limits, and with the construction of the Danish Medical Association housing of 1853. Bech-Danielsen recounts:

"People knew nothing about bacteria in those days. They went about it empirically, identifying certain districts as extremely vulnerable to the spread of disease. Next, they began to monitor densely built-up, overpopulated districts with damp housing. This was where the risk of infection was worst."

The Danish Medical Association housing scheme, also known as Brumbleby, was built outside Copenhagen, and was completed by 1872.[51] The housing association homes were built on large expanses of greenfield outside the city, in what is now the Østerbro district of Copenhagen. The homes were built for the large influx of migrant workers seeking work in industrial factories. The Medical Association housing was just one of several association-led housing schemes for blue-collar workers that were designed to raise standards of public health and also morale among recent migrant workers. Some of the most renowned housing schemes established by housing associations under the Danish sanitary movement included Sverigesgade in the Amager district (1867-1871), Kartoffelrækkerne (1873-1889) and Komponistkvarteret in what is now the Østerbro district, and Humleby (1886-1891) in what is now the Vesterbro district. These were all built in connection with the creation of Arbejdernes Byggeforening (the workers' building society) (1865-1974).[52] Sub-standard housing conditions were believed at the time to be the reason why working men neglected their families. In this way, the housing associations aimed to promote a more orderly way of life and encourage domestic bliss where decent conduct prevailed.[53] The latter half of the 19th century also brought a keener focus on the health aspect of urban life. The nuclear family emerged as the foundation for the good life, where 'morality' was

Tent camp outside the old city limits between Nørreport and Vesterport. The tent camp served as emergency accommodation for city-dwellers evicted from homes and relocated out of districts ravaged by cholera.
Painting by H.G.F. Holm Illustration: Scanpix.

linked to a healthy way of life. This era established the concept of the sound and healthy domestic life that has prevailed in Denmark ever since, Bech-Danielsen explains. In sum, the cholera epidemic revolutionised the Danish cityscape. New initiatives and innovation in building practices and technologies changed urban areas and the vulnerability of the public to communicable disease. Examples of the changes ushered in by cholera include underground sewerage and paving in crowded tenement backyards. Before then, the backyard gutters were used for emptying chamber pots or contained squalid privies until the first network of sewer pipes was laid underground in 1884.[54] In addition, the authorities began to regulate where people could live and the density of housing and occupancy. This was the build-up to 20th century Modernism.

Modernism and health

The Danish Modernist movement that emerged in the mid-20th century was also a reaction to the major challenges faced by society. Copenhagen was still generally characterised by unhealthy housing conditions, and so the Modernist principles of public health promotion, prefabricated homes and the benefits of nature gained traction.[55] It could be said that the 19th century 'hygienic movement' evolved into a very tangible form of 'clinical architecture'. Based on daylight and fresh air through large window openings and between homes, Danish housing changed radically from 1920 to 1939. Modernism aimed to provide healthy, affordable, efficient housing for the masses and this was done by economising on, or simplifying, many of the costly and labour-intensive decorative features that had characterised building design. Instead, the aim was to build faster, cheaper and more efficiently.[56] The stylistic features of the era – unembellished design, clean lines and functionality – also demonstrated what the Danes saw as the good life and healthy living. Industrialisation had now made it possible to build cheaper homes for more people. The general perception was now that decent living conditions made citizens behave decently.[57]

The healthy city and home

Over the course of the 20th century, environmental pollution took a turn for the worse, and the importance of building design for public health was undermined, explains Bech-Danielsen. One could say that the public health discourse has shifted from being associated with localised urban pollution to the contemporary discourse in Denmark, where global pollution is the focus.

"In early 20th-century Denmark, the focus was on local pollution of the foul-smelling type given off by gutters down in the densely populated courtyards. In the space of that century, that problem was 'fixed' by discharging pollutants to the surroundings,

The building society homes, in this case the Danish Medical Association's Brumleby development in what is now the Østerbro district of Copenhagen, were built as a reaction to the cholera epidemic and the unhealthy built-up city it ravaged. Here, major employers and unions offered workers a home on the outskirts of Copenhagen that they could ultimately aspire to own. In this way, the workers gained both healthier homes and a better livelihood. Danish Medical Association homes in 1853, in what is now the Østerbro district of Copenhagen. By the architect M.G. Bindesbøll. Photo: Per Munkgaard Thorsen.


S

i.e. to rubbish tips, the sea and high up in the air. Eventually, the surroundings could not hold any more; the sea and atmosphere were filled up and pollution had become a global problem," comments Bech-Danielsen.

According to Bech-Danielsen, the effect of this was that as the environmental problems became more remote, they also became more abstract. Through technological innovation, we have pushed the problem further and further away from our senses. "In the past, urban pollution was all in evidence, and was readily sensed. At the late 20th century and today, environmental pollution in Denmark has become far more abstract. We cannot see, smell or hear it – we can only measure it using advanced equipment! This can make it more challenging for architects to incorporate environmental protection into their design, given that architecture is so sensory," says Bech-Danielsen.

Another major health factor for the built environment around the end of the 20th century was the de-densification of cities. This was achieved by means of Modernist buildings that were dispersed in the landscape, since the principle was that the dense city was unhealthy. From then on, Denmark equated these types of landscapes with health. According to Bech-Danielsen, there are fundamental health principles we ascribe to nature:

"Denmark has come to associate a healthy life with greenery, green spaces, suburbs and holiday homes. Oddly enough, Denmark built holiday homes in parallel with its suburbs. And the typical Danish holiday home is associated with the good life and healthy living. Just like the Romantic period back in the 1850s. The ideals of Romanticism: of the simple pastoral life with essential qualities such as fresh air and good food, which is still the ideal lived out in Danish holiday homes."

Top: Large open grounds surrounding Bellahøjhusene housing in Copenhagen, 1953. By the architects Tage Nielsen, Mogens Irming and landscape designer C.Th. Sørensen. Bellahøjhusene, Denmark's first tower blocks, from the Modernist period, exemplify the new style of architecture and the building methods that enabled efficient construction of more housing. Photo: Sandra Gonon.

Left: Sjælør Boulevard station building in the 1970s. Places like these are regarded as sustainable public transport infrastructure. The S-train rail network opened in 1934, linking the city centre with the rest of the island of Zealand in that it serves as a metropolitan, local and regional rail system. Public transport services like the S-train rail network made it easier for city-dwellers to move out into the green suburbs. Photo: Mogens Falk Sørensen, Stadsarkivets Fotografiske Atelier.

Right: Stairwell linking the flats in the twinned Bellahøjhusene tower blocks in Copenhagen. This typology is a distinctive Modernist feature in being characterised by functionality in its simplicity and straight, clean lines. It was important that the construction technology allowed the housing to be built more cheaply and faster, among other things by separating out the building's functional elements, such as the stairs. Photo: Sandra Gonon.

Typical Danish residential estate consisting of detached homes. Suburbs were rediscovered during the COVID-19 pandemic, as many urban services were closed during the lockdowns, but working from home allowed some people to reside further away from their workplace and the city. During the lockdown, the Danish suburbs were once again in favour, associated with the ideal of healthy living, as they provided access to daylight, fresh air and nature.
Photo: Heidi Lundsgaard, Videncentret Bolius.

But when the city went from spreading to sprawling, suburbanisation posed challenges. Sprawl meant that suburbs were associated with commuting, and the idyll of living outside the dense city crumbled. The suburbs became increasingly oriented towards the historic centre, causing massive urban densification. At the same time, globalisation has allowed us to outsource a large number of the heavy industry sites that often made up the built environment at industrial and commercial ports. This freeing-up of land enabled the densification of city centres, a densification strategy commonly justified by the claim that high urban density is sustainable, as it facilitates the use of public transport.[58]

The new relationship with the city

Much of what happened during the COVID-19 pandemic and the ensuing lockdowns changed the way we viewed the city. The reality of working from home made many of us reflect on urban life and home life. Our many virtual devices enabled us to work more easily from home, which many people are still doing now, a few years post-pandemic.[59] Equally, our new relationship with home life directed focus on what a workplace should be able to offer, including in the way of social life. The role of the home workplace, as Bech-Danielsen explains, is nothing new, but something we, as a society, have had on the agenda for some time. In many respects, the COVID-19 pandemic catalysed new potentials.

"To my mind, we've been talking about working from home since the previous millennium. But it took the pandemic for us to realise that potential. Meanwhile, COVID-19 made us reflect on the current ideals surrounding high urban density. Holiday homes became popular, and more Danes were inclined to move out of the city. Reflections on our urban density principle led us to rediscover that density is not just about building density but also how many people inhabit the area. Can we even claim that we have high urban density if we are building tower blocks containing spacious apartments occupied only by singletons? High occupant density rather than high building density is what generates life in the city and the basis for the urban amenities we expect to have."

Our concept of urban density changed in the wake of the pandemic, and some of the benefits of living in suburbia and owning a second home by the sea have been rediscovered. Perhaps not surprisingly given that the suburbs were created to promote public health and resilience in the 20th century. Urban life and the built environment have great influence on our health. This is all in evidence when we dip into our national architectural history. Through his research at AAU BUILD, Department of the Built Environment at Aalborg University, Bech-Danielsen demonstrated that the health and hygiene ideals that were brought into play in response to epidemics have had a prominent role in design of the built environment.

Neighbourhoods and social infrastructure

COVID-19 exposed vulnerabilities in our built environment. We were forced to find new forms of interaction. Our ability to socialise was challenged by the radical restrictions placed on access to urban meeting spaces. How did this change affect our physical and mental health? When we look at the built environment as a health factor, many aspects, according to Marie Stender, are mutually reinforcing. One has to include the social aspect of architecture when equating it to public health, Stender explains:

"The social aspect is a big part of public health. That's why it's important for us to focus on our social network and neighbourhood and domestic dynamics. The urban building stock and its layout in terms of our relations with other people are a huge part of our daily functioning and well-being. And it's important for us to examine how the social environment and the built environment mesh," explains Stender.

Stender works in interdisciplinary teams made up of anthropologists, architects, sociologists and geographers focused on how our cities, buildings and spaces impact human behaviour and perceived quality of life: "The research team combines qualitative and quantitative approaches. My research focuses on the qualitative surveys."

Marie Stender is a senior researcher and research team leader at AAU BUILD, Department of the Built Environment, Aalborg University.

Marie Stender holds a PhD in anthropology from SBi, the Danish Building Research Institute, Aalborg University. Her field of expertise is social phenomena, architectural anthropology, and how people are impacted by the built environment.

A typical street in Copenhagen's new Nordhavn district. This district has relatively high building density, which has impacted many of the district's open spaces. The district has a shortage of green spaces, which became clear during the COVID-19 pandemic lockdowns. Against that, most homes have balconies and roof terraces. Photo: Kontraframe, By&Havn

What do we mean by density?

When we discuss the built environment and its implications for sustainable development and public health, we typically refer to urban density as a sustainability metric in terms of infrastructure. For example: we often have to share public transport options and other services in a high-density city. Another example might be that the communities that thrive in the densely populated cities cause us to share many spaces. Space utilisation is also a sustainability parameter that can be factored in because simply by sharing facilities it may be possible to build smaller housing, that can accommodate more people. And if burning fossil fuels is the biggest climate culprit, then high-density occupancy is probably the most sustainable parameter there is. Director of Queen Mary's Centre, University of Copenhagen and author Simon Kjær Hansen shares this view, including in his book in defence of the city, Et Forsvar for Storbyen, which describes the sustainability potentials of residing in high-density cities.[60] But whereas urban density holds obvious potentials in terms of efficient utilisation of resources and space, the COVID-19 pandemic revealed the drawbacks of people density when it became evident that the rate of virus transmission was highest in densely populated urban areas.

In addition, the residents in dense areas also had limited access to open spaces: they could not just wander around in their own private garden, but had to, for instance, walk in line in one direction around Copenhagen's lakes, holding their breath on passing each other.[61] According to Stender, density is a shifting concept with widely differing individual interpretations:

"Did COVID-19 alter our perception of urban density and our willingness to inhabit dense urban areas, sharing spaces with other people? Looking at urban density going forward, what can we learn from COVID-19? One of the most striking lessons is the difference in opinion between the groups we interview. Architects, developers, urban planners, all those involved in city-building refer to urban density in terms of building density, meaning how close buildings are to each other. But when we ask people living in cities about density, their focus is on people (or population) density; as in how many individuals they have to share space with," explains Stender, confirming why different perceptions of urban density matter in discourse on development of the built environment:

"The built environment influences our view of other people: their physical proximity to us, and our relationship to them if the people density is high. And building density is obviously not the same as population density. It is perfectly possible to build a high-density district with low population density, which is thus not a shining example of sustainability. We have to bear that in mind in assertions that 'urban density' equals 'urban sustainability'," says Stender.

In sum, the built environment affects us at multiple levels. Our relations with that noisy upstairs neighbour affect us just as much as our relations with our favourite bakery around the corner. Many of these ideas are familiar from Jan Gehl, the Danish architect who pioneered the development of 'human(e)' cities with titles such as *Cities for People*.[62] Although urban density may be sustainable in terms of resources and the environment alone, it only works as a strategy if it is perceived as socially sustainable by the inhabitants of high-density urban areas.

Peblinge Dossering, Copenhagen. The lakesides serve as recreational spaces for walking, running or resting on the many benches. During the COVID-19 pandemic, this urban blue space was used differently: for infection control, the lakeside path was made one-directional. The restrictions impacted how local residents used this urban blue space as a social meeting place. Photo: Linda Kastrup.

Urban nature for people and goats

Our relationship with urban nature and outdoor environments changed during COVID-19, and even now, several years post-pandemic, Danes are increasingly making use of nature.[63] In many cases, green spaces in the city were the only spaces where people could meet safely, out in the open, where distancing could be maintained.[64] But has COVID-19 permanently altered our relationship with urban green and blue spaces? To answer this question, Stender took part in a field study of public attitudes to urban nature pre- and post-lockdowns. The researchers studied archives from the National Museum of Denmark and interviewed members of the public to learn how their relationship with nature had changed.

"The National Museum collected diaries from the public during COVID-19, which we delved into. We also interviewed people, while observing how everything was being digitalised."

Stender also observed that while people were making more use of urban nature, this trend was offset by digitalisation. This was likewise revealed by the research team's particular interest in 'interspecies relations', meaning the relationship between people and other species like non-human animals and plants, during and after COVID-19. To that end, the urban nature project inspired a qualitative study in ByOasen, a green recreational space complete with farm animals in the Nørrebro district of Copenhagen, and although it might seem slightly off-scope in conventional urban design, in this case the research team enlarged their respondent field: "Our researchers are out interviewing and observing how people interact with other species to see if relations between them have changed." This is of particular interest, as the research examines how people and nature's informants changed during and after COVID-19. The project also provided an opportunity to study green spaces as meeting places, Stender explains. This is because the green spaces that had always been used as meeting places gained special status during the pandemic in being the only locales where people could meet socially with a clear conscience.

The 2020 COVID-19 lockdowns in Denmark radically altered public perceptions of urban nature.[65] Pocket parks designed as little 'breathing spaces' were suddenly overcrowded, creating a shortage of green urban spaces.

"Where the public would normally have gone out for fresh air in parks, woods and around the city lakes, people were now having to hold their breath and keep their distance, because of the high density of people in these green spaces. That caused a reaction. Some people actually moved out of the city or realised they could work from their holiday home."

But according to Stender, there does not appear to have been any lasting shift in the Danish appreciation of nature or the national sommerhus (holiday home) culture. Since the 1850s, the Danish countryside and holiday-home idyll symbolised a healthy lifestyle, which in a sense has been compromised by urban density. Conversely, high urban density is seen as more sustainable, since aside from the social infrastructure, it also means shorter distances to urban amenities and reduced resource and energy consumption for transportation. But the pandemic led us to question the sustainability of urban density if the aims of sustainability also include access to fresh air, nature and space.

"If the good life in a high-density city means having access to a second home outside the city then we have to remember to factor that into our sustainability reporting. Because is living in the dense city actually sustainable if we all have to have an urban garden or a second home in the countryside?" asks Stender, pointing out that COVID-19 also revealed that opting into urban density and direct access to urban amenities typically means opting out of the benefits that exist outside of urban areas.

When the power cuts out

One of the tools Stender uses when researching how people make active use of the built environment is the concept of social infrastructure. Stender explains that there are three levels of social infrastructure, but that they are not always that easy to spot. The first level of social infrastructure is characterised by spaces designed for socialising, and that we notice them when they are closed down.

Enghaveparken, Vesterbro district, Copenhagen. This park reopened in 2019 following an extended period of relandscaping. Since the original opening in 1929, the park had been intended as a green space in a high-density district. This is a good example of a green space amenity for sports, socialising with friends or quiet seclusion. Tredje Natur undertook the parkscape transformation, which preserved the original pavilions, stage and entrance designed by Arne Jacobsen. Photo: Flemming Rafn.

Den Grønne Sti is a trail and park course in Copenhagen linking the city for cyclists and pedestrians. An example of second-level social infrastructure. When first-level social infrastructure went into lockdown, people met in spaces not designed for socialising. The area around Den Grønne Sti is characterised by large green spaces, most of which are not programmed. This enables use of open spaces for gatherings and events like flea markets, birthdays or as restful spaces in the sun. Photo: Det Grønne Loppemarked

"We don't realise how much we use the grid until there's a powercut. In the same way, the closure of schools and public childcare facilities affected not only the families of children who attended them, but entire neighbourhoods. All the young people and senior citizens who had nowhere to meet."

According to Stender, this exemplifies the importance of *the first level of social infrastructure*. "A lot of the formal social infrastructure closed down during COVID-19, and on social housing estates, housing officers were sent home and the estate community centres were closed. With this, much of the formal social infrastructure was suspended. But it was replaced by something else," Stender explains.

And this is where the other two levels of social infrastructure come into the picture because although the levels were also used before the pandemic, they now had to replace the physical amenities that had been closed down during the pandemic.

"*Second-level social infrastructure* denotes the informal spaces that were not designed as meeting places. Examples of these include stairwells, carparks and redundant lawns between buildings. These spaces typically receive little architectural attention compared with spaces within the first-level of social infrastructure. But during the pandemic they proved vital as daily social interaction spaces that were often activated in new ways," Stender explains.

The transformed Absalon church building in the Vesterbro district of Copenhagen exemplifies first-level social infrastructure. Before Absalon became a community space for meeting and dining in central Vesterbro, the building was a church. This is a place specifically designed as a social space. But when many of these social meeting places closed down during the pandemic, local residents had to find new places for social interaction. Photo: Folkehuset Absalon community space


LASPALMAS

Social infrastructure

First-level social infrastructure
The first level, or the formal type of social infrastructure, consists of spaces or facilities specifically designed as social spaces. In Denmark, they are typically linked to the Danish welfare system and must be low-threshold inclusive across gender, ethnicity, income and age. Examples include public libraries, parks, community centres.[68]

Second-level social infrastructure
The second level of social infrastructure is characterised by spaces for temporary occupancy. This is the social infrastructure or the spaces that are part of daily life and that are shared with other people. They typically have another function than for networking and socialising and are typically not designed for that purpose. In many cases, they appear to have been given little architectural attention. Examples include stairwells, car parks, and corridors.[69]

Third-level social infrastructure
The third level, also known as the informal type of social infrastructure, is typically technologically mediated. It consists of networks in which contact can be made without those socialising being physically present. This form of social infrastructure is beneficial in times of crisis as it can more easily mobilise groups of people or even whole neighbourhoods. Examples of this would be classmate phone lists, Facebook groups or other social online networks.[70]

Top: In Copenhagen's Nordhavn district the many open spaces are blue spaces. This makes the outdoor environments more accessible for water-based recreation such as swimming, sailing or socialising on the pontoon. In other words, blue spaces are open spaces that cannot be used in the same way as green spaces. Green spaces are usually said to be more accessible, whereas the blue spaces are for using actively or to provide visual appeal. Photo: Kontraframe, By & Havn.

Bottom: Kødbyen, the former meatpacking district in Vesterbro, Copenhagen, is an example of an urban recreational space for universal civic use: for sitting, walking, and cycling in. The area is now a creative meeting place for Vesterbro residents. Kødbyen exemplifies that urban areas can be repurposed for social infrastructure for civic life. As the area is accessible to pedestrians, cyclists and car-drivers, it is core to Vesterbro's social life. Photo: Martin Auchenberg

Both the first and second levels of social infrastructure are characterised by being physical spaces, which is what sets them apart from *the third level of social infrastructure*, where socialisation happens in non-physical (virtual) spaces and is often technologically mediated. This might be referred to as social networks, in that they arise in the groups, chats and clubs we form outside of physical spaces. The third level would include letters exchanged with a pen friend in Chile, a classmate phone number list for snow days, or the housing association's Facebook group.

"Third-level social infrastructure , being typically digital, would also include a WhatsApp group or a community of volunteers that help each other out with the daily grocery shopping," says Marie Stender.

You can hear the neighbours through the walls

When using analytical tools and concepts like density, urban nature and social infrastructure it can be helpful to find real-world examples for comparing against each other. "If, for example, we compare two high-density urban areas in Copenhagen – the Vesterbro district consisting mainly of older buildings compared with a mainly new-build district like Nordhavn – their differences, benefits and drawbacks soon become clear," says Stender. The two districts and their differences can be used to shed light on the relationship between architectural design provisions and the public, meaning how people interact with the built environment.

"This is part of what we are interested in comparing: the impact of the built environment, the spatial layout, and how it affects us in terms of our proximity to e.g. a convenience store or generally to people we don't know. You could say that architecture mediates interaction with other people. It creates the spaces we meet our neighbours in and the neighbourhoods we share with each other. The built environment influences that relationship, and does so in different ways."

Comparing these two districts clearly reveals their similarities and differences. And although Stender and her fellow researchers are still in the process of studying these two districts, they have already identified specific trends in them, such as how their architecture affects our sensory perceptions. In fact, in interviews, users and residents use their senses as their frame of reference in describing spaces and their qualitative lived experience of the built environment, for example.

"The divide between the private and public spheres is generally more 'porous' in Vesterbro. People can hear the neighbours through the walls, but just live with that. It's annoying sometimes, but other times, such as during the pandemic, it can be a help." Stender recounts an anecdote about a Vesterbro resident who shouted for help, where the porous apartment walls meant that they were heard by the neighbours. This is striking compared with the sensory perceptions in the new-build district of Nordhavn.

"Nordhavn and a lot of other new-build districts are so well sound-proofed that residents feel secluded inside their own apartment. Simultaneously, the residents of new-build housing comment that the large windows and balconies create a strong visual connection to the city. In that way, the interiors, materials and building density alter interpersonal relations," Stender explains.

The comparison reveals that Nordhavn residents have a different sensory experience from Vesterbro residents. Which are factors to bear in mind in urban development. Where do people meet, and what type of social infrastructure is needed? These elements then, impact district-level resilience.

Urban nature is another factor that reveals differences and similarities in a comparison of these two districts. Vesterbro and Nordhavn differ hugely in terms of the type of urban nature established in the district, and how that urban nature is used. During COVID-19, the importance of urban nature and green spaces was revealed by the many new dog owners, who now lacked somewhere to walk their dogs.[66] In Nordhavn they discovered that they lacked green spaces. Nordhavn on the waterfront is characterised as 'Copenhagen's blue space district'.[67] This means that the primary outdoor environments in Nordhavn are environments connected to water, as opposed to grass. This gives the district one specific recreational value. However, recreational spaces with water are not much use for dog-walking.

"Nordhavn residents have long been calling for more green spaces. And although the residents and the developers liked to claim that 'in Nordhavn, the green spaces are blue', this caused problems for the many Nordhavn residents who got a dog for company during the pandemic. This placed increased focus on issues that were important pre-pandemic such as biodiversity and urban nature. And people became aware of the importance of having access to green spaces for free."

In sum, outdoor urban environments, such as those exemplified here, can be very different. The differences also come down to the way they are used: we can go for walks in urban green spaces, but not in urban blue spaces, and we can go for a dip in the blue spaces, but not in green spaces. Equally, they have a different effect on our sensory register: urban blue spaces typically offer great vistas, whereas green spaces are more accessible for recreation. An example of a large urban green space would be the Skydebanehaven public park or the linear park of Sønder Boulevard in the Vesterbro district. These types of urban spaces can be used far more actively than the blue spaces, as they tend to be more accessible.

The three levels of social infrastructure were also distinctly different in the two districts during the pandemic, Stender explains. The differences revealed what types of social networks the building stock facilitates – differences that are very striking when we compare Vesterbro and Nordhavn.

"In Nordhavn, the first-level social infrastructure of schools, churches, community centres – spaces that are tied into the Danish welfare system – were not high-priority. In Nordhavn there are hardly any public spaces; they are mainly privately owned grounds. For example, the playground Konditaget Lüders was established on the privately owned rooftop, and many other places along the harbour are not publicly accessible. Many of the people we interviewed in Nordhavn met their neighbours on the roof terrace for the first time. During the pandemic they were meeting every day on the roof terrace for an after-hours drink. I think many Nordhavn residents got to know their neighbours during the COVID-19 lockdowns, although some never met their neighbours, not even in the stairwell. Against that, Nordhavn is very strong on third-level social infrastructure. The residents readily self-mobilise, form online networks, Facebook groups, yoga clubs, etc."

With the aid of the research team's analyses of the built environment and the interview-based research, it is possible to identify distinct trends in Nordhavn where physical community spaces provided by the welfare state are less frequented. Instead, the majority of residential properties have private roof terraces where residents met during the lockdowns to socialise with their neighbours. The Nordhavn demographic also indicates that most people have jobs that allow them to work from home. In that sense, one argument would be that this type of residential property combined with the privilege of having a flexible job facilitated a more

resilient district during the lockdowns. Nordhavn is thus driven more by third-level social infrastructure, which is often digital. In this case, Stender explains that they use these forums for social networking, which was also a benefit during the lockdown. If we compare Nordhavn with Vesterbro during the lockdown, many Vesterbro residents generally had a harder time of it because many of the homes in this district are relatively small.

"Residents in the Vesterbro district were perhaps more vulnerable. Someone living in a small flat might be unable to take part in communal events at the Absalon community space or meet up with people at Enghave Plads. On the other hand, many of the Vesterbro blocks have large green courtyards, which don't exist in Nordhavn," says Stender, explaining that the pandemic made us reflect on whether urban densification is the best way to go in terms of resilience. She also fears that the outcome is likely to be more priority given to privatised community spaces instead of the public community spaces that grew out of the Danish welfare system.

"Of course it's too early to draw conclusions from these studies, but we're going to have to reflect on whether high urban density is also the most liveable during and after a pandemic. And regrettably, there's evidence to suggest that the outcome of COVID-19 might be that everyone in Denmark will have to have their own plot and private garden in order to be future-proofed," says Stender.

Care facility and school learnings from the pandemic

"Certain functions in our society are crucial for the functioning of everything else. And those functions include early-childhood educators." The statement was made by the then Minister for Children and Education Ms Pernille Rosenkrantz-Theil in a statement to the TV2 news programme during the Danish COVID-19 lockdown in 2021.[71]

This was the state of the nation during the pandemic when certain essential workers were obliged to go to work while the rest of society locked down. In a country like Denmark that guarantees subsidised public childcare (for children age 6 months to 6 years) and eldercare, essential workers include not only healthcare professionals, but also early-childhood (preschool) educators and eldercare professionals. One characteristic of the Danish welfare model is that public care facilities are used by the youngest and oldest in society.

But how did Denmark keep its care facilities open, and what did we learn along the way? We put these questions to Sidse Grangaard and Rikke Skovgaard Nielsen, who research childcare facilities, schools and eldercare facilities and the built environment at Aalborg University where they recently carried out a study on care-facility and school learning from the COVID-19 pandemic. The two researchers offer a unique perspective, as their research department operates with a multidisciplinary approach spanning architecture, sociology and anthropology, thereby supplementing social science

Sidse Grangaard is a senior researcher in architecture and research team leader of the Universal Design research team at AAU BUILD, Department of the Built Environment, Aalborg University.

She holds a PhD in architecture from the Royal Danish Academy. She also edits Rumsans, a platform advancing universal design best practice examples and insights.

Rikke Skovgaard Nielsen is a senior researcher at AAU BUILD, Department of the Built Environment, Aalborg University, and works with the relationship between social relations and physical space and school segregation.

She is a sociology graduate of the University of Copenhagen and holds a PhD from Aalborg University. She is also responsible for the Sustainable Building Processes BA and MSc programme at Aalborg University.

with built environment insights. The research group studied COVID-19 as a catalyst to learn how certain care facilities and schools can use their built environment differently.[72]

This article is based on the three types of Danish care facilities – early-childhood (pre-school) facilities (for children from 6 months to 6 years), schools and eldercare facilities – which were some of the public service providers in Denmark that did not shut down or which were partially open during COVID-19 and the ensuing lockdown.

New approaches to eldercare facilities and visits

The pandemic meant that people had to meet in new ways. This was particularly true of eldercare facilities, schools and childcare facilities which had to engage with staff and relatives or parents in new ways. For various reasons, Danish care facilities and schools did not close down. The eldercare facilities could not be closed, as they are home to their residents; and schools and childcare facilities had to look after the youngest members of society in Denmark while their parents were at work.[73]

Institutionalised eldercare in Denmark's past was in poorhouses and the 'hospital for commoners', Almindelig Hospital, established in the 1800s. In this era, elderly persons and people living with disabilities were sent away from their homes because they were no longer able to contribute to the household. The emergence of the welfare society and humanitarian principles brought a new focus on creating decent homes for people in health and care settings that met their physical and social needs. Almindelig Hospital pictured here was located on Amaliegade in Copenhagen, and housed both women and men in the 1800s. Photo: Museum of Copenhagen.

As a result, new arrangements had to be made for visiting times at eldercare facilities and school and childcare facility child drop-off and pick-up. The eldercare facilities especially have very special standing, as they are so embedded in the creation of the Danish welfare state.

Before Denmark had care facilities, the oldest members of society were housed in poorhouses in different parts of Denmark.[74] Over the course of the 1900s, the Danish poorhouses were subject to many new initiatives, and in combination with the creation of a mandatory health insurance scheme, the precursor to the modern Danish health service, a welfare model emerged of universal access to eldercare.[75] Care facilities for senior citizens have obviously changed radically since the poorhouses of the late 1800s. Today, eldercare facilities have transitioned from being 'nursing' homes where the focus was on ill-health to a focus on residential care and 'homeliness', enabled by the senior citizen housing act, *ældreboligloven* of 1987.[76] During the COVID-19 pandemic, however, it became difficult to maintain a 'home' for older people in residential care, as their visiting times became restricted, explain the two researchers. Eldercare facility residents and their relatives were subject to specific visiting times during COVID-19, which posed a number of ethical dilemmas.

"One remarkable aspect is that Danish care facilities became more peaceful to reside in, in the wake of the pandemic," explains Skovgaard Nielsen, adding: "The fact that residents don't have to deal with new faces has been a good thing, but also a challenge. The residents as a community have benefited from the peace and quiet of fewer visits, but as individuals, they have not benefited from fewer visits, which is an unsolvable dilemma. It's not good for 'Anne' that her son can only visit her at certain, fixed times of day, but it is good for her not to be constantly disturbed by other visitors. The individual versus community schism is obviously of interest to us."

The problem of individual needs versus community needs is probably inevitable in care facilities. And the question is not just when but where relatives can visit older people in care. For family visits, some Danish eldercare facilities actually installed tents in the carpark, or used the greenhouse in the garden, or made the most of ground-floor rooms having their own door to the facility grounds.[77]

Outdoor areas provided more options for social interaction

Another main topic during the pandemic was how outdoor areas were used. The pandemic caused us to re-examine the value of outdoor environments, raising awareness of the importance of usable open spaces, explain Grangaard and Skovgaard Nielsen. That showed us the importance of having direct access to outdoor areas, among other things because they allowed people to maintain physical distancing from extremely vulnerable older people.[78] The eldercare facilities especially revealed that the better access residents and staff had to outdoor environments, the better their quality of life during the pandemic, emphasise the researchers.[79]

"There was also the pleasure of having easy access to the outdoor spaces of a care facility. These outdoor areas are more appreciated now post-pandemic. It became clear that care facilities with direct access to the outdoor spaces from individual residential units were the most beneficial. These allowed residents to converse, which they really appreciated," Grangaard stresses.

The ready access to outdoor environments made it easier for residents to meet each other, as they were able to interact socially outdoors or from their own balconies. In other words, the architecture was very important, but so was the prevailing culture. According to the research duo, open spaces were clearly used more if the care facility layout was designed to enable access to them.

"The care facilities that had organised themselves around green spaces also had the staff capacity to bring residents outdoors. Another good option was for the residents to interact socially from their own private balconies, meaning they didn't have to leave their own accommodation unit," explains Skovgaard Nielsen, citing Dronning Anne-Marie Centret, Solbjerg Have in Frederiksberg Municipality, Greater Copenhagen, as an example. This care facility is part of a pilot project carried out by the two researchers on care facility and school COVID-19-control response[80] and is also described in this publication on pages 130-133. The open spaces of this eldercare facility were a key factor in how the residents stayed connected with each other during a distressing period of isolation.

The care facility's layout of outdoor/indoor spaces is reminiscent of general housing with a courtyard/block structure. This is an advantage, as the premises are centred in a communal open space while the communal areas of the sections are located in the periphery of the open space.[81] This easily enabled the residents to stay in contact with their neighbours during the COVID-19 pandemic, explain the two researchers.

"The care facility director told us that at one time, a communal event was organised in the form of a concert in the garden. Residents from each section remained segregated from each other. This was the first time all care facility residents were together again and able to see each other, which was so overwhelming that many of them burst into tears. Another time, they hosted a Sakura festival where the garden was decorated with pink balloons, as it was not possible to bring the residents out to Bispebjerg to see the Japanese cherry trees in bloom. And in December, the care facility held a traditional St. Lucy procession in the garden."[82] This is also mentioned in a report carried out in relation to the pilot project by the two researchers.

In this way, the grounds of the care facility played a major role in promoting residents' quality of life during the pandemic and the COVID-19 lockdowns. It could be argued that the layout of the open spaces at this care facility was more resilient during the lockdowns, as it enabled the residents and their relatives to meet in new ways.

Drop-off, pick-up and settling at a childcare facility

The pandemic also meant that childcare facilities and schools also had to make different arrangements for social interaction. As at the eldercare facility, children benefited from less daily disruption, but possibly at the expense of something else. The school and childcare facility heads told the researchers that parents were asked to drop off and pick up their children outside the childcare facility and school entrances. The researchers explain that this new initiative made for a less hectic start to the day.

"Pre-pandemic, parents could drop off and pick up their children whenever it suited them, and typically came through the cloakroom to the activity rooms. They also tended to stay a while to settle their child in, or ask about how their child was doing. Pre-pandemic, it was seen as a strength that childcare facilities could be flexible towards parents in this way. But during the pandemic they realised, by virtue of necessity, that keeping parents out of the childcare facility had a settling effect on the children,"[83] Grangaard explains.

A number of schools initiated post-pandemic 'shoe-free' initiatives for preschool pupils, year 1 and year 2 pupils, respectively. During the pandemic lockdowns, parents were not permitted to enter the school building, which actually calmed the pupils. Pre-pandemic, parents would often see drop-off time as an opportunity to hold unscheduled meetings with the educators/teachers. The researchers explain that this was a bad time for a parent to ask staff about how their child was doing, as staff are typically hard-pressed at this time of day. The staff consequently found it easier to welcome the children at the start of the day if the parents did not enter the pre-school activity rooms or school classroom. This initiative helped childcare

facility and school staff, as it supported them in asking parents and staff to raise individual concerns at a different time.[84]

However, change took some adjustment, as parents and staff had to find new options for meeting each other, explain the two researchers.

"The premise is different now, so they have to make other arrangements for receiving parents and children in the morning. The care facilities are reporting a new self-awareness among staff about how they are organised and their practices. If something changes, they are aware of it. This new post-pandemic awareness is obviously of interest," explains Grangaard.

The two researchers discovered that Denmark's care facilities and schools have generally become very aware that when changes are made to customary social practices, they have to find new ways of maintaining the contact that has been lost. In sum, the conclusion is that the pandemic created a new form of structure in Danish childcare facilities and schools. What started as an infection control measure catalysed new initiatives and resulted in a more structured day.

We see this not only in the drop-off and pick-up arrangements, says Skovgaard Nielsen, but also in the children's play.

"The preschoolers had fewer toys to choose from, which also had a calming effect in the activity rooms, This was also seen as helpful for staff, as it made it easier for them to organise games and keep the toys hygienic, which resulted in improved infection control. The study also highlights the long-known fact that children become more creative when presented with fewer choices. During the pandemic we were all forced into things we thought would be inconvenient or tedious, but which actually put us on a new track sooner," says Skovgaard, stressing that children benefit from having fewer choices. There are even studies asserting a connection between children's ability to concentrate and the number of toys available to them.[85] And although the initiative to limit the number of toys in pre-school had a positive effect on the children's play and concentration, it was originally an infection-control initiative.

Stengård Skole in Gladsaxe Municipality, north of Copenhagen, was a school designed by Vilhelm Lauritzen and built in 1951. The school was able to tackle the restrictions entailed by the COVID-19 pandemic due to its layout and decentralised entrances/exits in the form of the garden doors in each classroom that allowed pupils to be divided into small groups. Photo: Claus Møller.

Pre-school grounds used in new ways by children and staff

Another focal topic in children's play and well-being is their access to and affinity for outdoor spaces, and the layout of the built environment in facilitating this, explain the two researchers. Because just as in the eldercare facilities, the siting and incorporation of outdoor spaces was key to how schools and childcare facilities tackled COVID-19 and the associated restrictions.

"Through the study we discovered that certain physical structures facilitated various measures during the pandemic. The single-storey schools had their own garden-access doors from each classroom, and were more adaptable, as the doors could be used as separate entrances to each classroom. In this way, the school building was turned inside out," explains Skovgaard Nielsen, pointing to the layout of the exterior of Stengård Skole as an example of how multiple entrances were an advantage during the pandemic. This enabled not only zoning of the school for infection control, but also new uses for school grounds, explain the two researchers.

"For many care facilities and schools, the COVID-19 pandemic entailed increased use of outdoor spaces to improve ventilation (both by being outdoors and by airing out interiors while the occupants were outside). This means that outdoor space criteria changed, and the use of outdoor spaces changed as teaching was increasingly moved out into the open air."[86]

The two researchers are not alone in making this observation. The Nordea Fonden research report, *"Kom Med Ud"*, on the benefits of nature for children, also demonstrates that regular contact with nature can have a lifelong positive impact on children.[87]

Some of the childcare facilities visited by Grangaard and Skovgaard Nielsen during the COVID-19 pandemic, like the Nøddehegnet childcare facility, clearly demonstrated new approaches to using outdoor settings in that bringing the children out into natural settings, dressed in all-weather overalls, soon became a daily routine. This impacts the design of outdoor spaces, explain the two researchers, as increased utilisation also causes wear and tear.

"Spending more time outdoors causes a lot more wear and tear to the grounds. We were astonished to find that nature couldn't keep up. The wear and tear meant that the natural features were unable to regenerate. So that's something to bear in mind in terms of upkeep. There's also more focus now on outdoor equipment like awnings to facilitate activities when it's raining outside. And obviously on trees, for creating variation in outdoor settings," says Grangaard.

Clearly, the pandemic has had a positive impact on utilisation of childcare facility and school grounds. Identifying how to use school grounds more and in new ways was a learning process. However, increased use of school grounds raises the requirements for these outdoor areas. In other words, we have to be better at considering which materials to use in outdoor spaces, and how these spaces should function.[88]

Decentralisation – 'the little in the big'

The COVID-19 pandemic revealed viable and non-viable arrangements in Danish childcare facilities, schools and eldercare facilities, stress Grangaard and Skovgaard Nielsen. The pandemic provided pause for thought; for reconsidering the types of spaces we should be providing for the younger and older generations. One of the lessons was that centralising activities, that is, confining shared activities to a communal space, is not always a good thing. This was a consistent issue across childcare facilities, schools and eldercare facilities, say the researchers:

"The theme of 'the little in the big' was a consistent finding in all of these settings, including as regards their staff. And while there may be economies of scale to be had, small-scale community life also needs to be facilitated."

In other words, the built environment should accommodate both small and large social groupings. The interviews conducted by the two researchers with the heads of Danish care facilities and schools indicate that not everyone is inclined to participate in communal activities if the social groups are overly large, although this observation may conflict with current national policy favouring reforms for economies of scale.[89]

"Clearly, there are economies of scale to be had. For example, it's easier to meet the cost of employing a joint food service assistant for multiple childcare facilities who can raise early awareness of healthy eating. And while this is a good example, smaller-scale settings also need to be facilitated. This is the large hall with a main entrance supported by small, decentralised entrances. The children tend to find

main entrances intimidating, while the decentralised entrances can secure premises in the event of future infection outbreaks," says Skovgaard Nielsen.

And the aim of decentralising functional rooms should be not only to facilitate diverse groupings, but also to raise the efficiency of daily activities. The two researchers also observed this at the care facility they visited as part of their pilot project.

"In terms of staff and medication-dispensing we found that decentralised dispensaries are effective in a situation like a pandemic outbreak. The flexibility they offer is all-important. We're all different, and some things cannot be tailored for every care facility, be it a childcare facility, school or eldercare facility, but some arrangements could be more diversified," says Grangaard.

The researchers identified marked differences across care facilities and schools in terms of commitment to what they term 'the little in the big' principle. They also explain that more residents in eldercare are likely to opt for daily exercise if it is organised decentrally, meaning in multiple small rooms. The large communal gym may be off-putting for the residents of eldercare facilities.

Flexibility and reorganisation

More spatial flexibility and a larger range of amenities at care facilities and schools is important, say the two researchers. In Danish schools, this has spurred adoption of the year-group approach whereby the traditional Danish form-based segregation has been abandoned so that pupils share classrooms and facilities year-wide. However, decentralisation may still be viable as a practical element in teaching at Danish schools. Because the COVID-19 pandemic may have revealed the resilience of the built environment not only to communicable disease, but also in learning contexts.

"With their year-group approach, Danish schools used more flexible furnishings that replaced form-based segregation. Increasingly, the aim is to assemble pupils as a class, but also divide them into smaller groups, if necessary, by partitioning. They can no longer maintain the classic desks-chairs classroom layout. The pandemic revealed the weaknesses of only having large common rooms that were more difficult to restructure using fixed furniture," Grangaard explains.

Decentralisation and flexibility are important, but we still have to bear in mind that it is human nature to seek other people. Fortunately, this is the general consensus in the Danish building industry.

"The greatest interest of people is other people," said the world-renowned architect Jan Gehl in the video installation *The Right to Space* presented in the Danish pavilion at the Venice Biennale Architettura 2016.[90]

This is borne out by the researchers' observations that many of the decentralised, temporary interventions established in Denmark during the pandemic were discontinued as soon restrictions were lifted. Some of the facilities and schools reported on here reverted, for example, to a centralised main entrance, as opposed to primarily using classroom garden doors. They found that decentralisation was of benefit during the pandemic, but that pupils missed interaction with pupils from other years and forms:

"As soon as the lockdowns ended, schools abandoned the decentralised entrances because pupils wanted to see each other again, which a common main entrance enabled. Because the aim in schools is for pupils from first year to year 9 to interact. And sure, decentralisation was right during the pandemic. But a century has elapsed since the last pandemic before COVID-19, so do we really need to build for resilience to this?"

It could be argued that 'the little in the big' principle could be a promising new approach because it is all about striking a balance. We are going to need to build schools and care facilities that are resilient to the impacts on daily life of a pandemic or other emergencies. The lessons learned during the COVID-19 pandemic need to be taken on board and elaborated on so as to enable small and large social groupings in schools and childcare and eldercare facilities.

Home and residence

What happens when our home is also our workplace? A home is not just the physical walls we reside within, but also a narrative of our culture and values. Because a residence, dwelling, accommodation, housing, or place of abode is not the same as a home. Our residence can be home if it means something for us. Not surprising then that working from home during the COVID-19 lockdown was a radical change for many Danes.

To learn more about the significance of the role of homes and home workplaces during the pandemic, we interviewed Mette Mechlenborg, a housing researcher at AAU BUILD, Department of the Built Environment, Aalborg University. According to Mechlenborg, the home and workplace are each associated with a set of social and cultural values. Our home reveals much more about who we are than we might realise, and can have implications for our health.

"I think it's quite important to base the organisation of public health on domestic life. In addressing public health, we have to view it from the perspective of the general public, that is, in terms of their own everyday life. And for most people, the home is focal in their daily lives.

According to Mechlenborg, the concept of *home* is difficult to define, linguistically, at least. Home, homeliness or domesticity transcends the bricks and mortar of where we reside or where we work. The elasticity embodied by the concept of home

Mette Mechlenborg is a senior researcher in the field of housing culture and the built environment at AAU BUILD, Department of the Built Environment, Aalborg University.

She holds a PhD in cultural studies from the University of Southern Denmark.

Much of her research focuses on the home as pivotal in topics such as domestic life in high-rises, sustainable everyday life practices, microliving, deprived housing estates, the gendered residence, etc.

may be something we are more aware of when we move geographically. Someone might say 'I'm going home for the holidays', referring to their childhood home, although they may not have lived in their hometown for years. But when someone leaves work for the day saying 'I'm heading home now', as an adult, they are unlikely to mean their childhood home, but more likely their apartment in the city. How we define home changes over the course of our lives, and home may have changed location many times over in our past.

On 17 May 1919, Denmark adopted a union agreement on an 8-hour work day. The agreement was the result of the workers' struggle for decent working conditions, since, until then, the working week had consisted of 10-12 hours a day, 6 days a week, This gave impetus to the 8-8-8 division of the 24-hour day, as we know it today, and which influenced our residential culture.
Photo: The Workers Museum.

Dwellings become homes

To understand what happened to our homes during COVID-19 when the home-based workplace moved in, we first have to understand the historical significance of homes. Because the concept of home is a relatively recent concept in Denmark,[91] and Europe-wide. In the wake of the industrial revolution and increasing urban densification the Danish urban middle classes began to move out to the new city outskirts.[92] Copenhagen, like other capitals, had become dense and unhealthy, and so the middle classes opted out of the city in favour of more space, daylight, fresh air and countryside. In this era, attitudes to city life changed radically.[93] The new distance to cities meant that many former city-dwellers now had a natural physical distance separating them from where they worked. The workplace that had often been in the same building as their house now was separated from the dwelling.

"The radical innovation of separating work from dwelling should not be under-estimated. The movement started back in the 1800s when private living quarters became separated from work. Until then, no work-dwelling separation had existed; a home was often just where a household slept. In the 1800s, a change began to take hold. The place of residence takes on a particular focus on quality of life, identity and close relationships," explains Mechlenborg.

Before the industrial revolution, the workplace was often part of the dwelling place, especially for people living in the countryside. The new distance between the workplace and the dwelling was decisive for separation of workplace and home. Industrialisation and capitalism gave impetus to the transition, explains Mechlenborg. Danes were no longer feudal peasants immobilised by serfdom but city-dwellers, who no longer slept and worked on the farms in the countryside. The new industrial factories detached living quarters from the workplace, and in the wake of early 20th century modernity, Danes, like other Europeans, were increasingly separating working time from leisure time, and public life from private life.

1920 saw the adoption of the Danish Labour Movement's collective agreement guaranteeing an eight-hour workday for all workers who until then had been obligated to work a 10–12-hour day, six days a week.[94] And from the adoption of the union agreement, the Danish labour movement, like its counterparts around the world, finally achieved the three-parts division of the day: *8 hours' labour, 8 hours' recreation, 8 hours' rest* – an 8-8-8 rule that influenced architects, who would now be helping to define new homes to match a new way of life. In Denmark, this is exemplified by architect Kay Fisker's (1893-1965) many residential projects

renowned as models of *Funkis* or *Danish Functionalism*.[95] Fisker housing represented the principle of building design based solely on purpose and function, and rational division of layout and spaces in line with the 8-8-8 division of time into work, recreation and rest.[96] A distinct example of this is Fisker's Vestersøhus project from 1936, which incorporated a squash club in the courtyard.[97] One principle was that the dwelling and workplace of the general public should as far as possible be separated in the interests of a healthy life. To that end, housing design prioritised a healthy lifestyle by allowing residents to play squash during their leisure time near where they lived. Based on historical events and features of Danish residential projects we can thus trace how the Danish functionalist ideal of separating work and leisure impacted society so radically that our buildings, housing and time became divided by function. This is the functional division that resulted in Denmark's separation of residential estates from commercial and industrial estates, cities from rural areas and nature, and family life from worklife.[98] We have constructed a reality in which home is where we can be ourselves, Mechlenborg explains. This is where we are private, and not least, in close, meaningful relationships.

Did I make the right choice?

COVID-19 and the ensuing lockdowns caused us to re-evaluate our way of life: had we made the right choices? We were forced back into our homes, which changed our daily rhythm. In a country like Denmark with guaranteed municipal child-care allowing almost all parents to work full-time, the norm is wake up in one's home, leave home for work and then return home at the end of the working day. In sociology, the regularity of this daily practice qualifies as a *social rhythm*. But during the pandemic, 'home' was redefined. In many cases, there now had to be space for staying at home and working from home, thereby radically altering our daily rhythm. We were not leaving our home. In many cases, this led people to reassess many of their life choices, Mechlenborg explains.

"During the pandemic, we were confronting the circumstantial choices we had made. The home-out-home movement was completely disrupted, making us domestic 'throw-backs'. And the conscious or unconscious choices we had made for our way of life were now reinforced in one way or another."

Life choices is one of the the topics Mechlenborg addresses as a housing researcher. To that end, she and her colleagues collected information from survey informants to track trends. Notably in the context of the COVID-19 pandemic, the research

team observed changes in the informants' life choices. How had the Danish public adjusted? Did working from home impact close relationships? Obviously, there is a difference in whether someone is living alone or with someone, but one thing is certain: we became more critical about our circumstances in life, says Mechlenborg:

"It is clear from talking to our informants that the pandemic era was hugely important as a timeout for reflection. Am I in the right job? Am I living with the right partner? Do I need to ring the changes in my home life and worklife?"

In many respects, the pandemic and the changes it entailed spurred re-evaluation of our circumstances: our work, home and how both are organised, as well as our close relationships were all being questioned. When those who used to leave their homes to go to work, no longer do so, they also have no timeout from the people they live with. We were spending 24/7 with the people we've chosen to live with, which caused Danes to reflect where and how they live, and, not least, with whom. We realised how much we value our homes. Home is where the heart is, or, at least, the hub of most people's lives. This is where we invest the most material and emotional resources, and, not least, our time, says Mechlenborg. In many respects, in the modern era, our homes have become synonymous with our identity and self-image. But does that mean we have ascribed too much value to our homes?

In 2022, Danish residential property spending totalled DKK 188 billion.[99] Although this is down 36 per cent on the previous year, it indicates that homes have high investment value. But do they also have high emotional value? Looking, for example, at owner-occupants of detached homes and villas, a new survey conducted by the non-profit knowledge centre Videncentret Bolius[100] reveals that they see their home as crucial for their quality of life. The respondents reside in their homes for an average of 21 years[101] while the average marriage lasts only 12.5 years.[102] In other words, the statistics indicate that owner-occupiers in Danish villas and detached homes are more attached to their house than to their spouse. Not surprising, then, that home life and family life came under pressure during the pandemic.

Another important point, says Mechlenborg, is the inequality that exists in the Danish housing market. The COVID-19 lockdowns revealed the differences between demographic groups in terms of challenges and opportunities.

"We know that income and wealth inequality persist in the Danish housing market. Some people have large homes, some can buy a home, others cannot get a mortgage, etc. But the means to arrange one's home life so as be able to work from home was also subject to widespread inequality," says Mechlenborg, adding, "This revealed the scale of the disparities in the Danish housing stock. For example, whether or not someone's home setup gives them the option of shutting a door for privacy.

In this way, according to Mechlenborg, our domestic life affords us widely differing means of coping with official stay-at-home orders. The layout of our home, and, not least, whom we live with, gave us a starting point for establishing a home workplace. Some of the same issues are also touched on in the interview with Marie Stender in "Neighbourhoods and social infrastructure", where the assumption is that the sustainable high-density city may not be that sustainable after all, if everyone demands more space outside urban areas. For example: do people need an extension building or a second home for working from home to be doable in practice?[103]

Home workplace as a privilege

During Denmark's lockdowns, different population groups were subject to different parameters for working from home. As described, one such might be domestics, but another might be occupational. Some people had no option of working from home during the pandemic, as their job is a critical service to society or the welfare system. This was the case for nurses, doctors, and bus drivers, but also for early-learning educators in a country with state-guaranteed childcare. However, some occupations are generally far more suited to working from home than others, Mechlenborg explains.

"One thing we do know is that working from home is generally seen as a privilege. But doing so is especially viable for the jobs that require concentration.

During the lockdowns and immediately post-pandemic, the consensus was that more people would opt to work from home, a few days a week, at any rate. In 2021, a Confederation of Danish Industry survey reported a significant increase in people working from home.[104] At that time, the number working from home on a given workday had doubled from 100,000 to 200,000 individuals in the space of a year. Since then, the trend in 'frequent home working' has been downward, according to a work survey conducted by Statistics Denmark in 2023.[105] Frequent home working is defined as working from home several times a week.

But while frequent home working may be in decline, Mechlenborg stresses that the pandemic altered our approach to, and adoption of, working from home and hybrid working, meaning forms of working arranged with regard for employee private lives and preferences such as a four-day workweek, flexitime and working from home. This has given employees more freedom, but does require them to manage their time in a whole new way, she explains, based on the informants in their research project, who report that utilisation of different home spheres facilitates working from home. What is clear, however, is that working from home varies in efficiency depending on size of home and also gender.

"Access to a home-based office or the ability to structure the home in such a way that work and home life are not blended differs," says Mechlenborg, who also mentions a difference related to gender and gender role patterns: "We see a tendency for it to be typically men who occupy the home office room, while women use the kitchen as their workspace when working from home. So that reveals another inequality. And basically, many men are fond of working from home because the family is available when they take breaks. Working from home is appreciated by women because their children are available in a different way, although this disrupts their work. That's a very general tendency seen internationally, too."

In sum, working from home is in many respects linked to location and spaces available in our homes. One assumption might be that it is easier to concentrate in a dedicated home-based office, as it facilitates separation of time. Mechlenborg confirms this in stressing that where a dedicated office space is available it occupies a different 'sphere' from the rest of the home. She also says that in the absence of an office room, their informants have to use improvised spaces.[106]

"Our research indicates that the home-based office has become a strangely amorphous space in the home. It is used for working from home, meaning that it typically stops being part of the private recreational time, and has become a private satellite to work. When people go into their office work starts, and when they exit, it ends," says Mechlenborg, adding: "In that sense, working from home during the pandemic revealed, especially by virtue of the technology, that work has no fixed abode, and can actually be done anywhere. That's why we also have examples of people spending a whole day working in bed or on the sofa or moving around their home to work, depending on their work tasks."

Vestersøhus in Copenhagen has a long façade, pictured here from the northwest. The Functionalist style is informed by the principle of separation of building functions, as seen both in the interior and on the façade. Here the façade functions are highlighted in the sharp lines, large window apertures, balconies, daylight and fresh air. Photo: Sandra Gonon.

Unfortunately, being able to shut a door and maintain privacy when cohabiting relates not only to home-based office setups. During the Danish COVID-19 lockdowns, the number of calls to crisis centres and hotlines increased.[107] Katrine Rønsig Larsen, a historian with the University of Copenhagen STAY HOME project, studied this problem, which was reported not only in Denmark, but in several countries during the COVID-19 restrictions. According to the UN and WHO, the number of incidents of domestic intimate partner violence increased by 60 per cent as a result of COVID-19 stay-at-home orders.[108] As such, the advent of the home workplace revealed the difference in home socio-economic and, not least, personal safety factors. While home is a safe haven for most people, for some it is a very unsafe place to be, where, during the pandemic, they were imprisoned and hidden out of sight from teachers, co-workers or friends.

Digitalisation and life choices

COVID-19 made us confront society's rigid 8-8-8 rule for our work, recreation and rest. This is expressed in the push-back on the labour market for greater worklife flexibility with initiatives such as the four-day workweek and its benefits in terms of stress reduction and increased productivity.[109] Another example of greater worklife flexibility is in housing projects incorporating home workspaces such as Siljangade 4-8 co-living & co-working, as presented on page 140 of this publication. For this housing, the idea was that moving work close to home would generate work/life synergies. These new initiatives have been facilitated by teleworking digitalisation. We discovered that certain types of work have no fixed abode, explains Mechlenborg, meaning that the work can be done anywhere. However, this requires effective digital solutions in the domestic setting.

"Kickstarting hybrid working entails substantial digitalisation. Any self-respecting business has now installed digital tools to enable digital work. That then entails having the same equipment at home. So the question is, does everyone have to have fibrenet, a powerful computer and sit somewhere they won't be disturbed, where they can attend online meetings? And do employees have the tech savvy to get it up and running?" asks Mechlenborg, adding that: "One of the benefits of working from home is that it's mobile. In that sense, the technologies have revealed that work has no fixed abode, that it can actually be done anywhere."

According to Mechlenborg, hybrid working has disrupted our former settlement paradigm, or *commute argument*,[110] which is defined by the distance we are willing to travel to and from work, and which as such defines settlement patterns. The implication is that we mainly choose to reside a certain distance from where we work so that our daily lives make sense. That approach, explains Mechlenborg, made working life central, and is what COVID-19 and the advent of working from home disrupt.

"We have primarily opted to reside a certain distance from our work. This means that work has been central, and we've drawn a radius around our work location and asked: where do we want to live? In reality, COVID-19 has shown us that we may need to invert the question, and instead draw a radius around where we want to live and then ask: where do we want to work?" says Mette Mechlenborg.

According to Mechlenborg, our homes are a key factor for public health in being directly linked to our life choices. Where should I live? How much money should I invest in a home? Whom should I live with? How should we set up home? What kind of daily life do I want? These are all questions that relate directly to key life changes and which are predicated on where we reside. In that sense, working from home has given us new scope for prioritising other life choices and confronting our compartmentalised time. And hopefully this will enable us to strike the right balance between work, recreation and rest.

Access to open spaces: During the COVID-19 pandemic, health outcomes in areas with no access to outdoor spaces, nature and recreational areas were poorer than in areas with access. Photo of playground in Høje Gladsaxe, Natalie Mossin.

Control through separation: Design that supports access control and separation of user groups were vital resources for infection control during the pandemic.
Photo of street art in Kaunas, Natalie Mossin.

Three design provisions for promoting public health in the built environment

Based on the experiences gained during the COVID-19 pandemic, we propose three architectural design provisions for promoting public health in the built environment.

These design provisions – *access, reorganisation and control* – are discussed in this section.

Three design provisions for promoting public health in the built environment

The built environment has the potential and a responsibility for providing physical settings that support public health. To realise that potential, in the built environment we must design, develop and renovate the built environment in a way that enables *access, reorganisation* and *control*, as these provisions have proven crucial for health and resilience in built environments from the pandemic perspective.

The three design provisions indicate best practices for spatial and built settings that promote public health in everyday life. These design provisions are not new, and nor are they limited to experiences from the COVID-19 pandemic. They point to beneficial qualities in the built environment in terms of resilience and public health, which we were reminded of during the pandemic, and which we will need to retain in how we build, plan and renovate going forward.

Examples	**Access to**			
	Outdoor spaces	Privacy	Community	Services
Friluftskolen	x	x	x	
Star Homes				
Aarhus River project	x	x	x	
Konditaget Lüders	x		x	x
Børnehuset Nøddehegnet		x		
Dronning Anne-Marie Centret		x	x	
Balancen senior	x	x	x	x
Siljangade 4-8		x	x	

The three design provisions can be used for posing questions (as opposed to providing answers) and bring forward new perspectives (as opposed to prescribing specific solutions) to the challenges to be addressed in a given project.

We thus propose employing the design provisions as a basis for early-stage discussion of a given building or development project as it relates to site-specific challenges.

In this chapter, we present the three design provisions, following them with eight built examples that illustrate how they could be applied.

	Reorganisation of			**Control through**		
	Functions	Distribution	Indoor to outdoor	Sanitation	Indoor climate	Separation
	x		x		x	
				x	x	x
		x		x		x
	x			x		x
	x	x	x			x
			x		x	
	x					

Access

Through the built environment, we can ensure that citizens have access to resources, and providing this access can contribute to public health.

Access is also a determinant of 'citizens' assertion of rights; people may have the right to use a resource such as a room, an amenity or a facility, but the means of exercising those rights (making use of the resource) depends on having access.

In the following, we describe four key resources that promote health and resilience when citizens have access to them:

Outdoor spaces
Privacy
Community
Services

Outdoor spaces

We can design our buildings and built environments so that they give users access to outdoor spaces. During the COVID-19 pandemic, areas offering no access to outdoor spaces, nature and recreational areas had poorer outcomes than areas with such access. Access to outdoor spaces, nature and recreational areas is associated with building density in neighbourhoods and urban districts, where rural environs generally offer better access while high-density urban districts typically provide more limited access. However, access depends on far more than density. Urban planning, infrastructure and safety in public spaces are all factors that impact access to outdoor spaces.

Access to outdoor spaces can be ensured by, for example, creating flexible outdoor-indoor transitional spaces that are adaptable for those who use them, such as gardens, balconies and conservatories. Another option is to create private outdoor areas adjoining communal assembly areas as a means of ensuring differentiated access to both outdoor spaces and social interaction.

In housing developments and urban planning, access to open spaces can be achieved by establishing or developing public spaces serving adjacent premises.

Access to outdoor spaces can also be provided by facilitating a connection between users and a local public resource, which already exists, but where access is limited. This can be achieved by, for instance, establishing a new crossing over a main road, a new pavement, a new bicycle lane, ramps or by facilitating access through an area with no or limited right of way or passage.

There are also good examples of public outdoor spaces being established by providing access to a resource that would otherwise be private. This might be a school playground to which public access is granted out-of-hours or a privately owned building that designates grounds specifically for public use.

Design provisions for access to outdoor spaces are illustrated by the following cases: *Friluftsskolen, the Aarhus River project, Konditaget Lüders* and *Balancen.*

Privacy

We can design buildings and built environments so that they give users access to privacy. When the policies during the pandemic instructed people to work or study at home, the divide between our public and private life became blurred. Far from all families were able to adapt their homes to the new needs, which in some cases meant that activities requiring privacy could not happen. Similarly, the privacy of public spaces was also lost for many. For example, a group of teenagers used to hanging out in a park or on the street to get away from the eyes and ears of parents could no longer get together in this way during lockdowns.

Access to privacy through planning and building design can be provided through spatial organisation that integrates pockets or niches. The same applies to public spaces containing niches which can afford users a level of privacy.

Access to privacy can also be facilitated by designing flexible and dynamic solutions that can generate different spatial layouts depending on user needs. Housing units where occupants can opt in or out of contact with communal areas and services also increase access to privacy.

Design provisions for access to privacy are exemplified by the following projects: *Friluftsskolen, the Aarhus River project, Børnehuset Nøddehegnet, Dronning Anne-Marie Centret, Balancen* and *Siljangade 4-8.*

Community

We can design buildings and built environments so that they give users access to community and social infrastructure. Our social life and interactions are affected by the built environment just like our physical lives. During the lockdowns in Denmark, the inaccessibility of many formal and informal meeting places and communal spaces impacted well-being and eroded social support systems. This revealed a need to reassess the layers needed for facilitating social infrastructure in response to changing conditions.

Access to community can be supported by redesigning or reimagining public spaces in urban contexts so that they accommodate social and recreational functions. This could include reinventing how we meet, and what we meet for, creating new types of public meeting spaces both indoors and outdoors to meet changed needs.

An important foundation for facilitating access to community is to incorporate universal design so that users living with disabilities can participate and contribute to their community on an equal terms.

Finally, it is crucial that the design and development of housing and residential areas support community-building and a resilient social infrastructure. This can be achieved by, for example, prioritising communal spaces and areas and by involving residents in programming which spaces are designed for communal use and which are private.

The projects *Friluftsskolen, the Aarhus River project, Konditaget Lüders, Dronning Anne-Marie Centret, Balancen* and *Siljangade 4-8* exemplify access to community.

Services

During the COVID-19 pandemic, citizens experienced unequal access to essential services, including access to COVID-testing and healthcare, groceries and services, outdoor spaces and the internet. Lack of access to private and public services and basic infrastructure such as water and sanitation affects both physical and mental health.

Access can be secured by integrating service infrastructure into the design of buildings and urban spaces and by creating hotspots for public services such as public libraries, which besides lending books also give users free access to amenities such as the internet, toilets, electricity and heated spaces.

Konditaget Lüders and *Balancen* exemplify solutions to providing access to services.

Reorganisation

How we build and plan is a crucial factor for whether and to what extent reorganisation is feasible. Facilitating reorganisation options is a good investment in spatial or building adaptability over time, but becomes particularly important when the aim is to build resilience and a capacity to respond to public health challenges. The flexibility of reorganisation depends on how rigidly a project is tailored to its current functions. We can design buildings and built environments so that they can be reorganised in response to changing circumstances, but this requires prioritisation in the design phase. For society to function, we need access to a wide array of rooms and facilities, including healthcare and other services provided by public-sector facilities and authorities as well as rooms for sleeping, eating and working. During the Danish lockdowns, many public and private spaces could not be reorganised to enable their continued use. This points to the development of new design solutions and a new approach to spatial infrastructure.

Below, we outline three key focus areas in design to facilitate reorganisation:

Functions
Distribution
Indoors to outdoors

Functions

The way we design for function determines how those functions can continue if the conditions for, or the circumstances surrounding, those functions change. If our spaces are ultra-optimised to serve the use we know today, they may well prove incapable of serving the needs we have tomorrow. Functionality, devices, know-how, furnishings, etc. evolve continually, and our physical surroundings consequently need to provide sufficient flexibility to enable a reorganisation of functions in a space or reconfiguration of that space for other functions. The need to reorganise functions became urgent during the pandemic, but only few buildings had the spatial design to make reorganisation possible.

Reorganisation of functions can be facilitated by designing the load-bearing structures in buildings so that the size of and connections between interior spaces are adjustable over time. It is also crucial to dimension individual interiors to make them usable for more than their current function. This might, for instance, involve determining interior dimensions so that they are not only compatible with a single device currently in use, but designed to be capable of serving more purposes.

Examples of projects enabling the reorganisation of functions are *Friluftsskolen, Børnehuset Nøddehegnet, Dronning Anne-Marie Centret* and *Siljangade 4-8.*

Distribution

The distribution of interior spaces, stairwells, entrances and corridors determines future options for reorganising access to a building or neighbourhood. Open-plan offices, covered atriums and large common rooms have been a popular organisational model in recent years, but the pandemic demonstrated that these large, open-plan spatial solutions are vulnerable in terms of altered distribution. They are difficult to reorganise and often lack the secondary infrastructure, informal infrastructure or adjacent connecting spaces like passageways and corridors that facilitate redistribution or reprogramming of building or interior space access and use.

The reorganisation of distribution can be supported by designing flows to enable multiple uses. A simple strategy employed in both buildings and public spaces during the pandemic was to control movement, making it 'one-way' instead of permitting bidirectional movement. This is only possible, however, if the building or the space can accommodate a 'loop' serving the required spaces.

It is also crucial to prioritise scope for distribution by supplying secondary spaces and connecting spaces and to design for relocation of facilities from a centralised to a decentralised siting.

The Aarhus River project and *Dronning Anne-Marie Centret* are two examples of different scale that facilitate the reorganisation of distribution.

Inside to outside

Reorganising what takes place indoors and outdoors provides new options for programming our buildings and urban spaces. The value of providing options for this became evident during lockdowns when the relocating of functions from indoors to outdoors made it possible to maintain people's access. By, for example, relocating teaching, sports matches, social events and meetings, the scale and duration of the lockdowns could be reduced. The way we design our buildings and urban spaces can support options for moving activities out into the open. The pandemic showed us that some urban areas are difficult to reorganise, while others more easily could be adapted to new functions and uses. The architecture of a building can also be designed to enable relocation of periphery spaces from indoors to outdoors in order to meet changing uses or seasons.

The options for reorganising the divide between the indoors and outdoors can be supported by new typologies, by designing spaces that can switch siting between outdoors and indoors and by incorporating intermediate climatic zones such as unheated greenhouses or outhouses. This strategy has a historical tradition in granaries, sheds and garages.

Examples of design provisions enabling interior to exterior reorganisation include *Friluftsskolen, Dronning Anne-Marie Centret* and *Balancen.*

Control

The built environment can enable or limit both individual building owner's and the authorities' access to control infection and virus transmission or enforce restrictions on movement.

Below, we outline three key tools for enabling control related to public health threats in the built environment:

Sanitation
Indoor climate
Separation

Sanitation

Adequate sanitation systems and a fine-meshed infrastructure of washbasins, toilets and bathrooms are key to public health. This was demonstrated during the COVID-19 pandemic when it was demonstrated that there was a link between the number of bathrooms per occupant and the infection rate. Actions in the built environment during the pandemic included the installation and re-installation of washbasins in public and communal facilities.

In order to promote public health by means of sanitation it is crucial to prevent sewage and wastewater from coming into contact with or overflowing into water bodies, but it is also critical to ensure that the public have access to toilet facilities that can be kept clean. This entails providing payment-free access to hand-washing, e.g. by installing washbasins in public spaces and washrooms in, e.g. schools, transportation terminals and healthcare facilities.

The three examples of *Star Homes, the Aarhus River project* and *Børnehuset Nøddehegnet* illustrate sanitation control as a key component in building design and urban development.

Indoor climate

The ability to control air quality and to separate ventilation systems played an important role during the pandemic. In the Danish context we were greatly aided by national legislation prohibiting air drawn into a ventilation system in one room from being recirculated in another. The control this provided in the Danish building context illustrates the value of designing for indoor climate control at room level. However, the indoor climate factors that impact public health go beyond air quality and include temperature, humidity as well as airborne pollutants from building materials and interiors.

Public health as it relates to indoor climate can generally be assisted through design that enables users to influence and adjust their spatial comfort. This includes designs that increase air flow and remove airborne pollutants such as cooking fumes from indoor spaces. It is also imperative that building industy professionals make well-informed and healthy materials choices.

Design approaches to indoor climate control are exemplified by the projects *Friluftsskolen, Star Homes* and *Balancen.*

Separation

Access control and strictly inforced distribution of user groups proved vital for infection control during the pandemic. How we design for separation can support or limit our well-being in the built environment. Temporary measures such as safety checks and COVID-testing or queue markings in supermarkets and school playgrounds were widely used in Denmark, but built structures and urban spaces can also be designed to support separation depending on the situation.

The separation of user groups is typically established by designing checkpoints for controlling who and how many pass in or out of an area or building. This strategy is often used in airports, government buildings, museums and even in certain retail establishments. However, the checkpoints tend to become bottlenecks and need to be manned. Building layout and design can facilitate separation while maintaining safe flow and reducing the need for supervision.

Options for separation can also be provided by organising an amenity or a facility into small units, and finally, buildings and urban spaces can be designed to enable flow separation.

Control options by means of separation are part of the design in the examples of *Star Homes, the Aarhus River project, Børnehuset Nøddehegnet* and *Dronning Anne-Marie Centret.*

Reorganisation of functions: The need to reorganise functions became urgent during the pandemic, but only few buildings had the spatial design to make that possible. Photo of ESB Headquarters, Dublin, Natalie Mossin

The design provisions exemplified in realised architecture and planning

In this section, we explore eight examples illustrating, in each their own way, how the three design provisions described in the previous section can be brought into play.

These examples were selected because they embody architectural approaches and layouts demonstrating how the design provisions can be elaborated and implemented in the built environment.

The first two examples, Friluftsskolen and Star Homes, illustrate how the design provisions are realised in architecture created to promote user health. The next two examples, the Aarhus River project and Konditaget Lüders rooftop amenity, exemplify how the design provisions can be brought into play in an urban context. In the next examples, Børnehuset Nøddehegnet and Dronning Anne-Marie Centret, the design provisions are explored in a childcare and eldercare context, and in the last two examples, Balancen and Siljangade 4-8, novel housing concepts show how the design provisions can be brought into play.

FACTS

Location: Copenhagen

Type: Institutional

Scale: Building

Built/converted: 1938 , 2019-2021

Contributors: Kaj Gottlob | Nøhr & Sigsgaard architects; City of Copenhagen contracting authority, NIRAS consulting engineers; Thing Brandt Landskab landscape architects; Caroline Krag, conservator, Københavns konservator; Varmings Tegnestue architectural restoration consultancy.[111]

Friluftskolen

Friluftsskolen in Copenhagen was built in 1938 as a school for children afflicted by tuberculosis, a communicable disease posing one of the greatest threats to public health in that era.[112] For this reason, the school, then known as 'Svagbørnsskolen' [school for sickly children], was radically different from conventional schools at that time, which were typically laid out in long corridors and uniform classrooms.

The architect Kaj Gottlob wanted to link the latest health and educational science with state-of-the-art architectural materials and style to prove that the right surroundings would help the afflicted children from urban working class families.

The architecture was innovative: expansive façades to let in daylight and fresh air, novel use of colour and colour schemes, large open-plan interiors and incorporating room and space for rest, treatment and nursing. Today, the school has been renovated and updated to serve as a school for children with mobility impairments, and the above-stated architectural provisions to improve child health, have now been updated to meet the needs of a new era.

Design provisions

Access to outdoor spaces
All interiors provide access to outdoor spaces, enabling close proximity to nature and a healthier indoor climate.

Access to community and privacy
Universally designed solutions such as stepless, flexible room partitions and access routes ensure that everyone has equal access to community interaction regardless of ability or disability.

Reorganisation of functions
In connection with renovation of the school, the layout of rooms was reorganised in line with contemporary educational requirements.

Reorganisation from inside to outside
The close visual and physical connectedness between the school's indoor and outdoor spaces permits teaching and activities to switch between indoor and outdoor settings.

Control through indoor climate
The school's original design prioritised autonomy in terms of indoor climate, daylight and fresh air enabling patients, pupils and staff at the time to open, shut and screen and unscreen windows. This principle prevails today.

Stepless, accessible common room in Friluftskolen open-air school, Copenhagen. Photo: Laura Stamer.

Fresh air and daylight as building materials

For many public care facilities and schools, the COVID-19 pandemic entailed increased use of outdoor areas, partly to reduce the risk of virus transmission and partly to gain more space. This meant that the requirements for outdoor areas changed in line with how they were to be used.

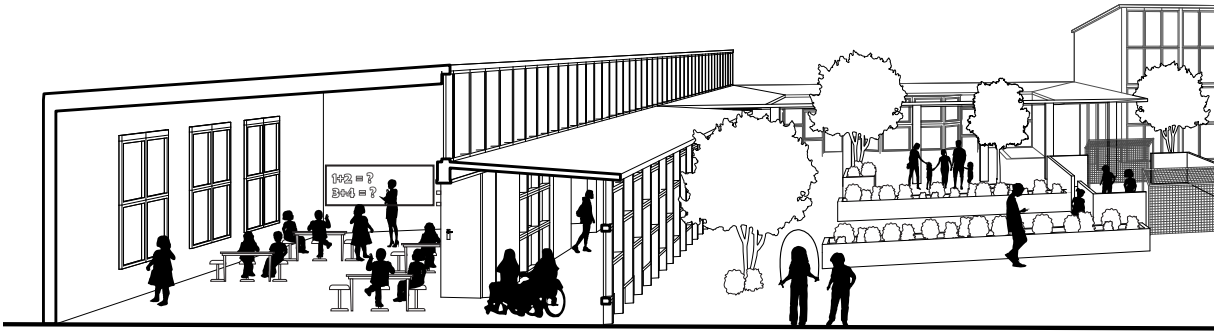
The name Friluftskolen translates as 'the open air school', and the original idea was to achieve a close connection between the outdoors and the indoors because fresh air and daylight were good for the indoor climate and healing for the children. This is why the school's outdoor areas are as accessible to the children as the indoor areas, and why spaces can be organised within the outdoor spaces in the same way as for the indoor spaces.

During the pandemic it became clear that single-storey schools organised as pavilions with 'garden doors' from the classrooms were more adaptable because such doors could be used as entrances to each individual classroom, and reduce the risk of disease transmission. For this reason, several schools, and also integrated care and educational facilities, were 'turned inside out,'[113] in the sense that access went from being centralised to being decentralised. The advantages of this form of layout is also exemplified by Børnehuset Nøddehegnet childcare centre presented on pages 124-128 of this publication.[114]

The close connections between indoors and outdoors and the ease of access are also an advantage in the absence of a public health crisis. It is well-documented that regular contact with nature is beneficial for children's mental and physical health.[115]

Inside-out rather than outside-in

Originally, the school was designed with a clear separation and grouping of functions around a large gardened central courtyard. It consists of a



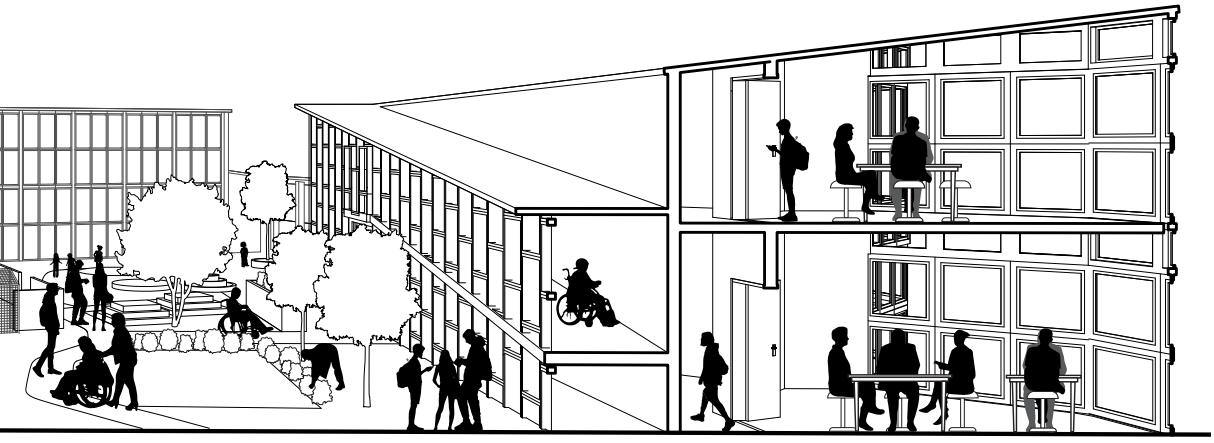
south wing with six pavilion-style classrooms, a north wing with rooms for healthcare and hygiene and a building for physical exercise. The seamless transitions between indoor and outdoor spaces ensure the diffusion and circulation of daylight and fresh air, and thus hold a number of health and learning benefits. However, during a pandemic, the distribution of multiple entrances and exits also facilitates infection control.

This way of organising a building with a view to daylight, fresh air, indoor climate and flexibility originated in the pavilion hospitals of the late 1800s,[116] but was subsequently forgotten under the influence of an (overly optimistic) faith in clinical medical care regardless of the architectural setting. Other factors included cost and the need to achieve economies of scale in healthcare buildings. There are, however, some examples of a revival of the pavilion principles in hospital buildings in the form of Mary Elizabeths Hospital in Copenhagen, where the cluster structure is incorporated in a multi-storey building.[117]

Open-air movement alters architecture

Traditionally, buildings are seen as protection against external elements, but in Friluftskolen, being 'out in the open' means more than just moving a number of indoor activities outdoors.

The open-air movement denotes a design principle centred around the body-environment interaction, of indoors and outdoors being mutually dependent resources for physical and social care.



The concept went beyond the purely physical surroundings. In the early 20th century, when tuberculosis was claiming the lives of one in seven people in Europe and the USA new 'open air schools' arose in Germany initially followed by a number of other countries. Friluftsskolen in Copenhagen is a pioneering Danish example of educational architecture evolving in response to public health requirements.[118]

New users, same approach

The renovation/restoration of the school, partly carried out during lockdowns between 2019 and 2021, received a Europa Nostra award for cultural heritage conservation in 2023. The jury verdict stated that the restoration work demonstrated how reinstatement of the main principles of the open air movement 'can serve as a model for other schools in Europe, especially in a post-COVID era'.[119]

The restoration project's focus and aim was to upgrade the school for its new user group: children with mobility impairments. This was achieved by implementing universal design: improved accessibility generally, ensuring stepless access between the various indoor and outdoor spaces and creating equal access to all storeys and rooms.

Moreover, the restoration/renovation project preserved the original architectural concepts that continue to provide children with sound conditions for well-being, fresh air, daylight, good acoustics, and a calm and consistent colour scheme. The original design was innovative for its time in its use of large, tall window arrays to let daylight and fresh air into the school and define the interiors. In this way, the architects leveraged the antimicrobial properties of daylight and fresh air and natural ventilation, which had proved instrumental in past efforts to combat tuberculosis, and which now, more than half a century later, proved beneficial in combating a respiratory disease like COVID-19.

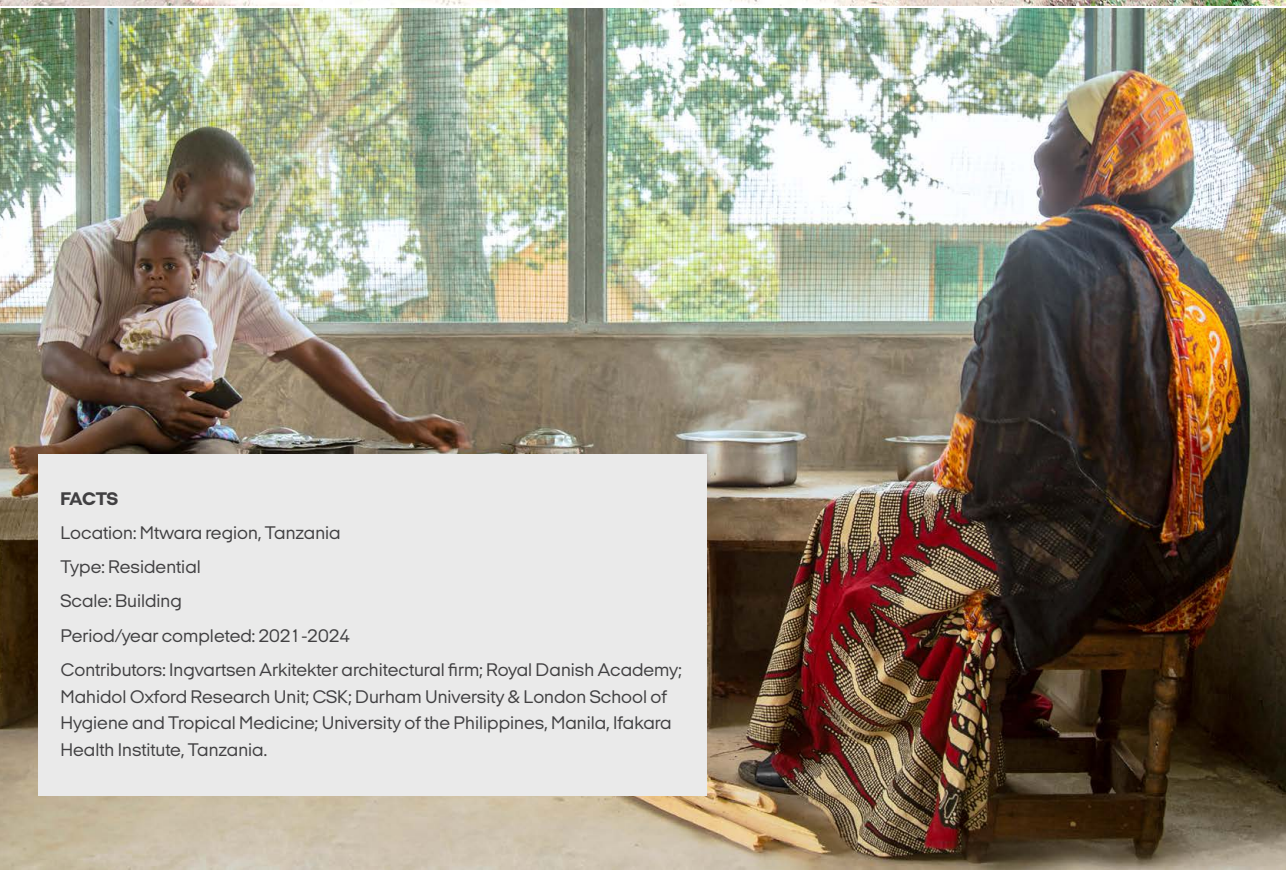
The old alliance between healthcare and architecture

When we address the relationship between architecture and public health in the light of the COVID-19 pandemic, it makes sense to look back at a project such as Friluftsskolen and its era.

This was conceived during the onslaught of the tuberculosis epidemic that forced a strong, interdisciplinary alliance between architects, doctors and educators. Although the architect, Kaj Gottlob, is credited with designing this school building, its innovative architecture is just as much an expression of his era's state-of-the-art insights into health, learning, well-being and educational principles.

Looking at Friluftsskolen from the perspective of the interdisciplinary alliance, we stand to learn not only about effective architectural design concepts enabling child health and well-being, but also about the value of interdisciplinarity. The interfaces between education, treatment and design generate fresh discourse on spaces that give children the best conditions in which to thrive, and which can be adapted to current health requirements and enable preparedness for future emergencies.

Children resting on daybeds in Friluftsskolens' 'recumbent hall'. This clearly shows the outdoors-in effect of opening the large windows and letting in fresh air.
Photo: Copenhagen Public Libraries



FACTS

Location: Mtwara region, Tanzania

Type: Residential

Scale: Building

Period/year completed: 2021-2024

Contributors: Ingvartsen Arkitekter architectural firm; Royal Danish Academy; Mahidol Oxford Research Unit; CSK; Durham University & London School of Hygiene and Tropical Medicine; University of the Philippines, Manila, Ifakara Health Institute, Tanzania.

Star Homes

The Star Homes project is a housing development project in the rural Mtwara region in Tanzania where 110 housing units form a research and demonstration project that has been under development for more than a decade. The primary objective of the project is to develop housing specifically designed to reduce malaria transmission by mosquitoes, but the homes are also aimed at reducing respiratory infections and diarrhoea, two of the deadliest diseases in Sub-Saharan Africa.[120]

From a post-pandemic perspective, this project is interesting to look at because it demonstrates the positive impact architecture can have on general health, and how the concept of *Stealth*[121] represents a flexible, adaptable architecture can be realised in a built example. In the Star Homes project, architectural solutions and design provisions are used to prevent people coming into contact with health hazards like mosquitoes, fumes and wastewater.

Design provisions

Control through sanitation
Toilet facilities that can be cleaned and maintained by the occupants limit transmission of infectious diseases.

Control through indoor climate
The permeable material covering the external walls increases air flow and draws pollutants such as cooking fumes out of the interiors.

Control through separation
Bedrooms are placed on the top floor to separate the occupants from the mosquitoes, as the bedrooms are above mosquito flying height.

Top: Star Homes unit in Mtwara, Tanzania. The entrance to a unit in which the bedrooms are on the top floor, raised above mosquito flying height and with external walls in mosquito net textile panels. Photo: Ingvartsen Arkitekter.

Bottom: The kitchen in a Star Homes unit. The smokeless stove improves the indoor climate, and the surfaces are smooth and easy to clean. Photo: Ingvartsen Arkitekter.

The alliance between architecture and health science is clearly apparent in the Star Homes project, which may be due to the fact that the two disciplines and their mutual relationship have been continually explored and advanced in regions across the African continent on account of the pervasiveness of infectious diseases, far more so than in the global north, where the link between architecture and health science was difficult to spot until the COVID-19 pandemic reminded us of it.

The Star Homes project also embodies and demonstrates how interdisciplinarity in a team of architects, medical experts and entomologists working with local community leaders and stakeholders can secure the requisite means for literally 'building away' infectious diseases.

The project comprises 110 identical single-family housing units spread across 55 villages in Mtwara, a region known for its high incidence of the above-named diseases, which account for the high mortality rate among children and vulnerable adults. The buildings serve as family homes, but also form the basis for a clinical trial that will be gathering robust data on the impact of higher-grade, healthier housing on family health.

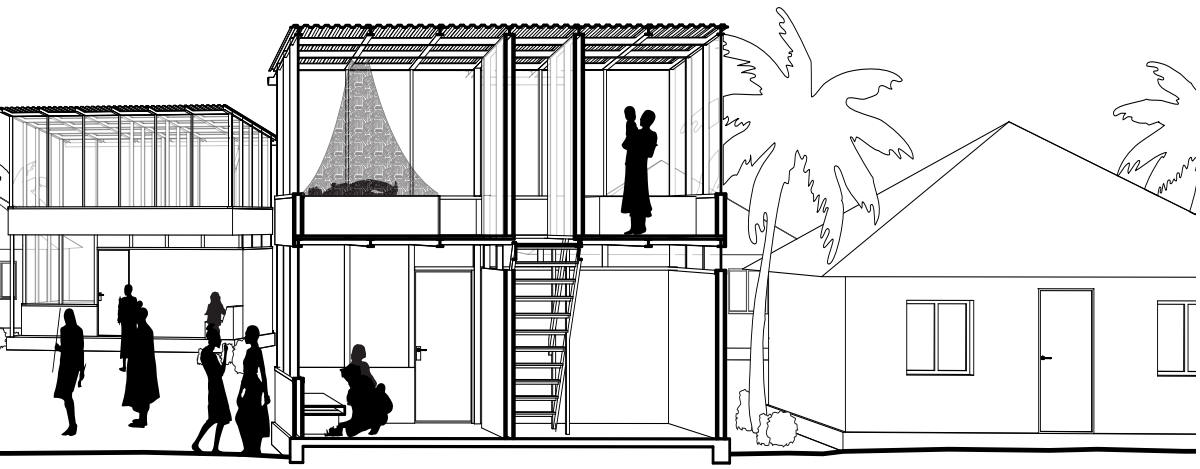
Housing for occupant protection

Traditional houses in rural Tanzania typically struggle with extreme heat, disease-carrying mosquitoes, poor indoor air quality and unsanitary surfaces, which are contributory causes of three of the most common diseases in this sub-Saharan country: malaria, respiratory tract disease and diarrhoeal disease. These are the health threats the Star Homes project is seeking to protect occupants against.[122]

The homes are light constructions inspired by building traditions from the Philippines, with fine-meshed netting covering the façade to permit air flow, which benefits the indoor climate while keeping out the mosquitoes. Furthermore, when the house is raised a level and the sleeping area is placed on the top floor, the mosquitoes are less likely to find their way into the bedrooms at night.

However, even if they do, the natural ventilation also helps to keep them at bay. Mosquitoes are attracted to the carbon dioxide emitted by humans, and also by cooking odours, but if the volume of carbon dioxide is dispersed by means of ventilation, the mosquitoes are unable to detect their target hosts.[123]

In this way, the netting material both promotes thermal comfort and addresses general health concerns by facilitating a healthier indoor climate and repelling mosquitoes. The natural air flow not only combats malaria but also the respiratory diseases caused largely by indoor cooking over an open fire and which to a great extent account



for the high mortality rate in the region. This is why the houses have a chimney to draw smoke and fumes out of the kitchen.

The Star Homes project is also improving sanitation and water supply by providing latrines and rainwater collection systems. Any project to improve sanitation in the built environment requires sufficient volumes of water. By utilising the large roof surface as part of a rainwater collection system, each housing unit is made self-sufficient in water for sanitation, which improves the capacity to maintain a good standard of hygiene and thereby reduce the risk of diarrhoeal disease.

Focusing on local sustainability

The homes are constructed from locally sourced materials and minimise the use of concrete, both of which factors reduce transport emissions while boosting the local economy. Naturally adapted to the local climate, these local materials enhance the home's durability and liveability. Innovative construction methods, like hollow walls with cement render on wire mesh, have reduced concrete use by 70%, lowering the homes' embodied energy and boosting sustainability.

Simple but innovative design

The Star Homes project exemplifies a transformative approach to housing, where the structures go beyond providing shelter to become active agents in health promotion. The integration of relatively simple elements like surfaces that are easy to clean, non-fuming stoves and mosquito netting not only tackles immediate health threats, but also fosters a healthier living environment with cleaner air and water.

This innovative approach in a rural African context can serve as inspiration for ideas about how similar principles could be adapted to other regions, and for how housing design generally can promote health, resilience and quality of life.

Although Tanzania is far from northern Europe, the simple design strategies realised in the Star Homes project could potentially be applied in other contexts where the materials, technology and economy differ. In the context of COVID-19, where the importance of high standards of hygiene, a healthy indoor climate and fresh air [once again] became imperative, the Star Homes project serves to highlight how residential architecture can foster a healthier, more resilient environment responding to multiple concerns at once.

FACTS

Location: Aarhus

Type: Infrastructural and urban planning

Scale: Urban

Period: 2005-2014

Contributors: Centre for Urban Design, Technical and Environmental Administration, City of Aarhus; Aarhus Vand (utility company); City of Aarhus;[124] and a large number of construction consultants and service providers.

Aarhus River project

The Aarhus River project is a large-scale, multifaceted urban development and water management project in Aarhus, Denmark's second-largest city. In this project, overflow of polluted water into the river and port was remedied, heavy traffic was redirected out of the city centre, the city's original river course was re-exposed and recreational areas were established along the riverbanks. At the same time, the river regained its original function in the landscape.

The river in Aarhus was always there, and the city was planned around this waterway and its estuary where the river flows into the bay, the site of the original harbour. In the 1920s, the decision was made to culvert the river to make way for a trunk road through the city to the dockside industries. Following the international trend, similar interventions were implemented in other Danish cities such as in Copenhagen, where Ladegårdsåen remains buried beneath the major trunk road of Åboulevard.

The culverting of urban waterways was carried out partly as a measure to combat outbreaks of communicable disease where the need arose to parcel out, channel and direct wastewater away

Top: Aarhus River by Mølleparken, Aarhus city centre. A social and recreational space by the riverbank connecting the city with scenic features. Photo: Kim Bruhn.

Design provisions

Access to outdoor spaces and community
The deculverted river and the adjacent urban spaces provide recreational amenities and meeting places for the entire cityscape.

Access to privacy
Zones and pockets along the river serve diverse user groups.

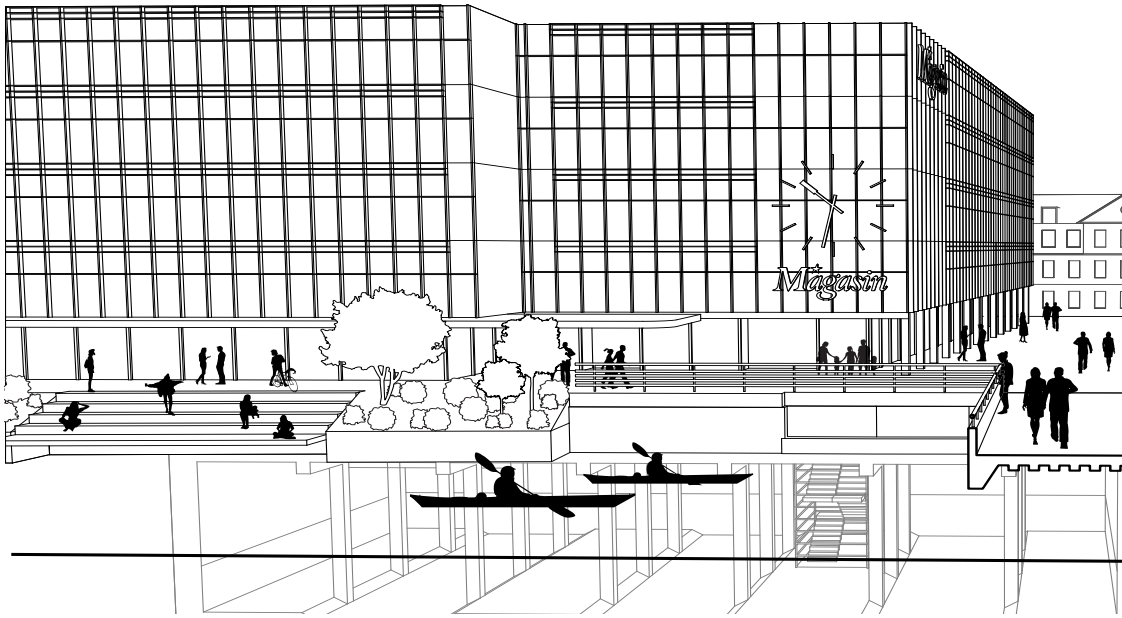
Reorganisation of distribution
The many access routes and zones facilitate distribution of areas, and diverse access and utilisation to meet different needs.

Control of sanitation and seperation
Improved sewer resilience to extreme precipitation prevents overflow and mixing of river water with wastewater.

from residents, and in an era struggling with frequent sewage overflow into lakes, rivers and harbours. However, the separation of watercourse and city adversely impacted urban naturescapes, and thereby also citizens' connectedness to and awareness of natural assets and landscape features.

In 1989, Aarhus City Council decided to deculvert the river in stages by a process that was completed by 2014. The aim was to create urban coherence by establishing a large urban recreational space connecting the city from west to east and contributing public amenity value in the built-up city.

The COVID-19 pandemic spurred reassessment of a number of elements in relation to urban density including proximity, connectedness, distribution of services and access to open spaces. Based on the knowledge that high-density urban centres generally fared better than suburban peripheries, theories and ideas emerged about the benefits of more resilient urban distribution.[125]



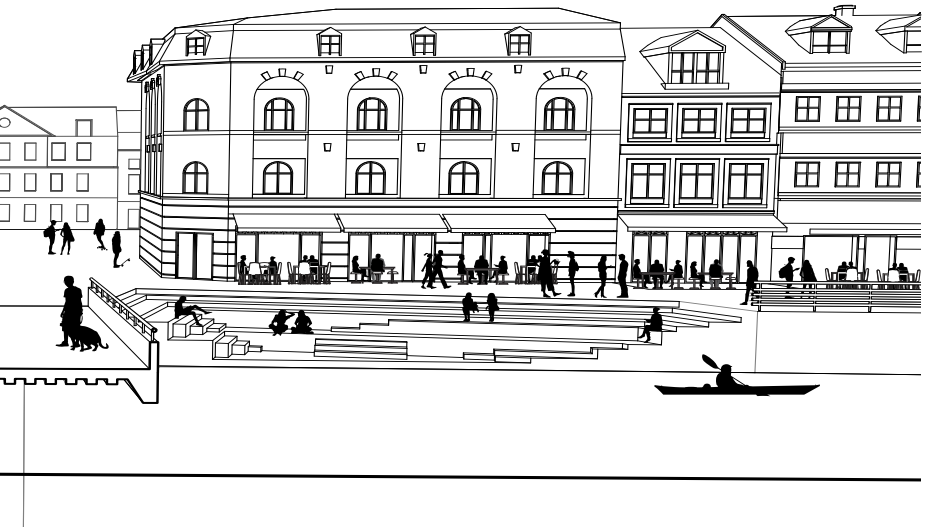
The 15-minute city: polycentric urban design

The basic principle underlying the concept of the 15-minute city is to remodel the structure of a city by splitting it up into districts.[126] This is also known as a *polycentric* city. Based on this logic, it is easy to see why the concept gained traction during the lockdowns when people the world over became subject to movement restrictions. The potential of the 15-minute city focus on local living in the form of reduced commuting time, and hence reduced infection risk was colossal.

The potentials of a more localised community-based distribution as proposed in the 15-minute city enable greater self-organisation with access to outdoor spaces and social meeting places within walking distance of home and other key amenities.

From one crisis to the next

One of the main objectives of daylighting the river was climate adaptation of the city centre for management of increased precipitation and flooding caused by climate change. However, exposing the river also served as an opportunity



for reintegrating blue and green infrastructure in the built environment. The result was improved water quality and flood prevention integrated in an expansive recreational commons in the heart of a high-density city.

The layout of the diverse public spaces along the river, including plazas and promenades, was designed to boost social interaction and an active lifestyle by encouraging walking and cycling. In addition, these adaptable, multipurpose areas contribute to social cohesion and mental well-being by enabling recreational activities. This proved very valuable during the COVID-19 crisis in that the blue and green infrastructures served as 'infection-safe' zones for leisure activities, routes to shopping amenities and venues for local interaction.[127]

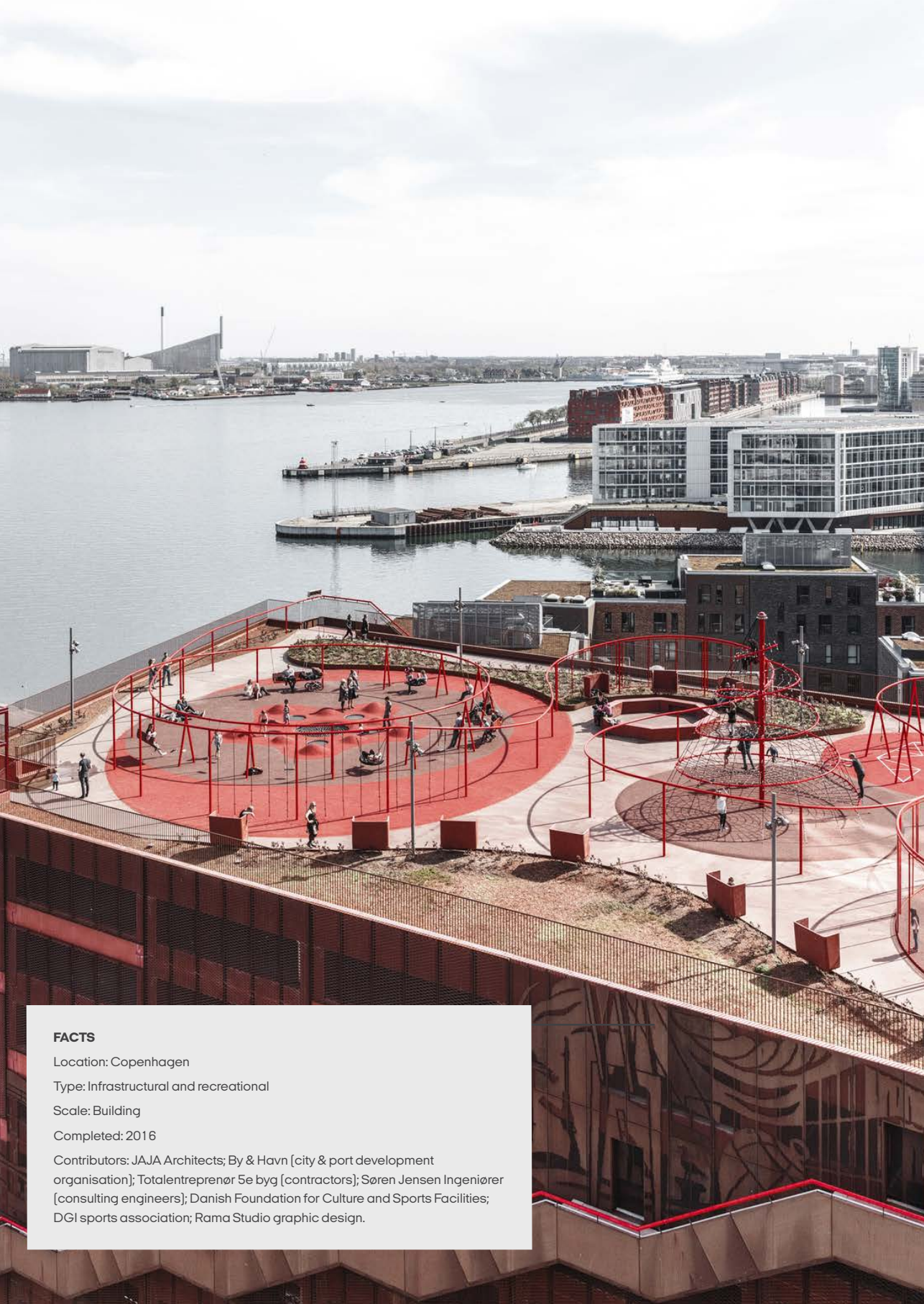
Public-private communal spaces

The pandemic revealed that the spatial assets of modern cities are the communal spaces that are neither strictly public nor strictly private but rather both at the same time. These are the public spaces used for private activities, or the private spaces that permit communal use, and everything in between. Several projects described in this book such as Konditaget Lüders and Balancen senior co-living illustrate the importance of this perspective.

The Aarhus River project thus forms part of a wider trend in addressing and experimenting with the relationship between the natural versus the man-made environment and the public versus private domains by partially dissolving these divides.

The ambitious, large-scale Aarhus River project was realised by many partners over a long period of time and with major investments in urban water management. This makes the project difficult to compare or use as a direct reference case, but the strategy of (re)using natural features and the landscape to overcome multiple challenges at once will hopefully be a source of inspiration.

The project of deculverting the river boosts the city's resilience in several domains: climate adaptation is strengthened in that the river also serves as a large rainwater reservoir; mental and physical health are boosted by improved recreational facilities and pedestrianisation; and the improved water quality serves to future-proof the city's aquatic and other natural resources.



FACTS

Location: Copenhagen

Type: Infrastructural and recreational

Scale: Building

Completed: 2016

Contributors: JAJA Architects; By & Havn [city & port development organisation]; Totalentreprenør 5e byg [contractors]; Søren Jensen Ingeniører [consulting engineers]; Danish Foundation for Culture and Sports Facilities; DGI sports association; Rama Studio graphic design.

Konditaget Lüders

Konditaget Lüders or 'Park 'n' Play' is an urban public space established on the roof of a multi-storey carpark in the newly developed Nordhavn district in Copenhagen. Designed for recreation and physical activity, this space features plantings, benches and a range of gym and sports equipment. The rooftop is accessed by a staircase on the exterior of the building and a lift.

Informed by an urban design philosophy similar to that of the Aarhus River project [see pp. 112-117] in which grey infrastructure is transformed into or integrated with recreational spaces in the high-density city. During the COVID-19 pandemic, residents of the Nordhavn district in Copenhagen and in similar built-up urban districts were confronted by the shortage of urban spaces and public open-air meeting places. The shortage became obvious because many of the privately operated meeting places that otherwise account for a significant share of social infrastructure had closed.[128] Konditaget Lüders demonstrates how

Design provisions

Access to outdoor spaces
The siting of activity, recreational and sports areas outdoors in public urban spaces ensures wider access.

Access to community
The outdoor urban space facilitates meetings and communal activities that would not be possible indoors.

Access to services
The multi-storey carpark also houses a swap station, recycling station and toilets for users and neighbours to use free of charge.

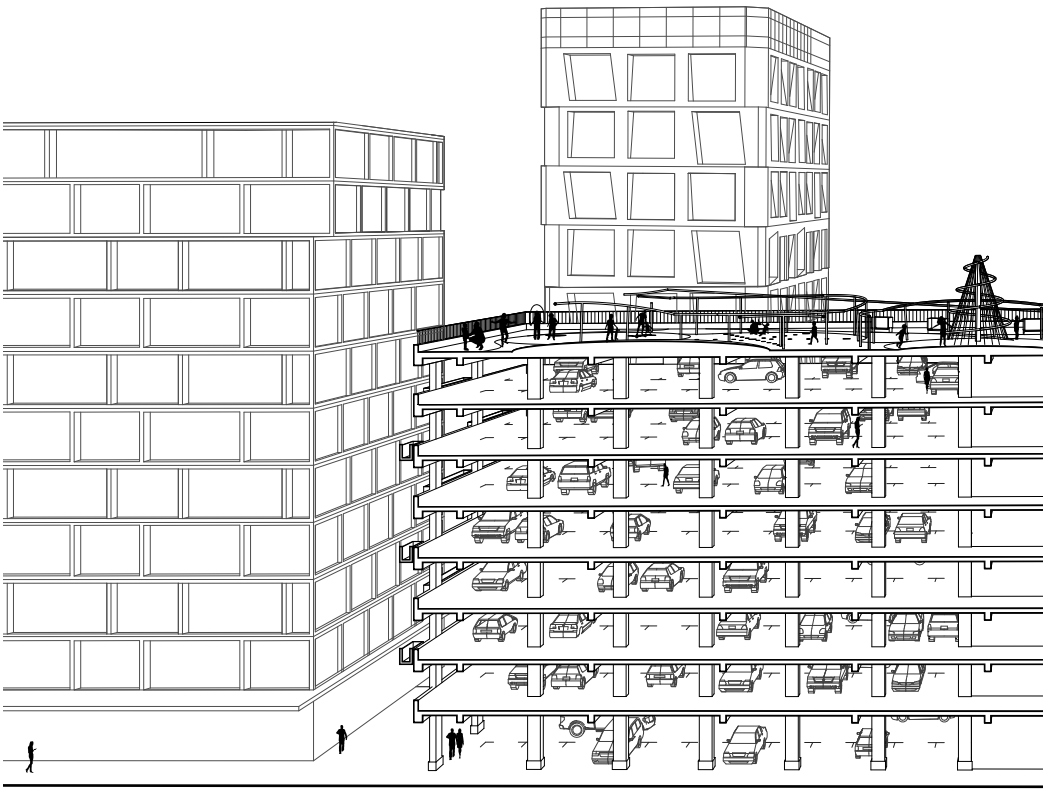
Konditaget Lüders creates a new urban space in a high-density district, where space is at a premium, by repurposing the roof of a multi-storey carpark. Photo: Rasmus Hjortshøj.

overlooked but utilisable spaces in the cities can be used to meet the need for public, open-air meeting places and thereby increase the resilience of urban areas.

The project promotes physical activity, play, sports and fitness training in an urban space atop the roof of a multi-storey carpark in a new urban district. It reimagines the conventional monofunctional parking facility into a hybrid 'Park 'n' Play' urban space, and as a neighbourhood landmark, playground, meeting place and recreational amenity. This confronts the separation of functions, infrastructure and typologies of conventional urban planning to realise more flexible, dynamic and resilient districts. While this does not necessarily make urban design and planning more straightforward given the complexity of combining multiple amenities, users and needs, when successful it boosts neighbourhood cohesion, optimises space use and allows many more people to benefit from limited urban resources.

Functional divides become dynamic

During the pandemic, social interaction and distancing became imperative parameters that were particularly difficult to comply with in a high-density city. The project demonstrates how unused spaces and surfaces in (and on) buildings can be given new functions and integrate public health, social interaction and usability in an urban



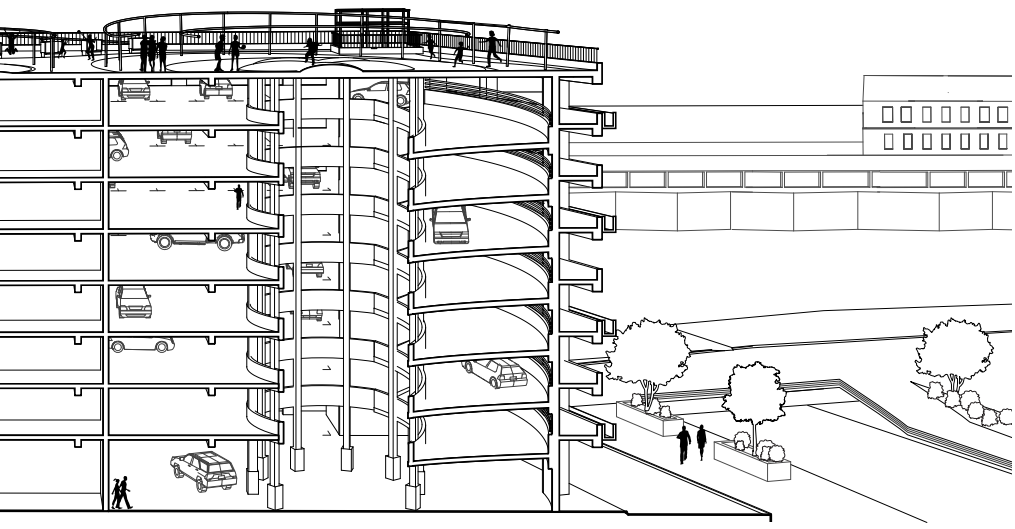
setting and with architectural design. Controlling, but not preventing social interaction and physical proximity requires space and flexibility, both of which are scarce in cities. In this way, the pandemic forced us to rethink who has access to what and where in our cities.

Konditaget Lüders could be reorganised along the lines of conventional street-level public parks and plazas, which during the COVID-19 pandemic were divided into 'private bubbles' in the same way that balconies were reformatted from private open-air spaces into public spaces as mass singalongs and other activities broke the mould and blurred the infection control barriers.

Repurposing the city

The flat roof of a multi-storey carpark towering 24 metres above ground is not normally somewhere we associate with a publicly accessible or even people-friendly space. This makes it of interest to explore the design provisions made by Konditaget Lüders, as these are also instrumental in altering neighbourhood perceptions of how the building, its spaces and surfaces can and may be used.

The building itself has a transparent, greened façade with suspended planters and reliefs giving it a transparent look, signalling that this is no conventional, off-limits carpark. The rooftop is accessed by stairs or a lift; the stairs are located on the exterior of the face to signal public access, and can also be used for stair-training workouts by runners and exercisers. The ground floor of the



building has an open swap station, where local residents can exchange household items like furniture, books, clothes, etc., making the building a venue for the whole neighbourhood, not just the fitness and training scene.

The rooftop itself is equipped with weather-resistant materials and elements for varied fitness and workout functions and to cater to as many types of exercisers as possible. The rooftop amenity also features playful, child-friendly elements like trampolines and a climbing net to encourage children in the community to play, and benches for enjoying the spectacular view or a spot of timeout.

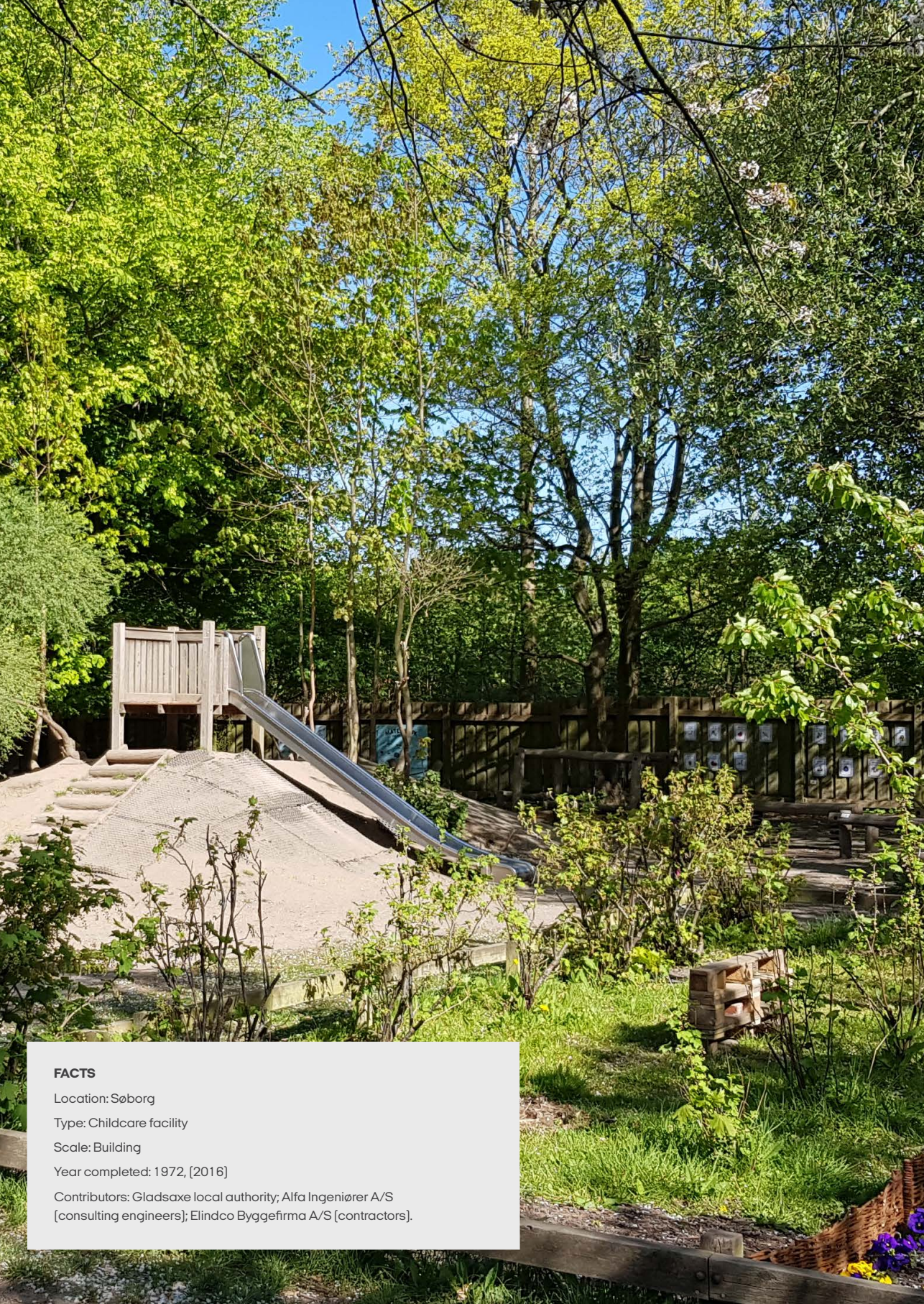
From designing buildings to designing settings

Konditaget Lüders challenges the conventional urban landscape, inspiring us to rethink how single-purpose built elements in our cities could be transformed into multipurpose spaces, retaining both their original primary function (in this case parking) while doubling as recreational, communal amenities.

The project is not a repurposing of one amenity into another, but demonstrates how facilities, users and needs can be hybridised and merged into a single design. With this design strategy, the focus shifts from designing buildings and spaces to designing and calibrating settings.

The project highlights the value of thinking more in terms of environments, contexts and user and use diversification. However, this also calls for highly methodical and collaborative innovation. For the built environment to be more cohesive, dynamic and adaptable, more building sector parties need to join forces and in new ways during the development process. This increases the complexity of urban and district development, but ultimately also resilience.

Konditaget Lüders unites multiple recreational facilities atop the multi-storey carpark, freeing up space at high-density street level.
Photo: Rasmus Hjortshøj.



FACTS

Location: Søborg

Type: Childcare facility

Scale: Building

Year completed: 1972, [2016]

Contributors: Gladsaxe local authority; Alfa Ingeniører A/S [consulting engineers]; Elindco Byggefirma A/S [contractors].

Børnehuset Nøddehegnet

Børnehuset Nøddehegnet is a combined local authority childcare facility (for ages 6 months to 6 years) in Søborg, Gladsaxe Municipality on the outskirts of Copenhagen, for approx. 100 children.[129] Built in 1972, it has been renovated several times over. It is designed as two sections: one for three groups of 3-5/6-year-old preschoolers and one for three groups of infants aged 0-3 years (Denmark provides state-guaranteed all-day childcare for infants). The two sections are linked by a daylit corridor, and the large grounds surrounding the building comprise small, more secluded spaces for the individual age groups and common areas in which all the children can interact and play.

Børnehuset Nøddehegnet, like many other public childcare facilities for preschool children in Denmark, was impacted by the Danish lockdowns during the COVID-19 pandemic. The temporary closing of the childcare facilities posed severe problems for Danish families, as the facilities are an essential service in

Design provisions

Access to privacy
Dynamic, adaptable solutions can generate more ad hoc spatial configurations to meet requirements. This enabled flexible solutions to the need for social distancing and privacy.

Reorganisation of functions
The layout of the premises made it possible to utilise different parts of the space available at different times of day.

Sanitation control
The addition of washrooms and washbasins (including outdoors) improved building resilience.

Control through separation
The layout of the premises made it possible to keep multiple small groupings separated.

During the pandemic, the grounds of Nøddehegnet were used more and differently from pre-pandemic.
Photo: Sidse Grangaard.

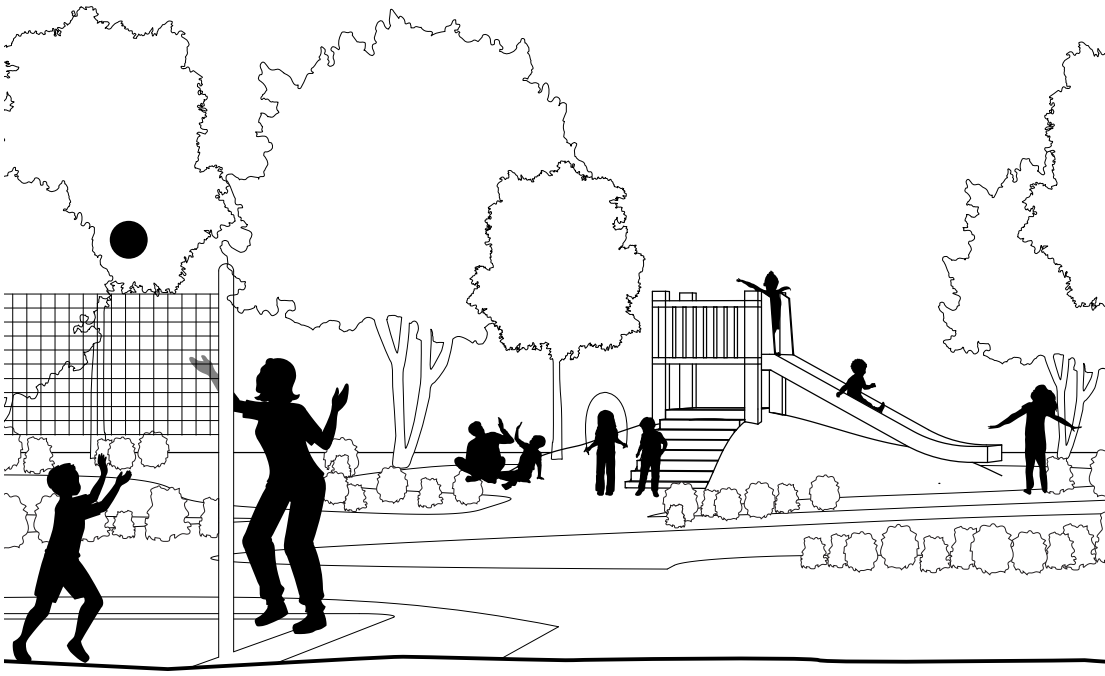
the Danish welfare model that frees parents to work and fulfil key socialisation and educational remits under Denmark's early learning policies. This particular daycare facility, however, was able to remain open for most of the lockdown period, thereby meeting an essential need for the many parents still working away from home or working at home without the option of simultaneously minding their children.

The municipal childcare facility is used daily by around 100 children attending either the nursery or preschool section. During the pandemic, the children were split up into small 'buddy bubbles' to reduce contact and maximise infection control.

'The little in the big'

Segregation into 'buddy bubbles', which ties in with *'the little in the big'*[130] concept of separate spaces and functions that can be divided into smaller units, also enabled outdoor areas to be put to alternative uses.[131] Within their buddy bubbles, the children, their parents and the staff connected with their outdoor settings in a new way. One of the most key lessons from the pandemic was that dividing the children into smaller groups centre-wide resulted in greater well-being among both children and staff.[132]

Before then, the prevailing structure in municipal childcare facilities was a number of groups around a large communal space. Experiences from the

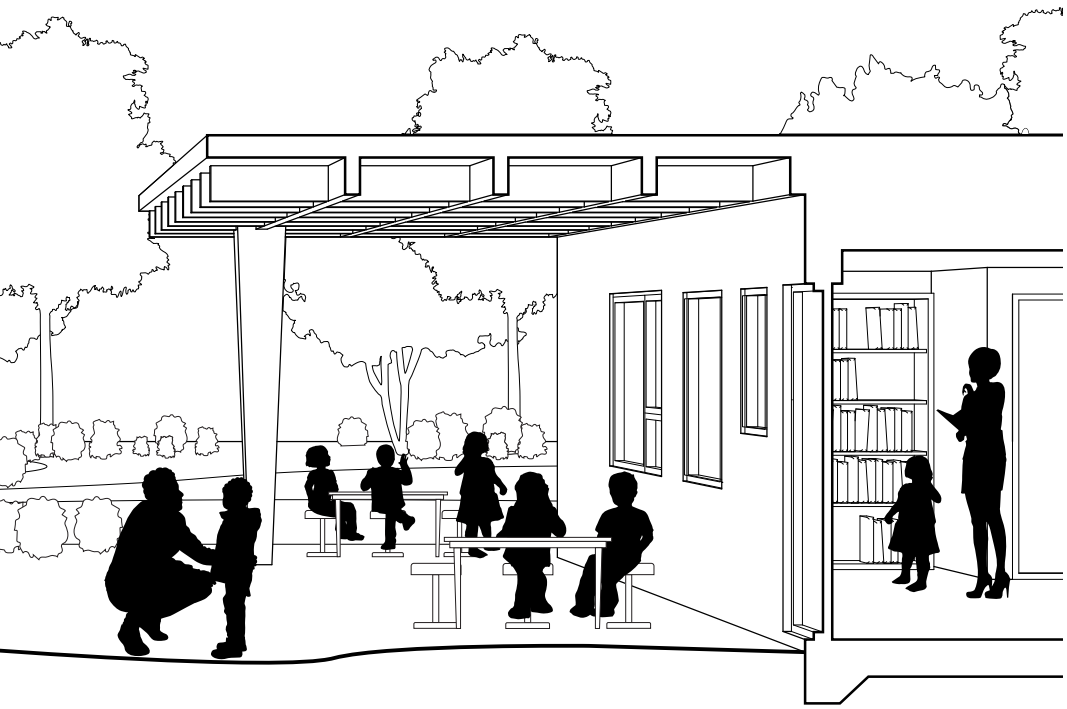


pandemic meant that the distribution of communal spaces changed. Today, the local authority operates with two levels of communal spaces in that two to three groups share a decentralised, local common room, and all the groups then also share a centralised common room. In facilities with more than eight groups, these groups additionally have access to a large common hall. This then provides settings for both micro-level socialisation and facility-wide joint activities for all the children.

During the pandemic, when they were outdoors, the children were also divided up into small zones with their dedicated member of staff, and the grounds were in use far more often and for more than pre-pandemic. This new connectedness with open-air settings was possible because this particular facility has direct exits from each group room, which permitted the groups to be moved from the indoors to the outdoors and back without intra-group contact or breaking the social distancing provided by the buddy bubbles.

Care facility turned inside-out

The architecture of the premises with their many secondary entrances and exits made it possible for this facility to comply with COVID-19 infection control restrictions within the buildings' existing structures.



By using the building's existing architecture but redirecting occupant circulation, the facility was able to solve the logistical and spatial problems of social distancing entailed by the pandemic. The facility's primary entrance and exit were partially closed, and the secondary entrances from the playground between the indoor wings were repurposed as direct access points to each individual group room.

The layout of this childcare facility made it possible to turn its use inside-out, switch from centralised to decentralised organisation, and thereby facilitate entry and exit throughout the day with reduced infection risk. The new, controlled group access was supported by temporary washbasins installed by the group-room exit doors so that each basin could only be used by members of a single group.

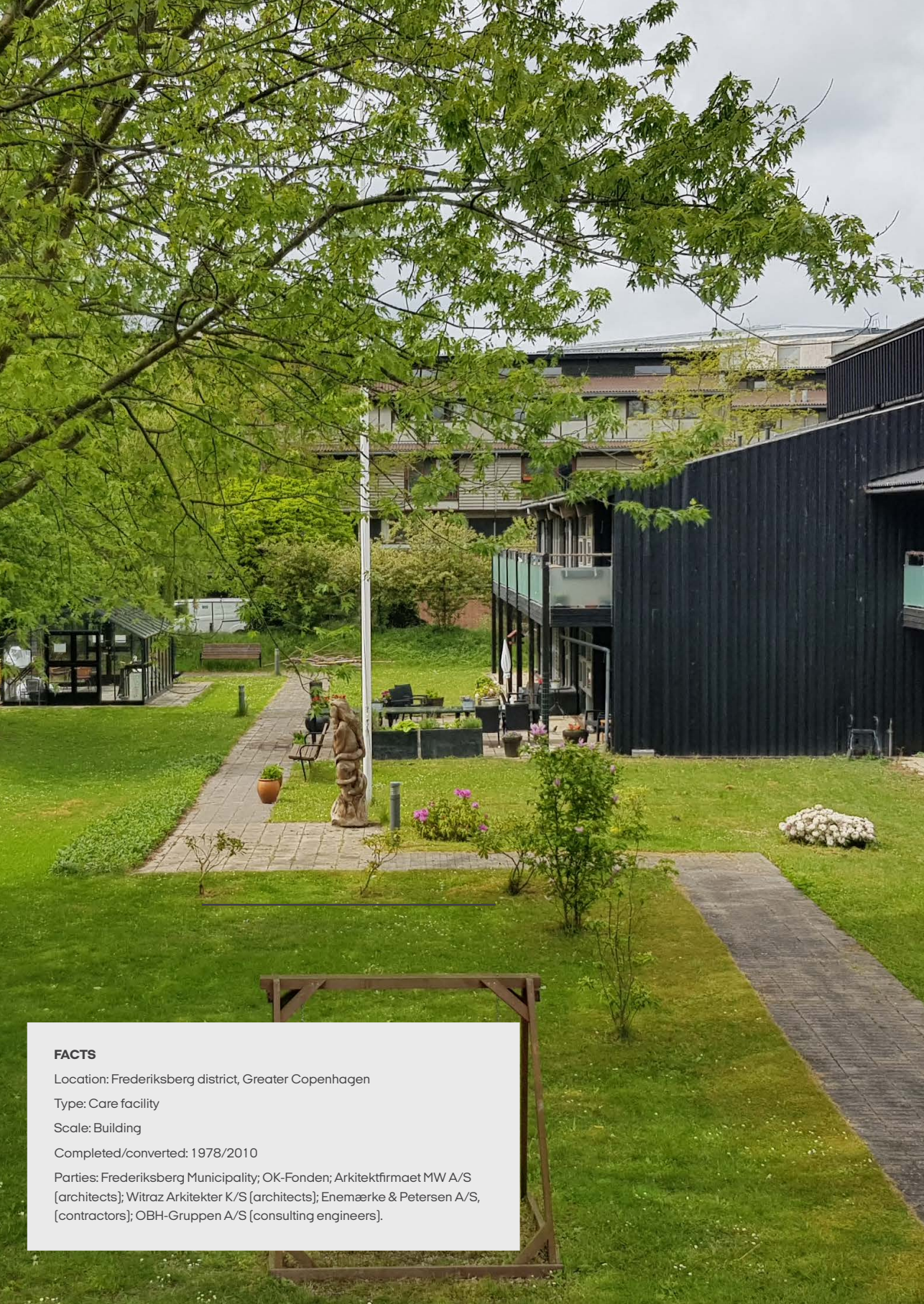
A new perspective on everyday practices

The smaller groupings also impacted the parents' drop-off and pick-up routines. Because the parents were not permitted to enter the facility during the COVID-19 pandemic due to the infection risk, drop-off and pick-up of the children was confined to the playground or by the doors to the group rooms.[133] This also resulted in more settled children, with staff noting that fewer children were upset after being dropped off than pre-pandemic. There was a predictability to the drop-off situation in terms of handwashing and arrival in a smaller group, which provided a sense of security and encouraged independence.[134]

Børnehuset Nøddehegnet childcare facility demonstrates how the design of a building can make it flexible and resilient. At this particular childcare facility the physical setting enabled occupant flows to be 'turned inside-out', thereby allowing the facility to stay open and comply with the restrictions without having to invest in major interventions.

The main entrance typical of Danish childcare facilities has a number of benefits for both staff and children in terms of uniting the occupants as a community, instilling social discipline and also as a supervisory and care setting. When this solution was no longer viable, the layout of the premises was adaptable to the new choreographies of human movement entailed by the restrictions. The result was not an interim hassle or emergency proviso, but a whole new perspective on staff, parental and local authority practices at childcare facilities.

The experiences of turning the building 'inside-out' and the benefits of this have been applied post-pandemic by a number of childcare facilities.[135] Not solely for infection control, but especially with a view to realising the greater well-being gained in interactions among parents, children and staff.



FACTS

Location: Frederiksberg district, Greater Copenhagen

Type: Care facility

Scale: Building

Completed/converted: 1978/2010

Parties: Frederiksberg Municipality; OK-Fonden; Arkitektfirmaet MW A/S (architects); Witraz Arkitekter K/S (architects); Enemærke & Petersen A/S, (contractors); OBH-Gruppen A/S (consulting engineers).

Dronning Anne-Marie Centret

Dronning Anne-Marie Centret is an eldercare facility and care home located in Frederiksberg Municipality serving 98 accommodation units. Like many other care facilities in Denmark, Dronning Anne-Marie Centret was built in the late 1970s, but was then renovated and converted in 2010 so that the accommodation unit configurations, the grounds and the architectural style today are more residential than institutional in design. The facility is part of the Solbjerg Have residential estate renowned for its green environs and car-free urban development.[136]

The facility is laid out with twin two-storey accommodation wings in which the ground-floor flats have access to a patio and the first-floor units have a private balcony. The two wings are connected by a communal building housing offices, a dining hall, facility kitchen, a large activity hall and a spacious daylit physical training centre comprising a sensory-stimulation and massage suite and physical rehabilitation facilities.[137]

Design provisions

Access to privacy and community
Private balconies permit participation in social activities from a safe distance.

Reorganisation of indoor and outdoor spaces
The greenhouse could be repurposed as a meeting place and social venue for the residents

Reorganisation of distribution
Healthcare facilities could be decentralised inside the facility during the pandemic.

Reorganisation of functions
Communal spaces could be segregated and scaled down for small groups.

Control through separation
During the pandemic, visitor areas were separated into smaller, segregated outdoor spaces to allow residents to still receive visitors.

The grounds of the Dronning Anne-Marie Centret care facility were used far more intensively during the COVID-19 pandemic. From their balconies and patios, the residents were able to take part in communal activities, and could receive visits from family inside the greenhouse.
Photo: Sidse Grangaard.

The grounds of the facility are diversified with small nooks, paths and shared patios, a greenhouse, benches and bedding plants. The green grounds connect seamlessly with the neighbouring grounds, unifying the neighbourhood.

The grounds were essential outdoor spaces for the care facility's resilience during the COVID-19 lockdowns. However, the design, layout and adaptability of the interiors were also crucial enabling factors for quality of life during the pandemic.

Options outdoors

The private open-air spaces, balconies and patios were greatly appreciated during the lockdown as they allowed residents to take part in communal activities and to see and hear each other from a safe distance.[138] The staff organised events such as open-air concerts, which the residents could attend from their own outdoor spaces.

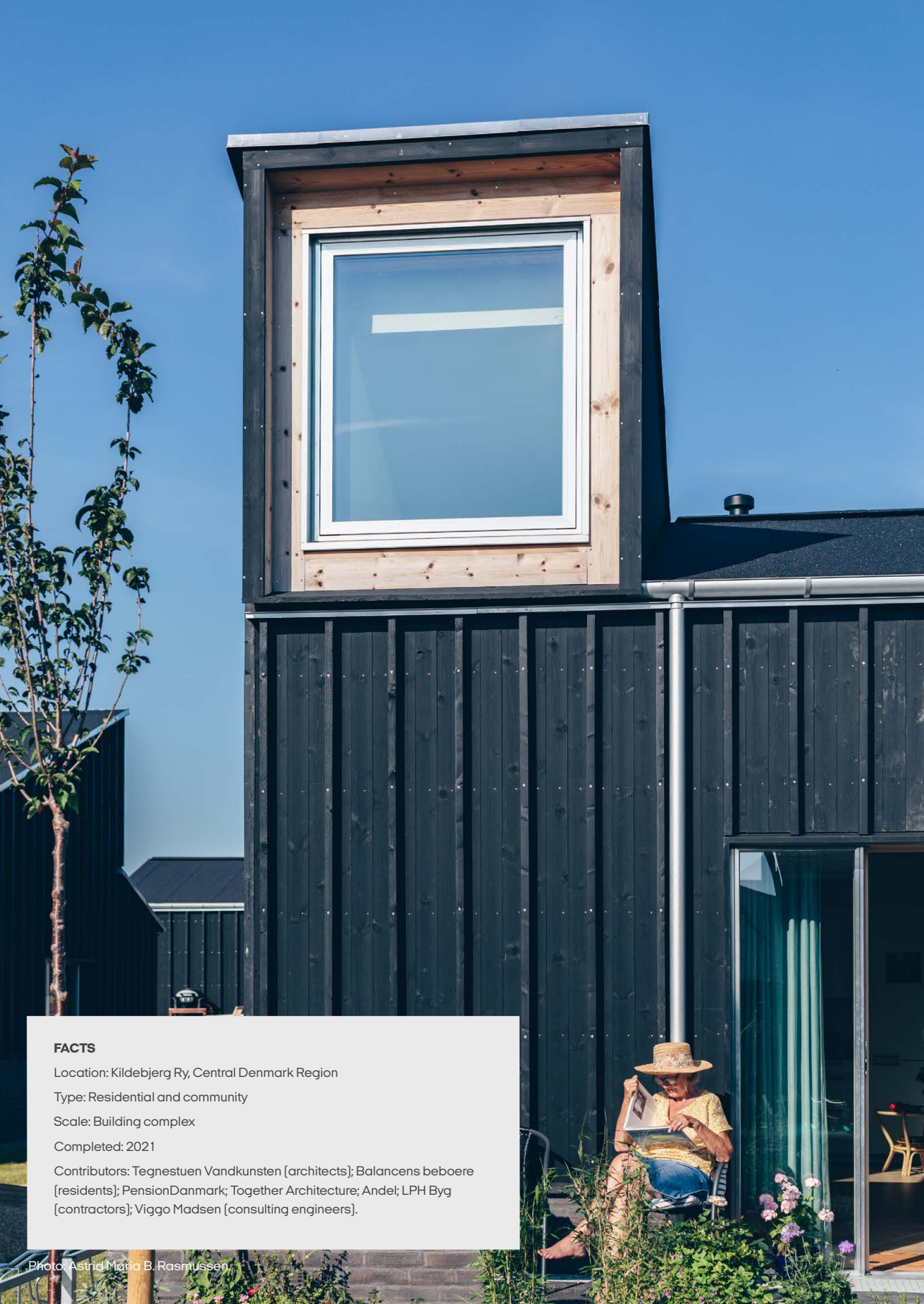
Another social meeting place during the pandemic was the care facility's greenhouse where family could visit residents when the facility was otherwise subject to visitor restrictions.

Options indoors

Inside the Dronning Anne-Marie Centret facility, various spatial configurations made it possible to divide the premises up into sections. The strict fire safety requirements for care facilities in Denmark, for example, meant that there are more and wider[139] fire escapes and emergency exits than in other residential buildings. During the lockdowns, these integrated safety features served as segregated access routes, allowing staff to avoid general access through the main entrance, thereby reducing the infection risk.[140]

Common rooms, offices and adjoining rooms could be used for COVID-19 testing, and generally, communal spaces could be partitioned into smaller spaces that permitted residents to meet in small groups for exercising, for example.[141]

In this way, the care facility enabled *'the little in the big'* groupings,[142] enabling more residents to feel confident about engaging in physical activities and social interaction during the COVID-19 pandemic.



FACTS

Location: Kildebjerg Ry, Central Denmark Region

Type: Residential and community

Scale: Building complex

Completed: 2021

Contributors: Tegnestuen Vandkunsten [architects]; Balancens beboere [residents]; PensionDanmark; Together Architecture; Andel; LPH Byg [contractors]; Viggo Madsen [consulting engineers].

Photo: Astrid Maria B. Rasmussen

Balancen

Balancen is a co-living estate for tenants aged 50+ with no children in their household, in Kildebjerg near Ry in Jutland, Central Denmark Region. The village-style estate consists of clusters of two to three terraced, single-storey rental units with black wooden façades and pitched roofs topped with vertical skylights.

The purpose-built neighbourhood consists of 33 homes and is founded on a principle of relatively limited private living space offset by high-quality shared amenities where more is shared with neighbours. This design strategy recognises a shift in housing needs by fostering robust social networks among residents aged 50+ and also reflects the evolving concept of multipurpose living spaces highlighted by Mette Mechlenborg as being especially relevant in the wake of the COVID-19 pandemic [see pages 74-83].[143]

Design provisions

Access to community and outdoor spaces
Orangery and grounds prioritised as community-fostering venues.

Access to privacy
The homes on this low-rise high-density estate give all households the option of enjoying privacy and electively opting into community life.

Access to services
Laundry, guest rooms and workshop located in communal grounds instead of in the individual household.

Reorganisation of inside to outside
Windows in kitchen corners blur the indoor/outdoor divide, and blend private life with community interaction.

Control of indoor climate
The residents can individually adjust the indoor climate in their home. Healthy, organic materials like wood and reclaimed tiles contribute passively to a pleasant indoor climate.

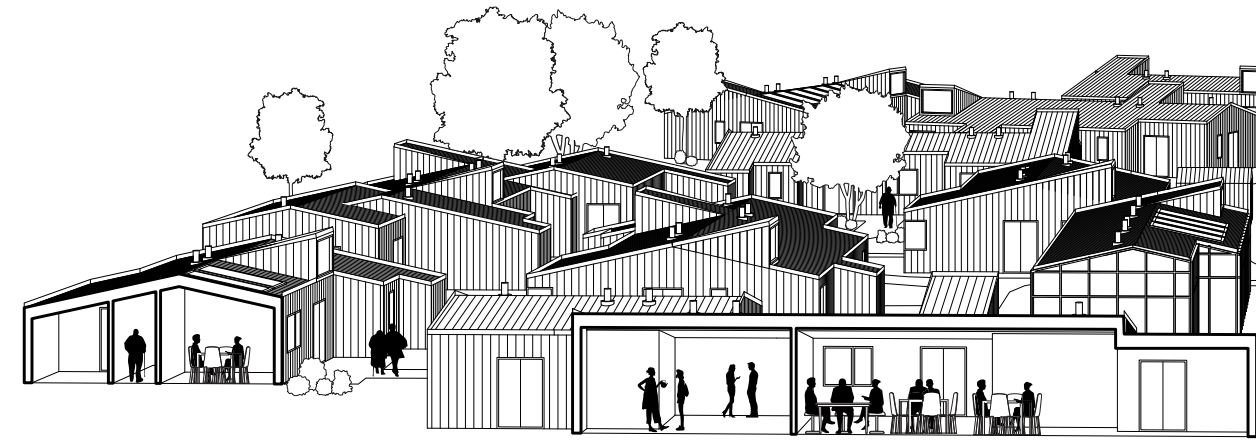
Balancen senior co-living consists of village-style clustered housing units in rural Ry, Jutland. The estate contains around 33 senior co-living units and shared amenities distributed across the landscape.
Photo: Astrid Maria B. Rasmussen.

This type of housing fills a gap between private residence and communal living, and the resulting community bond similarly blends the privacy of home with the village-life atmosphere Marie Stender describes as thriving in an urban neighbourhood such as Vesterbro in Copenhagen (see page 59).[144] During the pandemic, this ethic generally enabled senior co-living residents to maintain social but safe interaction.

This is described in *Seniorbofællesskaber i coronaens tid* which reports on how life in senior co-living communities like Balancen was organised during the COVID-19 pandemic lockdowns.[145] The report highlights the benefits of mutual trust among residents as being a source of great reassurance; of knowing that the community engagement of fellow residents means that they will comply with guidelines and protect themselves and others. Balancen's focus on a sustainable lifestyle also aligns with the rising trend of designing pro-health, pro-environment spaces in the post-pandemic era.[146]

A new type of residents

The population of 'empty-nesters' – people over the age of 50 whose children have grown up and left home – is growing in Denmark, as elsewhere.[147] Danish empty-nesters typically live in a villa, a large single-family detached home or a large flat that takes too much effort or time to maintain in proportion to the reduced number of occupants, especially if they simply prefer to spend their time on leisure activities and personal interests instead.[148]



The kitchens in Balancen face the communal grounds and the community's streets, which is unconventional given that Danish kitchens are traditionally very private domestic spaces, but here the kitchen space helps to connect privacy with the community. Photo: Astrid Maria B. Rasmussen.

Balancen gives singles and couples living in the project a unit each, that is slightly smaller than the share of private home space they pay for. The extra space is instead provided in shared amenities such as a common room, laundry, an orangery and grounds. Balancen's amenities are located on the 'village' main street, which is used by everyone, and which fosters regular, spontaneous social interactions.

Balancen is primarily built from organic and reclaimed materials. The large ground-floor windows and vertical skylights maximise the interior daylighting, and the interior materials are DGNB Diamond sustainability-certified.[149]

The residents are very active in shaping their community culture, and were involved in designing their communal spaces before they even moved in. This user engagement and commitment is key to building a socially coherent co-living project, with the right balance between privacy and community. Private spaces allow for introspection and relaxation, while communal areas encourage social interaction, both of which are vital for mental health.

Can housing provisions keep up with residents?

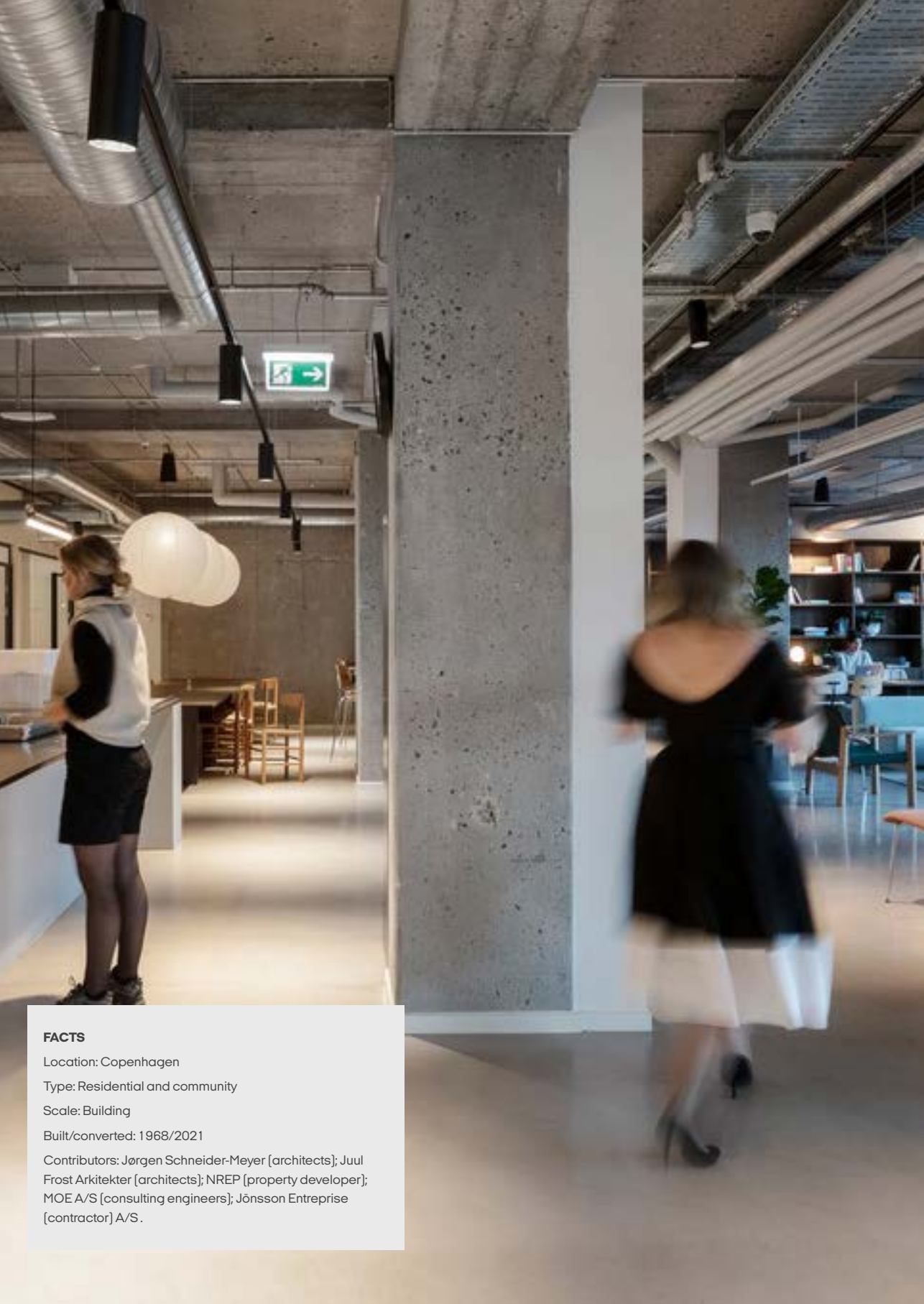
Balancen exemplifies how architecture and design can help to adapt our built environment to meet users' current needs. The residents on the Balancen estate do not necessarily see themselves as 'elderly', as they are highly active and invested individuals with lots of energy to bring to the community. That energy and commitment may not square with a large detached home or a one-bed flat among young singles and couples with a different lifestyle.[150]

Instead, the 50+ residents are looking for something in between: a mix of privacy and community and a place where they can spend the time they used to devote to the kids on their own life, own interests and personal development. This new empty-nester/senior co-living typology is proving highly attractive in Denmark.[151]

Senior co-living estates like Balancen also tie in with the ageing-in-place concept that gives people the option of enjoying independent living in their own home with advancing age. In terms of architecture, this requires homes designed with accessibility in mind, such as stepless access, on one storey or with lift-access to upper storeys.[152] Ageing in place has the advantage of minimising the risk and fear of loneliness if one's partner passes away or in the event of a health emergency, as became clear during the COVID-19 pandemic.

The popularity of senior co-living points to a need for housing typologies that fill a gap or strike a balance between the seclusion of complete privacy and the potential intrusions of communal living. The lessons learned from the pandemic indicate that co-living boosts resident resilience in terms of peace of mind, mental health and quality of life. Experiences gained from senior co-living will ideally serve as inspiration for similar forms of housing for other age/target groups.

The tenants' shared amenities include communal buildings, a laundry and grounds. All of these spaces encourage increased socialisation among the residents. Photo: Astrid Maria B. Rasmussen.



FACTS

Location: Copenhagen

Type: Residential and community

Scale: Building

Built/converted: 1968/2021

Contributors: Jørgen Schneider-Meyer [architects]; Juul Frost Arkitekter [architects]; NREP [property developer]; MOE A/S [consulting engineers]; Jönsson Entreprise [contractor] A/S .

Siljangade 4-8

Siljangade 4-8, in the Amager district of Copenhagen, was a disused industrial and commercial building from 1968 formerly housing a book-wholesaling distribution centre and now transformed into a co-working and co-living space[153] comprising housing units and a range of on-site amenities geared to sharing schemes and community interaction.

The building contains 138 studio apartments catering to small-business owners by making it more accessible to work from home.

Siljangade is located in one of Copenhagen's nine creative zones designated by the City of Copenhagen urban plan. The creative zones are areas that cater to creative businesses, offering flexible and affordable leases. The nine zones, of which the Siljangade neighbourhood is one, are intended to serve as development hubs for small artisanal enterprises, workshops and studios.[154] This new type of creative

Design provisions

Access to privacy and community
A small accommodation unit and prioritised communal spaces for co-working and leisure offer options for non-mainstream work/leisure and private/communal balances.

Reorganisation of functions
The mix of accommodation units, office spaces and workout facilities gives users and tenants options for organising a flexible way of living and working, allowing differentiated use of spaces at different times.

The disused industrial and office premises of Siljangade 4-8 have been transformed into 138 studio apartments with communal spaces on the ground floor for tenants and their neighbours. Photo: Niels Nygaard.

residential zoning is referred to by the architects, Juul Frost Arkitekter, as 'urban acupuncture'; a means of revitalising disused industrial estates.[155, 156]

This proved a valuable strategy during the COVID-19 lockdowns when many of the capital's amenities closed down together with offices.[157] The Siljangade tenants largely retained access to their co-working spaces and to leisure amenities on the premises.

All in the mix

Siljangade 4-8 combines accommodation, workplaces and leisure amenities all in one building. In response to new public trends in family life, worklife or leisure interests, architecture has to develop new typologies to cater for today's lifestyles. As discussed by Mette Mechlenborg, for more than a century, our lives were divided into work, recreation and rest (see pp. 74-83),[158] and some citizens and family types are now rejecting this model.

In being leased to small-business owners, the Siljangade studio flats serve as both a home and workplace with access to the requisite facilities for running a business. In that way, the project taps into a trend for new forms of co-living and co-housing that also enabled tenants to socialise in small groups during the pandemic lockdowns.

The studio flats ranging from 48 to 86 sqm in size all contain a private bathroom and only a basic kitchenette to encourage occupants to make use of the large communal kitchen on the ground floor. The ground floor also contains small office spaces,

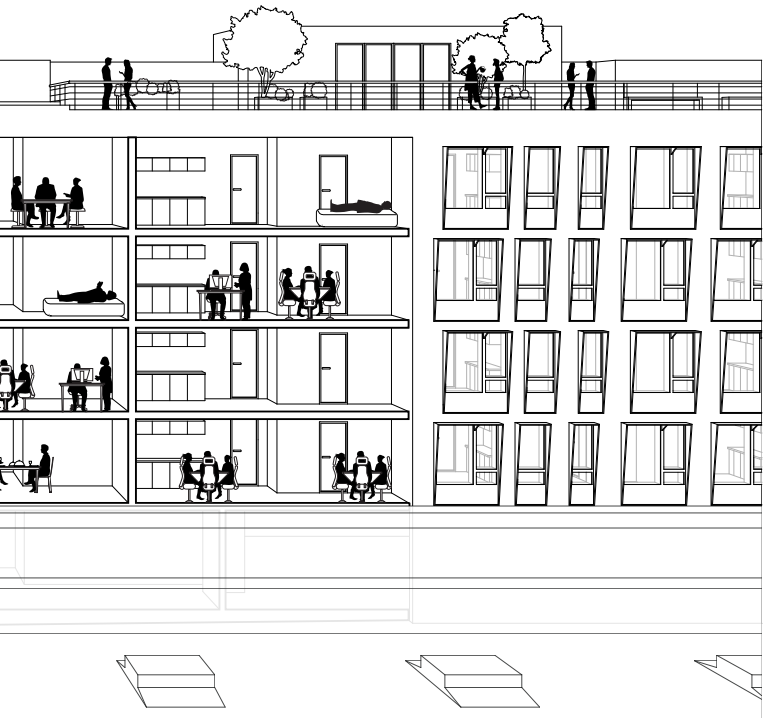
but the largest space on this floor is allocated for co-working areas, a community canteen and a spacious open-plan lounge. The canteen is also open to locals in the neighbourhood, making it a lunchtime social hub. This is a venue for meeting neighbours over an organic meal from the urban farm, Nabo Farm, located in the basement.[159] The in-house working facilities are complemented by leisure areas such as the spacious roof terrace, communal dining and lounge area and the shared gym to which tenants have access under their lease agreement. By incorporating an amenity for physical health, the design of this converted building makes it easier to maintain a healthy lifestyle.

Room for more nuances

The Siljangade project challenges long-standing principles about work-life separation.[160]

Many Danish homes and housing estates were designed for nuclear families, but as demonstrated by the Balancen project, Denmark now has many diverse family structures and circumstances. At Siljangade 4-8, the tenants have the option of realising their own individual way of life, including blending their personal life, work and leisure at will throughout the day. Residents can opt to hit the gym for a workout at noon, spend an hour working in the co-office space after dinner, take a coffee break with their neighbour or breakfast in the café on busy days. What might be a disruptive mix for some is a good fit for the life/work situation others prefer.

Whereas the efficiency-geared modernist ideal streamlined and systematised the basic urban typologies – home, work, care facility, etc. – we are currently witnessing a trend towards more differentiated housing and hybrid typologies that blend building functions.



Access to privacy can be achieved by, for example, spatial organisation that provides nooks or niches, balconies and patio gardens being examples of private open air spaces. Photo of Fredensborghusene, Fredensborg, Natalie Mossin.

Control through sanitation: It is crucial for public health to prevent sewage and wastewater from coming into contact with or overflowing into aquatic environments. Photo from Superkilen, Copenhagen, Natalie Mossin.

Architecture and public health – a theoretical perspective

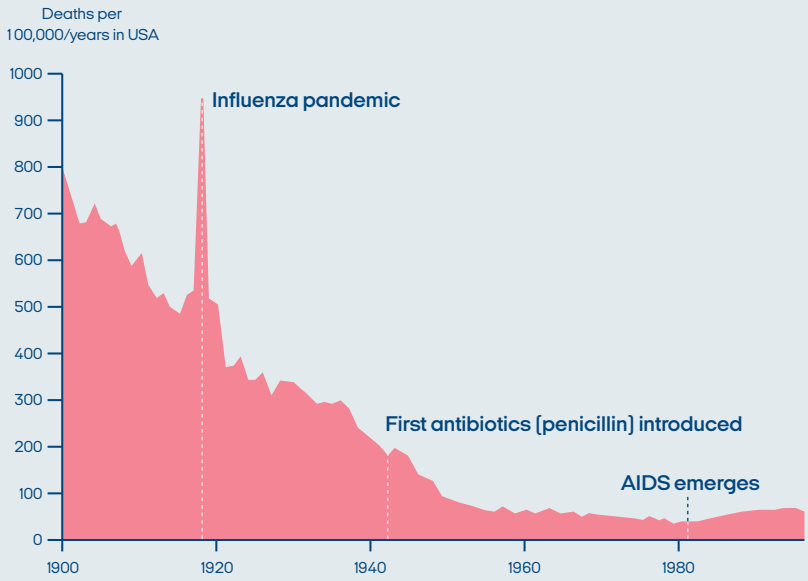
The following essay discusses the topic of this publication from a philosophical and multidisciplinary perspective.

Architecture and public health – a theoretical perspective

This publication is a contribution to the public health debate in the post-COVID-19 era, a debate dominated by medical and health science narratives, but which historically included the architectural profession. Hippocrates (c. 460–370 BCE), the father of medicine and namesake of the Hippocratic Oath, was both a doctor and an architect who stressed the importance of healthy physical environments, with a special emphasis on healthy architecture. Conversely, Vitruvius (c. 80 – 15 BCE), the father of architectural design theory whose theories inspired da Vinci's Vitruvian Man, emphasised human health as the foremost goal of the architect. Modern history abounds with examples of infectious diseases (notably cholera and tuberculosis) illustrating, as described by architectural historian Beatriz Colomina, that: 'Doctors and architects have always been in a kind of dance, often exchanging roles, collaborating, influencing each other, even if not always synchronized'.[161]

Reopening the dance floor

While this dance went off-balance in an era of medical optimism from the mid-20th century, we see it as imperative in the aftermath of the COVID-19 pandemic to reopen the dance floor between architects and other health-related professions. Scientific investigation of lab-tested pathogenic microbes should be complemented by a renewed focus on 'unhealthy' spatial configurations brought to light by the pandemic. This shift in focus is by no means an attempt to belittle the remarkable medical achievements during the pandemic of developing vaccines at record speed, the aim being rather to call attention to some of the spatial predicaments revealed by restrictions and lockdowns, especially for the most clinically vulnerable members of society. The biomedical sciences themselves caution us against overoptimism given the number of emergent communicable diseases like SARS,



Three-quarters of the reduction in communicable disease mortality from 1900 to the present-day is attributable to non-pharmacological public health interventions.[181]

Ebola and COVID-19, which are less predictable than formerly assumed, making it far more difficult to develop vaccines or other forms of treatment.

Moreover, it is worth noting that 75% of the reduction in mortality from infectious diseases from 1900 to the present day is due to non-pharmacological public health measures.

The built environment as a means for infection prevention

In early 2020, due to a lack of available medical treatment options and acute awareness of the specific spatial expression of the SARS-CoV2 microbe, the built environment was brought back on the agenda as a crucial public health factor. Whereas viruses pre-pandemic were monitored and managed in laboratories as isolated infectious agents, with the outbreak in early 2020, the novel coronavirus emerged as a relational or social matter of concern. What the pandemic made visible was how we all exist in relation to other human beings, but also to non-human social infrastructures like buildings, parks and public institutions. In the attempts to reduce the rate of infection, the virus redefined both urban spaces and individual

liberties: no one has the right to infect anyone else; everyone must abide by rules to protect other people. Pre-pandemic, the USA ranked as the best-prepared country in the world, but when the virus swept the globe the USA rapidly emerged as one of the hardest-hit nations in terms of infection and mortality rates.[162] Before the pandemic, life-threatening communicable diseases were largely associated with hazardous locations mainly in Africa and South-East Asia, but as the virus went global it was soon associated with certain situations that needed to be balanced everywhere and all the time.

Pandemics are social crises

The chief editor of the prestigious medical journal *The Lancet* proposed that COVID-19 should be tackled not as a pandemic but as a syndemic, meaning a pandemic synergised with biological, social and environmental factors, thus questioning the excessive focus on minimising the spread of the pathogen while disregarding other structural aspects.[163] The high infection rates correlating with low-income areas, precarious working conditions and malfunctioning infrastructures revealed marked structural deficits in every society. As the Swedish ideas historian Sverker Sörlin reminded us: 'a crisis is always also a mirror that shows us our societies as they really are. And how they could be'. [164]

That then, is the premise for this publication: by tracing the deficits in our built environment revealed by the pandemic – but also by using the numerous situated and often self-organised ways of managing such failings – we point to new ways of understanding the relationship between architecture and public health. In our approach, communicable disease is not only a result of microorganisms infecting a host, but also an outcome of the changing relationships that make disease more or less likely in different situations. Microbes thrive best where there is least mutation pressure, meaning in locations where they can spread quickly and unhindered. People in densely populated neighbourhoods in overcrowded housing with an unhealthy indoor climate and who have limited access to the open air are thus more at risk both of infection and the adverse impacts of lockdowns. The vulnerabilities of these configurations and the options for adapting to the circumstances on a spatial scale are thus key concerns addressed by this publication. In other words, one of the main topics of this publication is resilience.

In line with the Stockholm Resilience Center, resilience in our context is defined as the capacity to deal with change and continue to develop under the stresses of changing circumstances and uncertainty.[165] Thus, resilience should be understood as a prospective rather than a retrospective approach, the aim being to bounce back to a kind of normality.

The pandemic's 'acid bath'

The COVID-19 pandemic changed our ways of life in that our scope for engaging socially was radically reduced – for some more than others. As a paradoxical outcome of all social relationships being temporarily reduced to physical distancing, the value of caring and sharing networks became apparent. As such the pandemic 'acid bath' clearly mapped a great many flaws and failings in our physical and social environment, which under normal circumstances are less apparent.

Designing for the weakest position means designing for increased public health

The Finnish architect Alvar Aalto, famous for designing the Paimio sanatorium in 1929 which would inspire a whole movement of healthy architecture, said that architecture is always conceived for the healthy person standing upright and that we should always design for the person in the weakest position.[166] Today, in light of the unequal effects of the COVID-19 pandemic, this principle should be reframed and adapted to meet the current predicaments: catastrophic situations are perceived in diverse ways – bodily, culturally, politically, economically – as limiting, weakening and threatening. Whereas one individual may be distressed by being in the presence of a potentially deadly virus, someone else may be equally distressed by a government lockdown in response to that virus. The weakest position is not single but multiple, and is linked to changing relationships depending on personal circumstances, life phase and conditions. Nowadays, we understand that there is no single upright ideal person, and that human bodies and minds are diverse, and have diverse needs, abilities and relationships. These are the relationships, or rather the potentials of those relationships, we are seeking to mobilise on a spatial scale with this publication. We took our cue from the child in quarantine at home, feeling imprisoned and lonely, bereft of familiar social infrastructures such as school and sports amenities. Equally, we aim to understand and identify potentials for senior citizens who, during the pandemic, did not venture outside their homes and were forced to isolate from friends and loved-ones.

Architecture of the Pandemic

In short, during the COVID-19 pandemic, architecture became a key resource for infection control and maintaining some degree of quality of life. In *'Architecture of the Pandemic'*, also publicised as a part of the RESPOND initiative[167] the editors presented 35 cases of pandemic control through architecture, illustrating the power of architecture to balance the microbe-human relationship. By factoring in and mindfully addressing microclimates, air circulation, flexible open-plan designs

and a number of situated factors associated with vulnerable groups such as children and older people, care facilities, the service industry and cultural amenities, these cases point to the fact that communicable diseases are more than microbes alone, just as health cannot be defined as the absence of microbes. Disease is a product of relationships involving microbes, hosts and their social and physical co-environments.

From reactive to proactive

If the reactions or responses described in *Architecture of the Pandemic* were judged by their abilities to protect existing norms in a viral emergency, in the present publication we add a proactive layer by including scientific findings, expert interviews and the pop-up architectures presented in the earlier publication and other sources to question those very norms – in order for us to 'build back better' or, as we propose: to 'build back differently'. In this vein, COVID-19 is viewed more as a sign, rather than a cause, of global malaise.

As many others did during the pandemic, we should insist on questioning correlations between the built environment and disease and social vulnerabilities. Do my surroundings promote health or do they harm health? And further: how does the built environment impact my quality of life and my options for engaging socially with other people? Questions that pre-pandemic might have seemed somewhat academic, as in more nice to than need to know, arose in everyone's lives, literally as life or death questions. These are the questions addressed by this publication in terms of the resilience of buildings and built environments.

Eight examples building back differently

Our reflections and responses are centred around eight examples, which are partly assessed by their ability to question prevailing norms in the light of the pandemic – but also by their enabling value in times when crisis is no longer an exception, but a fact of life. The design provisions we propose should be seen as insights, potentials or dispositions that can be acted on, as opposed to being prescriptive guidelines. The intention is for them to serve as questions that can be asked in situated contexts, and which, from a performative, epistemic horizon, are enablers of new correlations in familiar contexts.

With this, we are showing our true colours in terms of a particular performative architectural stance: rather than seeking to define a distinct pandemic style and aesthetic, we are pursuing an interest in transitions and conceptions. We are asking: "what can it do?" and "what can it become?" as opposed to "what is it?"

The pandemic's invitation

This publication looks through a performative lens, not because we have a particular predilection for this way of viewing and understanding the world; instead, it is a positive response to an invitation. Like a prism, the pandemic simply made the world visible and viable with this approach. Unlike other emergencies and disasters where 'constructional' violence would be physical destruction of buildings and acute loss of 'homes', pandemics expose us to the 'structural violence' that may arise out of unsound spatial dispositions.

Spatial re-awakening

During the pandemic, bodies and buildings, physical and social infrastructures emerged as tipping points in networks of relationships and agendas as opposed to fixed structures. In order to 'flatten the curve' but also to make social and productivity provisions, buildings and infrastructures were like volume dials that could be turned up or down. Paradoxically, these infrastructures became noisier the more they were turned down. As suggested by American architect and writer Michael Murphy, the pandemic offered us a spatial re-awakening[168] – paradoxically virtually from the instant our shared spaces and our ability to navigate and engage socially became restricted.

Threatened buildings and alienated homeliness

During the pandemic, buildings were not destroyed by external forces – they were exposed to internal risk, effectively posing a threat to us. As such, epidemics and pandemics bring a social tension causing even the most familiar and reassuring settings – our home and our neighbourhood – to suddenly seem alienating. As evidenced by a number of studies, quarantining is mentally draining and may lead to stress and quasi-depressive states. During the pandemic, mounting aggression was reported among populations as a result of the constant and overwhelming proximity to other household members. Life in lockdown soon revealed that the pathological effects of a pandemic are not only associated with physical disease, but also include the restrictions or limitations on our scope for participating in and contributing to social, cultural and educational activities.

Doing away with buildings as sealed containers

Being forced to work from home, home-schooling children and meeting up with friends on Zoom – disconnected from the social structures we previously took for granted – made us realise how the everyday practices and social relationships that

shape our home life are linked to structures and relationships that extend far beyond domestic life. From events and behaviours in Wuhan, the number of ventilators at superhospitals and after-ski events in Ischgl to the mental and physical effects of closed schools and after-school clubs and other social and cultural arenas for letting off steam. New choreographies in daily life – at hospitals, in the supermarket, footprint decals and elbow bumps instead of handshakes and hugs – were a hassle, but also showed us potentials beyond the status quo. The blue skies over Beijing and crystal clear canals in Venice during the pandemic are dynamic potentials of the ways we have organised life locally and globally.

This sensibility defies the mainstream perception of architecture as solid objects with clearly defined perimeters. This common-sense approach is related to so-called signature projects, but also to the policy-based building codes and contractual and project formats to which the building industry is subject.

There was nothing spectacular about the practices that emerged during the pandemic in an iconic sense, just as virtually all predefined codes, project formats and limitations were confronted by designers and architects seeking to align ideal protocols and restrictions with non-ideal settings.

The examples presented in this publication should consequently not be judged on their aesthetic and/or site-specific merits, but rather as means of community-building with the potential to prevent health adversities in the face of societal emergencies and tipping points.

Building projects – from hardware to anti-virus software

The pandemic showed us that we inhabit dynamic environments in which any emergency is neither exceptional nor external in terms of our self-organisation. In that light, architecture can be seen as dispositions or potentials for interaction[169] that can enable action and quality of life when conventional know-how and practice no longer suffice. The dispositions we have proposed aim to enrich our built environments by highlighting the consequences of monofunctional thinking and practice. According to the American architectural theorist Keller Easterling, a disposition, like "a software that is constantly updated—might have both the practical capacity to react to changing conditions and the political capacity to respond to the moment it is outmaneuvred. An interplay is a form that keeps working even when things go wrong. And everything goes wrong."[170] To rejoin the dance between medical science and the architectural profession we opened with, from this perspective, the architect is like the oncologist who is not just looking for the tumour, but also focusing on the chemical interactions in the surrounding tissue in order to intervene in the potential. The best architects see beyond the forms and contours of buildings to the network of relationships that influence and create them for better or for worse.

In that sense, understanding health as a relational, dynamic factor in no way undermines the influence of designers and architects tackling complex and unpredictable conditions. On the contrary, by advancing this relational approach, the pandemic allowed us to reconsider what the best architects already know and do, and what is actually taught at schools of design and academies.

During the pandemic, no-one could hide behind prescriptive building codes and established project formats. The pandemic did not, as such, offer us a new view of architecture or a novel style but pointed to the potentials that already exist and prevail when buildings and infrastructures are liberated from conventional formats.

Learning from the past

As explained by Claus Bech-Danielsen and Jakob Brandtberg Knudsen in this publication, any epidemiological event activates deep narratives about architecture and disease, failures and successes that can be mobilised and adapted to meet current needs. Before the pandemic, few Danes would have had first-hand experience of life in a pandemic. Fortunately, important experiences and solutions from historic outbreaks of diseases like cholera and tuberculosis were encoded in the DNA of more affluent societies in the form of building codes, pro-health urban planning and emergency management.

Before the cholera epidemics, cities were sanctuaries providing protection against external danger, but after cholera broke out in the 1800s, the enemy was suddenly inside the city limits, turning vibrant cities into ghost towns from one day to the next. Just as city-dwellers fled cholera-ridden cities in droves, Denmark witnessed the same 'inside-out' effect of the COVID-19 pandemic as people left the cities to avoid the stifling sense of imprisonment, both physically and mentally.

If people move around in the world like the water circulating in the city, then the reorganisation of human circulation flows and tactility is one of the challenges latter-day epidemics and pandemics have given architects and designers.[171]

Learning from tuberculosis

Following the advent of tuberculosis, similar concerns about urban density were countered by new materials and organisational strategies. Informed by the principles of 19th-century hospital pavilions, the design of sanatoriums from the early 20th century was gradually adapted to modernist mainstream architecture as a counterweight to the conventional building that was a breeding ground for tuberculosis outbreaks and transmission. The curative effects of daylight and fresh air were translated into roof gardens, glass façades and not least, high-rises that elevated human beings into daylight, away from the ground-hugging, stinking miasmas of the traditional city.

By demonstrating how the shape of a building could produce measurably improved results, these functions were soon translated into macrostrategies for improving public health in cities where parks, plazas, healthy standards of living and piped sewerage systems gained traction as essential investments.

Learning from the open-air movement

Friluftskolen open-air school, as described in this publication, is an example of the open-air movement spurred by life with and among tuberculosis bacteria in the early 20th century. This school was built to ensure healthy learning environments by renegotiating indoor and outdoor settings. In 2019, a radical renovation and adaptation to meet contemporary standards was underway when the coronavirus emergency was declared. The similarities of the transmission route of the two pathogens (one viral, one bacterial) championed the open-air school's original design features in that these features proved ideally suited to meeting the needs of new public health constraints. The seamless transitions between interiors and exteriors and the antimicrobial properties of natural light and fresh air that had previously proved effective against tuberculosis bacteria soon proved their worth in preventing the SARS-CoV2 respiratory virus.

How to build relations

One of the notable impacts on architecture of the outbreaks of cholera and tuberculosis was a 'form follows fact' mindset. Both diseases brought out new correlations between health, sanitation and infrastructure, thereby transforming the discipline of architecture by bringing it into contact with a body of scientific knowledge. Some architects mastered this discipline, but only by taking a step back and allowing scientific knowledge from other fields to shape both processes and products of architecture. Given the achievements of Friluftsskolen open-air school, which was literally built upon a three-way dialogue between medical science, prevailing educational recommendations and architects, one question might be: what can we learn from open-air schools regarding the potential of interdisciplinary partnerships among architects, doctors, and educators? Is there scope today for such dialogue? How can architects, doctors, and educators contribute to rethinking school design and addressing current concerns? Not only to secure social infrastructures in times of crisis but also to ensure that educational settings promote health on all scales and in all dimensions.

Learning from malaria

Similar to the original approach to the Friluftskolen, the advantages of viewing relationships between microbes and humans as an integrated spatial parameter are clearly illustrated by the Star Homes project in Tanzania. To avoid potential illness, in this case malaria and a raft of respiratory diseases, the project's strategy consists of reorganising spaces and levels informed by scientific air flow studies. The effect of these measures is that the mosquitoes lose interest because they can no longer detect their 'victims' as the increased air circulation eliminates the CO2 given off by humans, thereby disabling the mosquitoes' navigation system. As proposed by Jakob Brandtberg Knudsen, this 'more stealth than armour' strategy could potentially be applicable to other settings where adaptation rather than elimination makes more sense given how closely the human condition is entangled with that of other lifeforms on the planet.

The Star Homes project also demonstrates how interdisciplinarity – in this case in a collaboration between a team of architects, medical experts, social scientists and entomologists, alongside local community leaders and stakeholders – can achieve extraordinary results. Equally, this underlines the need to form alliances with other disciplines to create healthy compositions, which in many western countries has been somewhat forgotten.

The disassociation of architecture and bodies from environments and context

This 'forgetfulness' was largely due to two factors: firstly, the non-pharmacological approach to improving health and quality of life via the built environment effectively killed itself off. By building communicable diseases out of buildings and cities concurrently with the advances made in medical science post-WWII freed up the architectural profession to concentrate its efforts elsewhere. The so-called antibiotic era meant that the body was no longer seen as dependent on, or an effect of, external surroundings.[172] The dissociation of the human body from its context also cut the public health ties between architecture and communicable diseases.

A further consequence of this split was a loss of the human scale and the natural systems we depend on to stay healthy. Urbanisation and medical overoptimism had put an end to nature, and cities became iconic of human transcendence over and disregard for nature. The effects of this development are well-known today. However, there is still a tendency for social scientists to study cities solely in terms of social or economic processes, while the domain of biologists is typically located well beyond city limits.

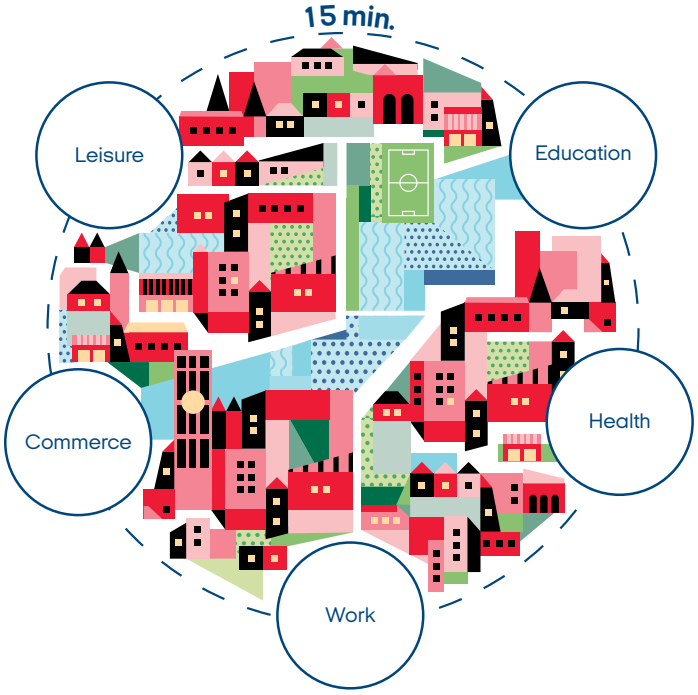
Learning from the 15-minute city project

The Aarhus River project demonstrates the benefits of reconnecting the city to bionatural systems while transforming the social infrastructure based on influences such as the '15-minute city' concept.[173] This chronometric urban planning principle introduced by Carlos Moreno in 2016 gives city-dwellers access to daily necessities and services within a 15-minute radius on foot or by bicycle from any point in the city. The COVID-19 pandemic became an ambassador for this form of distribution, as it allowed and enabled circulation during periods of restriction. Studies reveal that in Denmark the lack of accessible state-subsidised social infrastructures took a heavy toll on disadvantaged neighbourhoods where many residents, especially children and senior citizens, are more reliant on local networks and welfare services.[174]

This highlights the importance of facilitating flexible local and social open spaces such as pocket parks and backyard or courtyard gardens. The diverse forms of public self-organisation observed locally during the pandemic, in both advantaged and (especially) in disadvantaged neighbourhoods should be taken on board with a view to building greater resilience into post-pandemic urban planning formats.

On spatialised rights and limited self-efficacy

The COVID-19 pandemic illustrated the unequal distribution of risk and how the disabling social, mental and physical effects of COVID-19 were heavily dependent on very situated conditions such as life and work situation, age, physical condition and location. This suggests that any restriction is a wholly spatial experience on every conceivable scale from a potentially infected door handle, and the inability to shake hands and hug, through to the macropolicy realms of lockdowns, stay-at-home orders and bans on large gatherings. The restrictions have a demography that shapes and is shaped in situated mutual interaction and with various spatial impacts. The right to health is not worth more than the potentials and actions that at



The 15-minute city strategy is based on the accessibility for all inhabitants to six essential services and amenities: housing, work, food, health, education, and leisure. In the Danish welfare context, this means it must be possible for all citizens, regardless of financial means, to obtain accommodation in a city and have access to employment and to shopping. In addition, they should have access to healthcare, childcare and education as well as cultural activities, green spaces and other public spaces within the distance of a 15-minute walk or bike ride.[182]

any time and in any location extend the concept. Rights exist universally in and around us as embedded, embodied realities. If these are restricted, then so are the rights.

In the interview with Michael Bang-Petersen we learn that a sense of self-efficacy is crucial in a crisis such as the COVID-19 pandemic. Self-efficacy means having agency: a sense of knowing what to do, and of feeling capable of doing it. It is the sense that our actions will help to reduce the threat, and that the cost of taking those actions will not be be too high. During the pandemic, many people, especially the younger and older generation, were exposed to intense loss of control and, potentially, long-term adverse effects. Restrictions on the right of assembly and of mobility may be essential, but if there are other options, these should be addressed and given priority.

How social infrastructures become private tipping points

Children and young people were identified as a population group especially affected by the consequences of lockdowns during the pandemic. Isolating at home from friends and social activities caused mental strain from physical under-stimulation and functionally overloaded home spaces. Isolation and loneliness are known to cause stress, anxiety and depression and can progress to aggression and violence when the absence of chosen others or the constant, unavoidable proximity of other household members becomes overwhelming.

The effects of the pandemic on children and young people are still emerging, but the documented testimonies and the outlook for potential late effects is alarming and cannot be disregarded. It confirms what researchers have long known: that social infrastructure is crucially important, because local, face-to-face interactions – at school, in the playground, and at the local café – are the building blocks of all public life.[175] These formal spaces became even more conspicuous during the pandemic by their temporary absence, which confirms another widely reported tendency: that social infrastructure is invisible until it it disintegrates, simply because we take it for granted and are oblivious to it until it disappears or we are otherwise deprived of it.[176]

What is less well understood is how social infrastructures are not only key building blocks for maintaining public life and rights, but are also crucial tipping points of activities in the private domain. A home may be where the heart is, but it is the connections to numerous structures – social and physical – that makes it tick.

Spaces for everyone as spaces for no-one

In sum, during the pandemic, our dependencies became visible in new and different ways. Ideally, social infrastructure should be for everyone. But as we saw during the pandemic, there was not just one crisis, but many, depending on life situation and circumstances. Spaces for everyone could end up being spaces for no-one. According to several healthcare professionals, inflexible ventilation systems caused chaos and distress for both patients and staff in Danish hospitals during the pandemic. In many places around the world, isolation wards had to be set up ad hoc and hospital capacity and logistics were hard-pressed when routines, safety procedures and circulation had to be rapidly altered. There are several examples of architects and designers being called in to configure and optimise the conditions for providing medical care and nursing during the pandemic via a number of effective

Social infrastructure

First-level social infrastructure
The first level, or the formal type of social infrastructure, consists of spaces or institutions specifically designed as social spaces. In Denmark, they are typically linked to the Danish welfare system and must be low-threshold inclusive across gender, ethnicity, income and age. Examples include public libraries, parks, community centres.[183]

Second-level social infrastructure
The second level of social infrastructure is characterised by spaces for temporary occupancy. This is the social infrastructure or the spaces that are part of daily life and that are shared with other people. They typically have another function than for networking and socialising and are typically not designed for that purpose. In many cases, they appear to have been given little design focus. Examples include stairwells, car parks and corridors.[184]

Third-level social infrastructure
The third level, also known as the informal type of social infrastructure, is typically technologically mediated. It consists of networks in which contact can be made without thos socialising being physically present. This form of social infrastructure is beneficial in times of crisis as it can more easily mobilise groups of people or even whole neighbourhoods. Examples of this would be classmate phone lists, Facebook groups or other social online networks.[185]

'design hacks'.[177] The defective spatial flexibility in society's most vital health infrastructures testifies to the fact that a static notion of health and standardised solutions may potentially result in abrupt loss of control and impaired self-efficacy in a pandemic emergency.

The many senior citizens and people who were clinically extremely vulnerable during the pandemic reflect this inflexibility in the structures, especially in settings such as specialist-supported housing and care homes, where residents already have limited scope for exercising influence on their immediate environment. This forces us to question the impacts of the built environment. Most architects know how to orientate a building to optimise daylighting over the course of a day. But how are our buildings oriented towards diseases and physical and mental disabilities?

How to facilitate ‘the little in the big’

Countless narratives and pandemic research have established that many senior citizens felt unsafe venturing out of their homes and felt that they had no option but to isolate themselves, either in their own home or in their care home. One approach to this group would be to practise what senior researchers Sidse Grangaard and Rikke Skovgaard term ‘the little in the big’. The principle is quite simple but effective in terms of instilling self-efficacy for the most vulnerable members of society and their means of controlling, and to some extent determining, their own environment. Again, this refers to the impacts of the pandemic being like a photographic developer solution exposing what works and what does not in care facilities. One of the lessons was that centralising activities is not always a good thing. It may seem trite to assert that the built environment should provide for both small and large groups, but in a political climate that favours economies of scale, it is not a given. From the Dronning Anne-Marie Centret, which in its layout of outdoor/indoor spaces is reminiscent of a housing estate with a yard and block structure, we see how outdoor spaces were vital for the residents’ social life during a period when they were being shielded. The fact that the care facility is centred between communal grounds while the sections’ common areas are sited at the periphery of the grounds creates pockets of shielded public spaces, not unlike the hybrid space between the role of balconies as private public spaces, as seen around the world during the pandemic. The ready access to outdoor environments made it easier for residents to meet each other, as they were able to interact socially outdoors or across their individual balconies. In other words, it was down to the architecture, but also to the culture it enabled when the pandemic tested its potentials.

The researchers identified marked differences between childcare and eldercare facilities in terms of commitment to ‘the little in the big’ principle. They also explain that more elderly residents are likely to opt for daily exercise if it is organised decentrally, meaning in multiple small rooms.

How to turn buildings inside-out

As described in the Børnehuset Nøddehegnet example, it was essential in Denmark for preschool and school facilities to remain open during the lockdowns in order to preserve the functioning of a society in which many parents work. In the case of the Børnehuset Nøddehegnet childcare facility, chains of infection were broken by turning the choreographies for child drop-offs and pick-ups ‘inside-out’. The design of the premises, where the façade opens out into a shared playground and the diversified layout with multiple secondary entrances, made it possible to comply with the restrictions within the grounds of the facility. Maximising the building’s existing layout and reorganising circulations between primary and secondary entrances thus solved both logistical and spatial challenges.

The rituals induced by the pandemic in the form of new drop-off and pick-up routines and the use of secondary individualised entrances to the interiors have been continued at many facilities post-COVID. The advantages of turning things inside-out were not only breaking chains of infection, but also better scope for care-giving. The effects of closer integration of open spaces still play a major role at the facilities today. As in the eldercare facility, the siting and integration of open spaces in the overall layout was key to how Danish childcare and eldercare facilities tackled the COVID-19 pandemic. As stated, it is less important what it is called or what is looks like; the real question is what it can do and what it can become, especially when what we usually do no longer works as intended.

How to bring social infrastructures into homes

Another solution to the stifling constraints of life during lockdowns was to embrace the situation and physically bring vital social infrastructures into home life. Siljangade 4-8 is an example of a building where what sociologist Ray Oldenburg[178] defined as second and third places – work and leisure spheres – overlap with the first place, namely home. In the light of the pandemic, this collapse of spheres may feel claustrophobic, but as evidenced by Siljangade 4-8, the effect of multipurpose housing cannot be measured solely in terms of space, but also in terms of time. As such, Siljangade 4-8 radicalises the 15-minute city's temporal distribution by consolidating vital urban elements within an infection-resilient social bubble. However, working from home outside of periods with high infection rates is less claustrophobic in terms of avoiding morning rush-hour traffic jams and endless checkout queues at the supermarket or for the treadmill at the gym because everyone is doing the same at the same time.

Urban stretch without new-builds

A third solution to the closure of social infrastructures is to turn to other spaces that are more informal and tend to be overlooked in daily life. As explained in the interview with senior researcher Marie Stender, social infrastructures can be divided up into formal state-funded social infrastructures like schools and more informal, less obvious social spaces. Whereas the former are often characterised by a combination of indoor and outdoor spaces adapted for a number of societal services such as social care, learning and leisure activities, the importance of the other social infrastructure emerged when more trivial and ordinarily unseen physical spaces were put to use during the pandemic. Empty carparks, roads, corridors, secondary entrances, roofs and other zones on the border between private and public spaces, like balconies for example, became focal social infrastructures during lockdowns, as these spaces were not out-of-bounds, and instead came out of mundane obscurity as alternative, temporary spaces for interaction or shared reference. Balcony singalongs are probably the most remarkable examples of how

cities can be stretched, and how functional elasticity can provide healthy or socially uplifting environments both during and after crises.

The Konditaget Lüders rooftop amenity described in this publication is another example of a carefully designed hybridisation of a multi-storey carpark and a gym that reimagines the monofunctional carpark and transforms an infrastructural 'necessity' into a recreational space. This example advances a design ethos centred around the huge potential that exists in the overlooked everyday spaces that everyone uses, as opposed to the narrow focus of the unique and formal welfare architecture favoured by some.

In the wake of the COVID-19 emergency we should consider how by enabling greater flexibility in the built environment we can ensure greater self-efficacy, which can potentially not only improve our resilience to emergencies, but also ease some of the pressure on a healthcare sector burdened by budgets and labour shortages, including in more stable times.

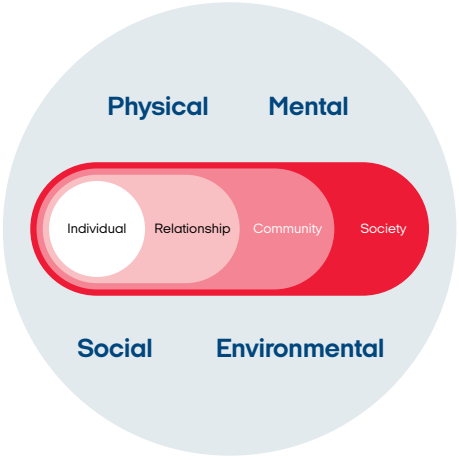
The socio-ecological health model

In order to reframe the transition from a blinkered focus on a given virus, i.e. the specific pathogen, to the inter-relatedness that shapes both human and microbial existential conditions, we subscribe to a socio-ecological health model.[179] Health is fostered across diverse scales and domains: in relationships between people, but also between human and non-human entities and through interactions with materials as well as political and financial agendas. In essence, more or less healthy lives are heavily dependent on the quality of the spatial relationships they are made up of.

In this sense, buildings and urban environments cannot be understood as passive effects of external societal perspectives predicated on budgets or medical science. Conversely, buildings and spaces are key to the ongoing creation and calibration of societal and health-related factors and emergencies.

Unlocking new potentials in familiar entities

We can and should learn from this. The claustrophobic experiences of the pandemic are in many respects comparable with the paralysing effect on us of confronting the dire implications of Earth Overshoot Day and the gloomy reports from the UN Climate Panel. The 2021 report from the IPPC states, for example, that western Europe has already built all the floorage required, and must consequently exclusively transform what already exists using a minimum of newly manufactured materials. In a world where more crave more, there is a need to enable new potentials in what already exists. The pandemic pointed the way forward.



The socio-ecological public health model we subscribe to in this publication is an elaboration of Urie Bronfenbrenner's ecological model of development. According to this model, public health is part of an ecological system.[186]

Based on this model, health is part of an ecological system in the sense that the impacts on the individual from interaction with other people and environments affect their personal health and agency. People are seen as intrinsic systems consisting of a number of health capacities, but also as part of many other social and environmental systems that are in constant motion and influence the individual's health capacities. Epidemics and pandemics are of particular interest in that context because of their societal influence and in that they link populations and places globally in chains of infection and social networks. My health and my behaviour affect other people and vice versa. The closure of schools and other social infrastructures adversely impacts health in the form of increased loneliness, stress and domestic violence. In that sense, buildings and infrastructures can be seen as tipping points circulating across scales and health dimensions.

Progress means not relapsing

Finally, we aim to contribute to the debate on resilience. As we transition from built reactions or responses in the examples presented in *Architecture of the Pandemic: A compendium of COVID-19 responses in the built environment* to a proactive focus in this publication, we are aligned with thought leaders in resilience research. Instead of defining resilience as the ability to withstand crisis to ensure 'normality', resilience in this context is defined as the capacity to live and develop with[in] change and uncertainty. Resilience as described here is thus a prospective approach. This is also the reason why we insist on building back differently rather than building back better.

Building back and forth

In the compendium of examples presented in *Architecture of the Pandemic*, we proposed that the documented responses could inspire and contribute to the discourse on how we can add value to pandemic preparedness in the built environment by a build back better approach.[180] In this publication we propose supplementing that approach with a build back differently approach. It goes beyond wordplay: the aim is not to disparage the good intentions and practices of build back better. In line with the socio-ecological health model, the build back differently approach emphasises a more situated approach in a world where different entities – human and non-human – inhabit discrete environments and have differing potentials and aspirations for what 'better' actually means, and how to achieve it. As for the temptation to predict what 'better' might be and then devise more or less generic procedures, we believe that this approach should be guided by a focus on how catastrophic events are not separate from, nor independent of the context[s] they arise in, either physically or socially.

Resilience

In line with the Stockholm Resilience Center, resilience in our context is defined as the capacity to deal with change and continue to develop well beyond the capacity to merely revert to the status quo. Resilience involves the ability to absorb shocks, avoid tipping points and keep options open, as well as the ability to innovate and transform in response to any emergency. This is why we emphasise the ability to build forwards as opposed to building back. From an architectural perspective, we are inspired by the two forms of resilience – *stealth* and *armour* – as presented in the interview with Jakob Brandtberg Knudsen.

Armoured resilience is a strategy of building using robust materials for protection against wind, weather and other contingencies, but which are less adaptable. Steal resilience is characterised by responding to an uncertain and unpredictable future with agility because the building is intrinsically adaptable. Whereas the armour strategy has been the most widely implemented in Denmark and elsewhere in the western world, a number of emergencies indicate that we need to incorporate both armour and stealth for resilience now and going forward.

Agency in a constricting world

Generally, our aim is to contribute reflection on what we can learn from the pandemic in terms of the wide array of ideas and practices that make up the built environment. As one perspective among others, a distillation of trends and actionable insights for an era in which our scope is gradually constricting the potentials. Four years into the UN Decade of Action, there is a need to not only recognise the urgency of the sustainability challenges, but also to better reflect on their complexity by rethinking and realigning public health and sustainable development in the built environment.

Control through indoor climate: The ability to control indoor air quality and separate ventilation systems was a major factor during the pandemic. Photo of ventilation in a façade, Copenhagen, Natalie Mossin.

Notes and references

Introduction

1 Tønnesen, Hanne. Terminologi : Forebyggelse, Sundhedsfremme og Folkesundhed [Discursive glossary of Danish-English disease prevention, health promotion and public health terms]. Version 1., Danish health Authority, 2005. P. 10. [accessed July 2024]: https://www.sst.dk/-/media/CA0B2ED9165F4C908DB3117BA4764058.ashx

Learning from the COVID-19 pandemic

2 World Health Organization. "About WHO." [2024]. [accessed 9 January 2024]: https://www.who.int/about

3 Statens Serum Institut. "Tidslinje for covid-19." [COVID-19 timeline] December 2022. [accessed 8 December 2023]: https://www.ssi.dk/-/media/arkiv/subsites/covid19/presse/tidslinje-over-covid-19/covid-19-tidslinje-lang-for-2020-2022-version-2---december-2022.pdf

4 Haugaard, Mie. Langberg, Maja. "Se de historiske øjeblikke: Sådan så Danmark ud gennem to års coronapandemi" [tele vised retrospective on two years of the COVID-19 pandemic in Denmark], TV2. 28 January 2022. [accessed 3 December 2023]: https://nyheder.tv2.dk/samfund/2022-01-28-se-de-historiske-oejeblikke-saadan-saa-danmark-ud-gennem-to-aars-coronapandemi

5 Aarhus BSS. HOPE. "How Democracies Cope with COVID-19 A Data-Driven Approach." [2022]. [accessed 9 January 2023]: https://hope-project.au.dk/#/

6 Faktalink. Bibliotek og undervisning. Historiske Kriser [article on past emergencies in Denmark, published by DBS Digital A/S]. [accessed 4 July 2024]: https://faktalink.dk/titelliste/kris/krishist?check_logged_in=1

7 Andersen, Anne Anthon. "1980'erne" [The 1980s]. Faktalink. Bibliotek og undervisning. [August 2019]. [accessed 9 January 2024]: https://faktalink.dk/1980erne

8 Jørgensen, Per Schultz. "Midtlivskrise". Den Store Danske på lex.dk [Entry on mid-life crisis in the online Danish national encyclopaedia]. [accessed 10 January 2024]: https://denstoredanske.lex.dk/midtlivskrise

9 Fenger-Grøndahl, Malene. "Big Data." Faktalink. Bibliotek og undervisning. [January 2020] [accessed 10 January 2024]: https://faktalink.dk/titelliste/big-data

10 Aarhus BSS. HOPE. "How Democracies Cope with COVID-19: A Data-Driven Approach." [2022]. [accessed 9 January 2023]: https://hope-project.au.dk/#/about

11 PsykiatriFonden. Tendenser i samfundet i en krise [Trends in society in a crisis]. [accessed 10 January 2024]: https://psykiatrifonden.dk/viden/temaer/klar-krisen/tendenser-samfundet-krisetid

12 Halberg, Louise. Roepstorff, Andreas. Petersen, Michael Bang. "Hvad kan vi lære om kriseadfærd fra corona-pandemien?" [What can we learn about crisis behaviour from the COVID-19 pandemic?]. HOPE Project [2022]. [accessed 12 January 2024]: file:///C:/Users/alin/Downloads/Hvad_kan_vi_l%C3%A6re_af_coronakrisen_HOPE_20220427%20(4).pdf

13 Halberg, Louise. Roepstorff, Andreas. Petersen, Michael Bang. "Hvad kan vi lære om kriseadfærd fra corona-pandemien?" [What can we learn about crisis behaviour from the COVID-19 pandemic?]. HOPE Project [2022]. [accessed 12 January 2024]: file:///C:/Users/alin/Downloads/Hvad_kan_vi_l%C3%A6re_af_coronakrisen_HOPE_20220427%20(4).pdf

14 Halberg, Louise. Roepstorff, Andreas. Petersen, Michael Bang. "Hvad kan vi lære om kriseadfærd fra corona-pandemien?" [What can we learn about crisis behaviour from the COVID-19 pandemic?]. HOPE Project [2022]. [accessed 12 January 2024]: P. 6.

15 Halberg, Louise. Roepstorff, Andreas. Petersen, Michael Bang. "Hvad kan vi lære om kriseadfærd fra corona-pandemien?" [What can we learn about crisis behaviour from the COVID-19 pandemic?]. HOPE Project [2022]. [accessed 12 January 2024]: P. 9.

16 Marker, Silas. "Ordet 'samfundssind' betyder ikke noget konkret - derfor kan det alligevel betyde så meget" [research article on the nature of 'samfundssind,' which translated literally to 'community mindedness']. Videnskab DK. 29 March 2020. [accessed 15 December 2023]: https://videnskab.dk/kultur-samfund/ordet-samfundssind-betyder-ikke-noget-konkret-derfor-kan-det-alligevel-betyde-saa-meget/

17 University of Copenhagen. "Stå sammen ved at holde afstand - Unge føler sig ensomme under coronakrisen" (on the impact of social distancing on youth loneliness). (2020) [accessed 12 January 2024]: https://coronaminds.ku.dk/resultater/de-unge-foeler-sig-ensomme-under-krisen/

18 See this publication, pp. 26-37.

19 Bech-Danielsen, Claus. "Pandemiernes aftryk på boligbyggeri og byudvikling" (Pandemic footprints on housing design and urban development). In: Aabo, Iversen, Lehmann, ed., Refleksioner fra en pandemi: en essaysamling om bymiljøer, bygninger og livskvalitet i lyset af COVID-19 (Essays on urban environments, buildings and quality of life in the light of COVID-19), 1st edition, Copenhagen.: Realdania, 2022. P. 8.

20 Finans Danmark. "Hvad skete der? – I august 2008 ramte den internationale finanskrise, der siden midten af 2007 havde ulmet, for alvor Danmark" (on Denmark and the 2008 financial crisis). [accessed 3 December 2023]: https://finansdanmark.dk/10-aaret-for-krisen/hvad-skete-der/

21 Mørk, Mads Biener. "Coronakurven er knækket, mener eksperter" (Experts believe COVID curve has been flattened). TV2 News. 21 February 2022. [accessed 3 December 2023]: https://nyheder.tv2.dk/samfund/2022-02-21-coronakurven-er-knaekket-mener-eksperter

22 Gørtz, Mette. "Vaccineskepsis skyldes informationsulighed og mistillid til myndighederne" (Vaccine scepticisim is due to information inequality and mistrust of authorities). University of Copenhagen. 1 February 2022. [accessed 12 January 2024]: https://www.econ.ku.dk/Nyheder/Alle_nyheder/vaccineskepsis-skyldes-informationsulighed-og-mistillid-til-myndigheder/

23 Halberg, Louise. Roepstorff, Andreas. Petersen, Michael Bang. "Hvad kan vi lære om kriseadfærd fra corona-pandemien?" (What can we learn about crisis behaviour from the COVID-19 pandemic?). HOPE Project (2022). [accessed 12 January 2024]. HOPE-Projektet (2022). P. 27.

The city and the built environment as a health factor

24 Sjøgren, Kristian. "Flere mennesker dør i dag tættere på gennemsnitslevealderen" (More people today die closer to the age of average life expectancy). Videnskab DK, 10 March 2020. [accessed July 2024]: https://videnskab.dk/krop-sundhed/flere-mennesker-doer-i-dag-taettere-paa-gennemsnitslevealderen/

25 Danish Architecture Center. "Modernisme" (Danish Modernism). [accessed July 2024]: https://dac.dk/viden/artikler/modernismen/

26 Paimio Sanatorium. "History: Paimio Sanatorium, Alvar Aalto's Breakthrough Project". [accessed July 2024]: https://paimiosanatorium.com/sanatorium/history/

27 Nielsen, Tine & Jensen, Line. "Beboelsesrum, en definition" (A definition of living space). Bolius, updated 14 March 2023. [accessed July 2024]: https://www.bolius.dk/beboelsesrum-en-definition-18684

28 Danish Architecture Center. "Brumleby: Banebrydende boligoase på Østerbro" (Brumleby: trail-blazing residential haven in the Østerbro district, Copenhagen).[accessed July 2024]: https://dac.dk/viden/arkitektur/laegeforeningens-boliger/

29 See this publication, pp. 26-37.

30 See this publication, pp. 103-106.

31 Høj, Olivia. "Tigermyggen bevæger sig længere og længere nordpå - og den tager vira med sig". (The tiger mosquito is migrating further and further north and carries viruses). DR, 2 September 2023. [accessed July 2024]: https://www.dr.dk/nyheder/udland/tigermyggen-bevaeger-sig-laengere-og-laengere-nordpaa-og-den-tager-vira-med-sig

32 Kongebro, Signe et al. "Hvad med dagslys? - Designmanual med forslag til helhedsrenovering" (What about daylight? A design manual with proposals for holistic renovation). Realdania, 2018. P. 7. [accessed July 2024]: https://realdania.dk/publikationer/faglige-publikationer/hvad-med-dagslys

33 See this publication, pp. 92-93.

34 Mikkelsen, Maria Hellesøe. "Lerjord – I en Sund Dansk Byggekultur" (Clay loam in a healthy Danish building culture). CI-NARK, 2022. P. 8.

35 Sjøgren, Kristian. "Hvorfor er der flere farlige dyr i troperne end i Danmark?" (Why are there more dangerous animals in the Tropics than in Denmark?). Videnskab DK, 26 April 2020. [accessed July 2024]: https://videnskab.dk/naturvidenskab/hvorfor-er-der-flere-farlige-dyr-i-troperne-end-i-danmark/

36 Kristensen, Sten Thorup. "Skal boliger bygges anderledes efter corona?" (Should homes be built differently post-Covid?). Børsen financial newspaper, 19 October 2020. [accessed July 2024]: https://borsen.dk/nyheder/ejendomme/skal-boliger-bygges-anderledes-efter-corona

37 See this publication, pp. 64-73.

38 Bech-Danielsen, Claus. "Pandemiernes aftryk på boligbyggeri og byudvikling" (Pandemic footprints on housing design and urban development). In: Aabo, Iversen, Lehmann, ed. Refleksioner fra en pandemi: en essaysamling om bymiljøer, bygninger og livskvalitet i lyset af COVID-19 (Essays on urban environments, buildings and quality of life in the light of COVID-19). 1st edition, Copenhagen: Realdania, 2022. P. 8.

39 Danish Centre for Disease Control. "Kolera" (Cholera). 2023. [accessed 6 October 2023]: https://www.ssi.dk/sygdomme-beredskab-og-forskning/sygdomsleksikon/k/kolera

40 Danish Centre for Disease Control. "Kolera" (Cholera). 2023. [accessed 6 October 2023]: https://www.ssi.dk/sygdomme-beredskab-og-forskning/sygdomsleksikon/k/kolera

41 Danmarkshistorien.dk. Aarhus University. "Modernisering, internationalisering og urbanisering" (Modernisation, internationalisation and urbanisation). 2020. [accessed 9 October 2023]: https:// danmarkshistorien.dk/perioder/fra-enevaeldig-heltstat-til-nationalstat-1814-1914/modernisering-internationalisering-og-urbanisering

42 Danmarkshistorien.dk. Aarhus University. "Modernisering, internationalisering og urbanisering" (Modernisation, internationalisation and urbanisation). 2020. [accessed 9 October 2023]: https:// danmarkshistorien.dk/perioder/fra-enevaeldig-heltstat-til-nationalstat-1814-1914/modernisering-internationalisering-og-urbaniserin

43 Carlsbergbyen. "Historien om Carlsberg og den gamle byggegrund" (The history of the Calsberg brewery and the former building site). [accessed 2 July 2024]: https://www.carlsbergbyen.dk/om-carlsberg-byen/historie

44 Danmarkhistorien.dk. Aarhus University. "Epidemier i danmarkshistorien" (Epidemics in Danish history). 2020. [accessed 4 December 2023]: https://danmarkshistorien.dk/om-os/nyheder/nyhed/artikel/epidemier-i-danmarkshistorien/

45 Barse, Marie. "Dansk kolera-lort fra 1853 kan give ny viden om epidemier" (Danish cholera faeces from 1853 can provide new insights into epidemics). Videnskab DK. May 2017. [accessed 2 July 2024]: https://videnskab.dk/kultur-samfund/dansk-kolera-lort-fra-1853-kan-give-ny-viden-om-epidemier//

46 Bech-Danielsen, Claus. Mechlenborg, Mette. Stender, Marie. Velkommen hjem: Tendenser i dansk boligarkitektur (Welcome home: Trends in Danish residential architecture).1st edition, Copenhagen: Politikens Forlag, 2018. P. 77.

47 Bech-Danielsen, Claus. Mechlenborg, Mette. Stender, Marie. Velkommen hjem: Tendenser i dansk boligarkitektur (Welcome home: Trends in Danish residential architecture).1st edition, Copenhagen: Politikens Forlag, 2018. P. 76

48 Frederiksberg Stadsarkiv. "Epidemier på Frederiksberg" (Epidemics in Frederiksberg Municipality, Copenhagen). [accessed 3 July 2024]: https://stadsarkivet.frederiksberg.dk/byhistorie/epidemier-pa-frederiksberg

49 Fridericia, L. S.: "Emil Hornemann" Dansk Biografisk Leksikon (Danish biographical encyclopaedia) at lex.dk. [accessed 4 December 2023]: https://biografiskleksikon.lex.dk/Emil_Hornemann

50 Rosdahl, Nils: "Emil Hornemann" Den Store Danske (Danish biographical encyclopaedia) at lex.dk. [accessed 9 October 2023]: https://denstoredanske.lex.dk/Emil_Hornemann

51 Danish Architecture Center. "Brumleby: Banebrydende bolig-oase på Østerbro" (Brumleby: trail-blazing residential haven in the Østerbro district, Copenhagen. [accessed 13 October 2023]: https://dac.dk/viden/arkitektur/laegeforeningens-boliger/

52 Danmarkshistorien.dk. Aarhus University. "FF Ulrik; Om arbejdernes byggeforeninger 1869" (Danish building socieities in 1869). (2020). [accessed 9 October 2023]: https://danmarkshistorien.dk/vis/materiale/ff-ulrik-om-arbejdernes-byggeforeninger-1869

53 Bech-Danielsen, Claus. Mechlenborg, Mette. Stender, Marie. "Velkommen hjem: Tendenser i dansk boligarkitektur" (Welcome home: Trends in Danish residential architecture), 1st edition, Copenhagen: Politikens Forlag, 2018. P. 82.

54 Jensen, Kirsten Marie Juel. "Det gammeldags toilet, dasset – hvor blev det af?" (The old-fashioned W.C., the privy, where did it go?). Videnscenteret Bolius. 1 April 2020. [accessed 4 December 2023]: https://www.bolius.dk/det-gammeldags-toilet-dasset-hvor-blev-det-af-92047

55 Bech-Danielsen, Claus. Mechlenborg, Mette. Stender, Marie. "Velkommen hjem: Tendenser i dansk boligarkitektur" (Welcome home: Trends in Danish residential architecture), 1st edition, Copenhagen: Politikens Forlag, 2018. P. 94.

56 Bech-Danielsen, Claus. Mechlenborg, Mette. Stender, Marie. "Velkommen hjem: Tendenser i dansk boligarkitektur" [Welcome home: Trends in Danish residential architecture], 1st edition, Copenhagen: Politikens Forlag, 2018. P. 95.

57 Danish Architecture Center. "Modernisme" [Danish Modernism]. [accessed July 2024]: https://dac.dk/viden/artikler/modernismen/

58 Bech-Danielsen, Claus. Mechlenborg, Mette. Stender, Marie. "Velkommen hjem: Tendenser i dansk boligarkitektur" [Welcome home: Trends in Danish residential architecture], 1st edition, Copenhagen: Politikens Forlag, 2018. P. 152.

59 Statistics Denmark. "Hjemmearbejdet er mere udbredt end før Covid-19" [Working from home is more common than pre-COVID-19]. 23 November 2022. [accessed 18 September 2023]: https://www.dst.dk/da/Statistik/nyheder-analyser-publ/nyt/NytHtml?cid=40158

Neighbourhoods and social infrastructure

60 Hansen, Simon Kjær. Et forsvar for storbyen : tæt, højt og fælles er vejen til bæredygtighed i det 21. århundrede [In defence of the metropolis: High-density, high-rise and shared is the way forward for 21st century sustainability]. 1st edition, Gads Forlag, 2021. P. 41.

61 Danish Centre for Disease Control. "Covid-19 - overvågning" [COVID-19 monitoring]. Ed. 2024. [accessed July 2024]: https://www.ssi.dk//sygdomme-beredskab-og-forskning/sygdomsovervaagning/c/covid19-overvaagning

62 Graugaard, Christian. "Først liv, så rum, så huse" [First life, then spaces, then houses]. Bibliotek For Læger. 1 September 2020. [accessed 3 October 2023]: https://ugeskriftet.dk/bfl/forst-liv-sa-rum-sa-huse

63 Danish Nature Agency, Ministry of Environment of Denmark. "Naturen stadig populær efter genåbning" [Danish nature is still popular post-pandemic]. 11 March 2022. [accessed 29 September 2023] https://via.ritzau.dk/pressemeddelelse/13645625/naturen-er-stadig-populaer-efter-genabning?publisherId=12230032

64 See this publication, pp. 84-93.

65 See this publication, pp. 84-93.

66 Branner, Charlotte. "Boom i corona-hunde fortsætter: 'Det er kommet bag på os, at det er steget så voldsomt'" [On the continuing boom in COVID-19 pets). Politiken newspaper. 30 December 2021. [accessed 3 July 2024]: https://politiken.dk/forbrugogliv/art8536893/%C2%BBDet-er-kommet-bag-p%C3%A5-os-at-det-er-steget-s%C3%A5-voldsomt%C2%AB

67 By og Havn. "Metroen til Nordhavn åbner den 28. marts" [On the opening of the Copenhagen Metro route to the Nordhavn district on 28 March 2020). 24 January 2020. [accessed 4 October 2023] https://byoghavn.dk/metroen-til-nordhavn-aabner-den-28-marts/

68 Stender, M. & Nordberg, L. W. [2022]. "Learning from Covid19 – Social Infrastructure in Disadvantaged Housing Areas in Denmark." Urban Planning. 7[4]. P. 434.

69 Stender, M. & Nordberg, L. W. [2022]. "Learning from Covid19 – Social Infrastructure in Disadvantaged Housing Areas in Denmark." Urban Planning. 7[4]. P. 441.

70 Stender, M. & Nordberg, L. W. [2022]. "Learning from Covid19 – Social Infrastructure in Disadvantaged Housing Areas in Denmark." Urban Planning. 7[4]. Pp. 441-442.

Care facility and school learnings from the pandemic

71 Petersen, Anne Sofie Møller. "Daginstitutionerne skal fortsat holde åbent, siger ministeren" [Prime Minister's statement on keeping childcare facilities open during lockdown). TV2 News. 4 January 2021. [accessed 8 November 2023]: https://nyheder.tv2.dk/samfund/2021-01-04-daginstitutionerne-skal-fortsat-holde-aabent-siger-ministeren

72 Skovgaard Nielsen, R.S. & Grangaard, S. "Corona som springbræt til fremtidens skole" [COVID-19 as a springboard to schools of the future). Issuu. 23 November 2022. [accessed 9 November 2023]: https://issuu.com/folkeskolen/docs/folkeskolen_nr._20_2022/s/17460555

73 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research Project on a new framework for everyday life). AAU BUILD, Aalborg University. [2022], p. 3.

74 Danish Gerontological Society. "Hjemlighed på plejehjem" [Homeliness in Danish eldercare facilities). 29 September 2018. [accessed 11 November 2023]: https://danskgerontologi.dk/wp-content/uploads/2018/09/200512.pdf

75 Museerne På Kanten. "Fattiggårdenes historie" [The history of Danish poorhouses]. [accessed 11 November 2023]: http://museernepaakanten.dk/huse/fattiggarden/fattiggardenes-historie/

76 Danish Gerontological Society. "Hjemlighed på plejehjem" [Homeliness in Danish eldercare facilities]. 29 September 2018. [accessed 11 November 2023]: https://danskgerontologi.dk/wp-content/uploads/2018/09/200512.pdf

77 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research Project on a new framework for everyday life]. AAU BUILD, Aalborg University. [2022], p. 27.

78 Mansø, Rikke Gjøl. Tofte, Line Rønn. Jørgensen, Anna Sol. "Få overblikket over de nye corona-tiltag" [Overview of the latest COVID-19 control measures]. Danish Broadcasting Corporation 17 March 2020. [accessed 13 November] https://www.dr.dk/nyheder/politik/faa-overblikket-over-de-nye-corona-tiltag-se-hvad-du-ikke-maa-fra-i-dag-klokken-10

79 See this publication, pp. 84-93

80 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research project on a new framework for everyday life]. AAU BUILD, Aalborg Univerity. [2022], p. 26.

81 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research Project on a new framework for everyday life]. AAU BUILD, Aalborg University. [2022], p. 26.

82 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag." Institut for Byggeri, By og Miljø (BUILD), Aalborg Universitet. [2022] S. 27

83 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research Project on a new framework for everyday life]. AAU BUILD, Aalborg University. [2022], p. 18.

84 Olesen, Emilie Palm. "Tre nye lærere: Dét ville jeg gerne have vidst inden første lærerjob" [Three new teachers: What I'd like to have known before my first teaching post]. Folkeskolen, 13 December 2022. [accessed 10 November 2023]: https://www.folkeskolen.dk/laererstuderende-laereruddannelsen-ny-laerer/tre-nye-laerere-det-ville-vi-gerne-have-vidst-inden-forste-laererjob/4690199

85 Videnskab DK. "Studie: Børn har ikke godt af for meget legetøj" [Study on the drawbacks of too many toys for early learners]. 6 December 2017. [accessed 10 November 2023]: https://videnskab.dk/krop-sundhed/studie-boern-har-ikke-godt-af-for-meget-legetoej/

86 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research Project on a new framework for everyday life]. AAU BUILD, Aalborg University. [2022], p. 18.

87 Nordea Fonden. "Ny forskning: Sundere og stærkere børn i naturen" [New study: Healthier, stronger children in nature]. 26 March 2019. [accessed 14 November 2023]: https://nordeafonden.dk/nyheder/ny-forskning-sundere-og-staerkere-boern-i-naturen

88 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research Project on a new framework for everyday life]. AAU BUILD, Aalborg University. [2022], p. 10.

89 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research Project on a new framework for everyday life]. AAU BUILD, Aalborg University. [2022], p. 7.

90 Stilling, Sofie & Mossin, Natalie. "Rapport fra Fronten" [Report from the frontline]. [Smith Innovation. [2016]. [accessed 15 November 2023]: https://smithinnovation.dk/da/viden/rapport-fra-fronten

Home and residence

91 Fishman, Robert. Bourgeois Utopias: The Rise and Fall of Suburbia. New York: Basic Books. 1987.

92 Jørgensen, Claus Møller. "Modernisering, internationisering og urbanisering" [Modernisation, internationalisation and urbanisation]. Danmarkshistorie.dk. Aarhus University. [2020] [accessed 9 October 2023.]: https://danmarkshistorien.dk/perioder/fra-enevaeldig-helstat-til-nationalstat-1814-1914/modernisering-internationalisering-og-urbanisering

93 Mechlenborg, Mette. "Hvordan skal vi bo, når arbejdet flytter hjem?" [On home-life impacts of working from home]. In: Aabo, Iversen, Lehmann, ed. Refleksioner fra en pandemi: en essaysamling om bymiljøer, bygninger og livskvalitet i lyset af COVID-19 [Essays on urban environments, buildings and quality of life int the light of COVID-19], 1st edition, Copenhagen.: Realdania, 2022. Pp. 30-40.

94 The Workers Museum. "100 år med 8-timers arbejdsdag" [Centenary of the 8-hour workday]. [accessed 23 November 2023]: https://www.arbejdermuseet.dk/det-sker/aktuelle-udstillinger/tidligere-udstillinger/100-aar-med-8-timers-arbejdsdag/

95 Zahle, Karen. "Kay Fisker. " Entry in Den Store Danske online national encyclopaedia. 25 May 2022. [accessed 23 November 2023]: https://denstoredanske.lex.dk/Kay_Fisker

96 Danish Architecture Center. "Funktionalisme" [Functionalism]. [Accessed 23 November 2023]: https://dac.dk/viden/artikler/funktionalisme/

97 Vestersøhus. Historie [A history of the iconic Danish funtionalist Vestersøhus housing block]. [accessed 23 November 2023]: https://vestersoehus.dk/ejerforeningen/historie

98 Mechlenborg, M. [2007]. "Hjemme i globaliseringen" [At home in globalisation]. Tidsskriftet Dansk Sociologi, 4[18], 71-85. Article no. 4, 18: https://rauli.cbs.dk/index.php/dansksociologi/article/view/2302/2292 https://vbn.aau.dk/en/publications/hjemme-i-globaliseringen

99 Kristensen, Anne Dahl. "Danskerne skar en tredjedel af forbruget på boliger i 2022" [Danes cut a third of their spending in homes in 2022]. Boligsiden. 14 January 2023. [accessed 26 November 2023]: https://www.boligsiden.dk/nyheder/bolighandel/danskerne-skar-en-tredjedel-af-forbruget-paa-boliger-i-2022#:~:text=Samlet%20set%20har%20danskerne%20brugt%20cirka%20117%20milliarder,resterende%2012%20milliarder%20er%20brugt%20p%C3%A5%20%C3%B8vrige%20boligtyper.

100 Bolius Videnscenter. "Danskerne i det byggede miljø. Boligens betyding for oplevet livskvalitet fordelt på boligtype" [Danes in the built environment. The significance of home for perceived quality of life, by housing type]. November 2021. [accessed 26 November 2023]: https://realdania.dk/publikationer/faglige-publikationer/danskerne-i-det-byggede-miljoe-2021

101 Gregersen, Kim. "Så lang tid bor en dansker i gennemsnit i hus og ejerlejlighed" [Average Danish occupancy of houses and owner-occupied flats]. Videnscenteret Bolius. 16 August 2019. [accessed 24 November 2023]: https://bolius.dk/saa-lang-tid-bor-en-dansker-i-gennemsnit-i-hus-og-ejerlejlighed-47952

102 Statistics Denmark. "Er du en gennemsnitsdansker?" [Are you an average Dane?]. [2023] [accessed 24 November 2023]: https://www.dst.dk/da/Statistik/laer-om-statistik/gennemsnitsdanskeren

103 See this publication: pp. 39-51.

104 Kaldahl, Sebastian. Ellegaard, Bastian Emil. "Den nye normal: 100.000 flere arbejder hjemme" [The new normal: 100,000 more Danes working from home]. Confederation of Danish Industry. December 2021. [accessed 27 November 2023]: https://www.danskindustri.dk/arkiv/analyser/2021/11/den-nye-normal-100000-flere-arbejder-hjemme/

105 Statistics Denmark. "Fald i hyppigt hjemmearbejde efter COVID-19" [Fall in Danish frequent working from home post-COVID-19]. 23 August 2023. [accessed 4 July 2024]: https://www.dst.dk/da/Statistik/nyheder-analyser-publ/nyt/NytHtml?cid=46150

106 See this publication, pp. 84-93.

107 Larsen, Katrine Rønsig. "Portræt: Ph.d.-studerende ved Saxo-Instituttet Katrine Rønsig Larsen." [Portrait: Katrine Rønsig Larsen, PhD student, Saxo Institute, University of Copenhagen]. "Stay Home". 24 November 2020. [accessed 26 November 2023]: https://stayhomestudier.dk/2020/11/24/portraet-ph-d-studerende-ved-saxo-instituttet-katrine-roensig-larsen/

108 United Nations. "Vold i forhold er steget med 60 procent" [Partner violence has increased by 60 per cent]. 8 May 2020. [accessed 26 November 2023]: https://unric.org/da/vold-i-naere-forhold-er-steget-med-60-procent/

109 Gudmandsen, Johan. "4-dages arbejdsuge sænker stress, mens produktiviteten bevares, viser nyt studie" [New study shows 4-day workweek reduces stress while preserving productivity]. Videnskab DK. 21 February 2023. [accessed 27 November 2023]: https://videnskab.dk/kultur-samfund/4-dages-arbejdsuge-saenker-stress-mens-produktiviteten-bevares-viser-nyt-studie/

110 Mechlenborg, Mette. "Hvordan skal vi bo, når arbejdet flytter hjem?" [On homelife impacts of working from home]. In: Aabo, Iversen, Lehmann, ed., Refleksioner fra en pandemi: en essaysamling om bymiljøer, bygninger og livskvalitet i lyset af COVID-19 [Essays on urban environments, buildings and quality of life in the light of COVID-19]. 1st edition, Copenhagen: Realdania, 2022. Pp. 30-40.

The design provisions exemplified in realised architecture and planning

Example: Friluftsskolen

111 Renoverprisen "Friluftsskolen Helhedsrenoveret" [Renovation award for comprehensive renovation of Friluftsskolen open-air school]. [accessed July, 2024]: https://renover.dk/projekt/friluftsskolen-helhedsrenoveret/

112 Rosdahl, Nils. "Tuberkulose (tuberkulosebekæmpelsens historie i Danmark)" [History of tuberculosis control in Denmark]. Den Store Danske online national encyclopaedia. 29 May 2010. [accessed 4 July 2024]: https://denstoredanske.lex.dk/tuberkulose_(tuberkulosebek%C3%A6mpelsens_historie_i_Danmark

113 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" [On care-facility and school learnings from COVID-19 – practice, use, interior design and buildings. Report from a pilot study under the RESPOND research project on a new framework for everyday life]. AAU BUILD, Aalborg University. (2022). P. 18.

114 See this publication, pp. 121-124.

115 Nordea Fonden. "Ny forskning: Sundere og stærkere børn i naturen" [New study: healthier, stronger children in nature]. 26 March 2019. [accessed 14 November 2023]: https://nordeafonden.dk/nyheder/ny-forskning-sundere-og-staerkere-boern-i-naturen

116 See this publication, pp. 26-37.

117 However, there are still examples of application of the pavilion principles in recent hospital buildings such as Copenhagen Children's Hospital in Copenhagen: 3XN, Arkitema, Kristine Jensens Tegnestue & NIRAS. Copenhagen Children's Hospital (Børneriget / Mary Elizabeths Hospital). For Capital Region of Denmark, 2016- . [accessed July 2024]: https://3xn.com/project/copenhagen-childrens-hospital .

118 Byens Netværk. "Helhedsrenovering af Friluftsskolen" [Comprehensive renovation of Friluftsskolen open-air school]. 2021. [accessed July 2024]: https://www.byensnetvaerk.dk/da-dk/arrangementer/2021/friluftsskolen.aspx

119 Europa Nostra. "Restaurering af Friluftsskolen i København vinder Europa Nostra Pris 2023" [Restoration of Friluftsskolen open-air school in Copenhagen wins Europa Nostra award 2023]. 2023. [accessed July 2024]: https://www.europa-nostra.dk/priser-awards/34-2/2021-2030/2023-friluftsskolen-i-koebenhavn/

Example: The Star Homes Project

120 World Health Organization. "Deaths from communicable diseases on the rise in Africa". 11 April 2022. [accessed July 2024]: https://www.afro.who.int/news/deaths-noncommunicable-diseases-rise-africa

121 See this publication, p. 23.

122 Torgan, Carol. "How Mosquitoes Detect People". National Institutes of Health – NIH Research Matters. 16 December 2013. [accessed July 2024]: https://www.nih.gov/news-events/nih-research-matters/how-mosquitoes-detect-people

123 Torgan, Carol. "How Mosquitoes Detect People". National Institute of Health – NIH Research Matters. 16 December 2013. [accessed July 2024]: https://www.nih.gov/news-events/nih-research-matters/how-mosquitoes-detect-people.

124 Aarhus Vand. "The Aarhus River Project". 5 March 2021. [accessed July 2024]: https://www.aarhusvand.com/showcases/climate-adaption/aarhus-river-project/

125 Hamidi, S., Sabouri, S. and Ewing, R. (2020). "Does Density Aggravate the Covid-19 Pandemic?". Journal of the American Planning Association, 86 (4), pp. 495-509.

126 Moreno, Bruno et al. The 15-minute City. Wiley. 2024.

127 Gehl People. "Public Space, Public Life & COVID 19." [accessed 6 July 2024]: https://covid19.gehlpeople.com/lockdown

Eksempel: Konditaget Lüders

128 See this publication, pp. 38-51

Example: Børnehuset Nøddehegnet

129 Børnehuset Nøddehegnet. "Om børnehuset" (About the childcare facility). Dagplejen i Gladsaxe. [accessed July 2024]: https://glx-noddehegnet.aula.dk/om-boernehuset/om-boernehuset

130 See this publication, pp. 52-63.

131 Finn Bach, Director of Building and Strategy, Gladsaxe Municipality. Written email reply to Adam Linde Nielsen dated 21 March 2023.

132 Finn Bach, Director of Building and Strategy, Gladsaxe Municipality. Written email reply to Adam Linde Nielsen dated 21 March 2023.

133 Finn Bach, Director of Building and Strategy, Gladsaxe Municipality. Written email reply to Adam Linde Nielsen dated 21 March 2023.

134 Finn Bach, Director of Building and Strategy, Gladsaxe Municipality. Written email reply to Adam Linde Nielsen dated 21 March 2023.

135 See this publication, pp. 52-63.

Example: Dronning Anne-Marie

136 Frederiksberg Forenede Boligselskaber. "Afdelinger: Solbjerg Have" (Frederiksberg united housing associations' data on the Solbjerg Have housing estate). [accessed July 2024]: https://ffb-bolig.dk/solbjerg-have

137 OK Fonden. "Dr. Anne-Marie Centret: Huset" (Description of the Dronning Anne-Marie Centret eldercare facility by the non-profit OK Fonden). [accessed July 2024]: https://ok-fonden.dk/damc/huset/

138 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" (On care-facility and school learnings from COVID-19 –practice, use, interior design and buildings. Report from a pilot study under the RESPOND research project on a new framework for everyday life). AAU BUILD, Aalborg University. [2022]] p. 26.

139 Skovgaard Nielsen, R.S. & Grangaard, S. "Institutioners læring fra Corona - praksis, brug, indretning og bygninger: Notat fra pilotstudie som led i forskningsprojektet RESPOND – Rammerne for den nye hverdag" (On care-facility and school learnings from COVID-19 –practice, use, interior design and buildings. Report from a pilot study under the RESPOND research project on a new framework for everyday life). AAU BUILD, Aalborg University. [2022]] p. 26.

140 See this publication, pp. 52-63

141 BR18. Danish Building Code. "5.1.1 Anvendelseskategorier. Anvendelseskategori 6" (use categories) (2018) P. 7.

142 See this publication, pp. 52-63.

Eksemple: Balancen

143 National Institute on Aging (NIA). "Social isolation, loneliness in older people pose health risks". National Institutes of Health (NIH). [accessed July 2024]: https://www.nia.nih.gov/news/social-isolation-loneliness-older-people-pose-health-risks

144 See this publication, pp. 38-51.

145 Pedersen, Max. "Seniorbofællesskaber i coronaens tid" (Senior co-living schemes during COVID-19). Seniorboligen.dk & Realdania. May 2024. [accessed July 2024]: https://realdania.dk/publikationer/faglige-publikationer/seniorbofaellesskaber-i-coronaens-tid

146 Riba Architecture. "Healthy Placemaking after COVID-19". 8 August 2020. [accessed July 2024]: https//www.architecture.com/knowledge-and-resources/knowledge-landing-page/blog-place-health

147 Danmarks Statistik. "Fortsat færre ældre bor i pleje- og ældreboliger" (Fewer Danish senior citizens residing in care homes and sheltered housing). Statistics Denmark Bulletin No . 433, 24 November 2020. [accessed July 2024]: https://www.dst.dk/da/Statisik/nyheder-analyser-publ/nyt/NytHtml?cid=32187

148 Ørum, Eva. "Balancen i Ry: Skønheden i materialerne" (Balancen in Ry: Aesthetic materials). Danish Architecture Center. [accessed July 2024]: https://dac.dk/viden/arkitektur/balancen-i-ry-skoenheden-i-materialerne/

149 PensionDanmark. "Seniorbofællesskab i Ry hædres med historisk diamantcertificering" (Senior co-living in Ry awarded unprecedented diamond certification). Press release, 16 August 2022. [accessed July 2024]: https://www.pensiondanmark.com/presse/pressemeddelelser/2022/seniorbofallesskab-i-ry-hadres-med-historisk-diamantcertificering/?AspxAutoDetectCookieSupport=1

150 PensionDanmark. "Værdiprogram: Balancen - Bæredygtige livsstilsboliger i Ry" (Value programme: Balancen - sustainable lifestyle housing in Ry). Vandkunsten & andel. March 2019. [accessed July 2024]: https://realdania.dk/publikationer/faglige-publikationer/værdigprogram-ry

151 Pedersen, Max. "Seniorbofællesskaber i coronaens tid" (Senior co-living schemes during COVID-19). Seniorboligen.dk & Realdania. May 2024. [accessed July 2024]: https://realdania.dk/publikationer/faglige-publikationer/seniorbofaellesskaber-i-coronaens-tid

152 Pedersen, Max. "Seniorbofællesskaber i coronaens tid" (Senior co-living schemes during COVID-19). Seniorboligen.dk & Realdania. May 2024. [accessed July 2024]: https://realdania.dk/publikationer/faglige-publikationer/seniorbofaellesskaber-i-coronaens-tid

Example: Siljangade 4-8

153 Renoverprisen. "Nomineret 2022: Siljangade – Fra nedslidt industri til co-working og co-living space" (Renovation award: Nominee 2022: Siljangade; from dilapidated disused idustrial site to co-working and co-living space). [accessed July 2024]: https://renover.dk/projekt/siljangade/

154 Københavns Kommuneplan 2019. "Retningslinjer: Erhverv: Kreative zoner" (City of Copenhagen urban plan 2019 for commercial creative zones). [accessed July 2024]: https://kp19.kk.dk/retningslinjer/erhverv/kreative-zoner

155 Juul Frost Arkitekter. "Projects: Siljangade". [accessed July 2024]: https://juulfrost.dk/en/project/siljangade

156 Lerner, Jaime. Urban Acupuncture. Island Press. 2003.

157 See this publication, pp. 64-73.

158 See this publication, pp. 64-73.

159 Nabo Farm. "Om Nabo Farm" (About Nabo Farm). [accessed July 2024]: https://nabofarm.com/pages/about-nabofarm

160 See this publication, pp. 64-73.

Architecture and public health – a theoretical perspective

161 Colomina, Beatriz et al. Editorial Sick Architecture. E-Flux. November 2020. https://www.e-flux.com/architecture/sick-architecture/360079/editorial/

162 Global Health Security Index. "How the US squandered its capacities to respond to the pandemic". December 2021. https://ghsindex.org/news/how-the-united-states-squandered-its-capacities-to-respond-to-the-pandemic/

163 Horton, R. "Covid-19 Is Not a Pandemic". The Lancet, 396, p. 874. 2020.

164 Sörlin, S. "Det är nu vi väljer hur Sverige ska se ut efter pandemin" (It's now we have to choose how Sweden should look post-pandemic). Dagens Nyheter newspaper, 4 May 2020. Available at: https://www.dn.se/kultur-noje/det-ar-nu-vi-valjer-hur-sverige-ska-se-ut-efter-pandemin/

165 Stadsplanelag (1931). Swedish Code of Statutes, 142.

166 Rockstrom, Johan et al. "Shaping a resilient future in response to COVID-19". Nature Sustainability. May 2023. https://www.nature.com/articles/s41893-023-01105-9

167 Colomina, Beatriz. "The bed in the age of Covid-19". Signe. July 2022. https://www.pavillon-arsenal.com/en/signe/12522-the-bed-in-the-age-of-covid-19.html

168 Mossin, Bøjstrup, Vasconcelos, Hinsby, Jensen. "Pandemiens Arkitektur" [Architecture of the Pandemic]. Realdania. April 2022. https://realdania.dk/publikationer/faglige-publikationer/pandemiens-arkitektur

169 Kennicott, P. "Designing to survive". Washington Post. July 2020. https://www.washingtonpost.com/magazine/2020/07/13/pandemic-has-shown-us-what-future-architecture-could-be/

170 Easterling, K. Medium Design: Knowing How to Work on the World. Verso 2021. P. 8 e-book version.

171 Easterling, K. Medium Design: Knowing How to Work on the World. Verso 2021. P. 15 e-book version.

172 Fogh Jensen, A. Brave New Normal. Filosoffen 2022. P. 95.

173 Latour, B. We have never been modern. Cambridge: Harvard University Press [1993].

174 Moreno, C.; Allam, Z.; Chabaud, D.; Gall, C.; Pratlong, F. "Introducing the '15-Minute City': Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities". Smart Cities, 2021, 4, pp. 93-111. https://doi.org/10.3390/smartcities4010006

175 Klinenberg, E. Palaces for the people: How social infrastructure can help fight inequality, polarisation, and the decline of civic life. Penguin, 2018. p. 17.

176 Klinenberg, E. Palaces for the people: How social infrastructure can help fight inequality, polarisation, and the decline of civic life. Penguin, 2018. p. 12.

177 Sar, S.L. "The ethnography of infrastructure". American Behavioral Scientist. 1999., 43[3], pp. 377-391. https://doi.org10.1177/00027649921955326

178 MASS architects. "Redesigning Hospital Spaces on the Fly to Protect Healthcare Wokers". April 2020. https://mass-designgroup.org/sites/default/files/multiple-file 2020-04Redesigning%20Hospital%20Spaces%20on%20the%20Fly%20to%20Protect%20Healthcare%20Workers_4.pdf

179 Oldenburg, R. The Great Good Place. Da Capo Press. 1999.

180 Bronfenbrenner, U. The ecology of human development. Cambridge, MA: Harvard University Press. 1979.

181 Armstrong, G. L., Conn, L. A., & Pinner, R. W. [1999]. "Trends in infectious disease mortality in the United States during the 20th century". JAMA, 281[1], pp. 61–66.

182 Freudendal-Pedersen, M. Galland, D. Høg, E. Hecht Stenum, O. "15 minutters byen. Kort fortalt" [a Danish explainer on the 15-Minute City concept]. Realdania. January 2024..

183 Stender, M. & Nordberg, L. W. "Learning from Covid19 – Social Infrastructure in Disadvantaged Housing Areas in Denmark". Urban Planning. 2022. 7[4], p. 434.

184 Stender, M. & Nordberg, L. W. "Learning from Covid19 – Social Infrastructure in Disadvantaged Housing Areas in Denmark". Urban Planning. 2022 7[4]

185 Stender, M. & Nordberg, L. W. "Learning from Covid19 – Social Infrastructure in Disadvantaged Housing Areas in Denmark". Urban Planning. 2022. 7[4], p. 441-442

186 Bronfenbrenner, Urie. The Ecology of Human Development. Harvard University Press. 1981.

Architecture for Public Health
Insights, design provisions and examples from the built environment in Denmark in the light of the COVID-19 pandemic

This publication was funded by the non-profit Realdania association under the "RESPOND – a new framework for everyday life" initiative focusing on what the built environment can learn from the COVID-19 pandemic.

The publication was compiled by
Royal Danish Academy – Institute of Architecture and Technology
Natalie Mossin (editor-in-chief)
Ingeborg Hau (editor-in-chief)
Adam Linde Nielsen (Interviews)
Peter Hinsby Leal (essay)
Tiago Da Costa Vasconcelos (Examples)
Thomas Chevalier Bøjstrup
Minna Regitze Berner
Clara Ringgaard Poulsen

Layout
AM Copenhagen

Cover photo
Steffen Stamp

Print
Dystan & Rosenberg

Circulation
250

ISBN
978-87-93360-56-3

Acknowledgements
With thanks to Mette Mechlenborg, Marie Stender, Claus Bech-Danielsen, Jakob Brandtberg Knudsen, Rikke Skovgaard Nielsen, Sidse Grangaard and Michael Bang Petersen.


PRINTED IN DENMARK


NORDIC SWAN ECOLABEL

5041 0504


FSC
www.fsc.org
MIX
Paper from
responsible sources
FSC® C016433


ClimateCalc™
This printed matter is carbon compensated according to ClimateCalc. Offsets purchased from:
Gold Standard
www.climatecalc.eu
CC-000062/DK

In the same series

Architecture of the Pandemic

Many creative designs and buildings saw the light of day during the COVID-19 pandemic. This book compiles 35 unique examples from around the world, including Denmark, presented as inspiration for promoting health and quality of life through architecture.

The aim of the book was to collect examples of COVID-19 measures in cities and buildings informed by needs that arose during the pandemic in Denmark and internationally. These are solutions intended to inspire and contribute to the discourse on how the built environment can be pandemic-proofed with co-benefits through a 'build back better' approach, and which may be adopted as natural elements of everyday life post-pandemic.

This publication was compiled and edited by the Royal Danish Academy and forms part of the Realdania association's "RESPOND – a new framework for everyday life" initiative.

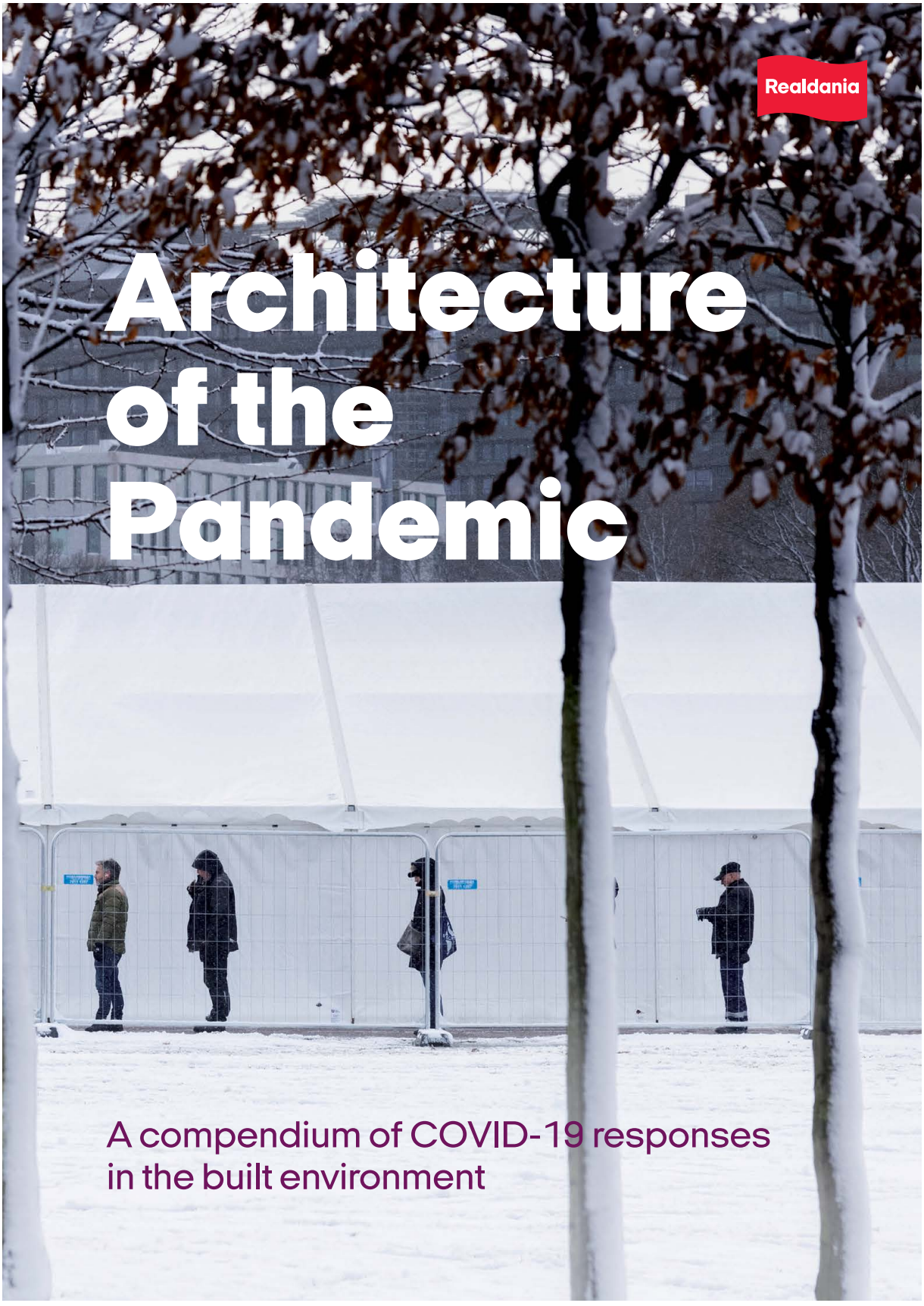
Publication date
2022

Number of pages
174

Authors
Natalie Mossin
Thomas Chevalier Bøjstrup
Peter Hinsby Leal
Tiago Da Costa Vasconcelos
Julie Zepernick Jensen

Realdania

Architecture of the Pandemic



A compendium of COVID-19 responses in the built environment

Access to community : During the pandemic, the inaccessibility of many formal and informal meeting places and communal spaces adversely impacted well-being and eroded social support systems. Photo from Tivoli, Copenhagen, Natalie Mossin.

Realdania