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BUILD BACK BETTER? PANDEMIC LESSONS FOR FUTURE RESIDENTIAL ARCHITECTURE

**MARIE STENDER, MALENE RUDOLF LINDBERG AND
SIRID BONDERUP**

Abstract

Previous pandemics have played a major role in the development of modern architecture and urban planning, but what will be the long-term effects of Covid-19 on residential architecture? A series of lockdowns severely influenced our ways of working and living, organizing and using the home, sharing spaces and relating to neighbours and surroundings. During the lockdown, scholars argued that the pandemic was a grey swan causing radical lasting changes (Krastev, 2020), that no turning back to normality was possible (Žižek, 2020) and that the pandemic was not to be seen as a crisis but rather as a condition (Latour, 2021). OECD and other stakeholders claimed that we in the wake of the pandemic must find ways to ‘build back better’ – hence not just return to business as usual to restore economies and livelihoods, but also increase society’s sustainability and resilience (OECD, 2020). This article reviews the research literature on housing and residential architecture published during and immediately after the pandemic lockdowns to outline researchers’ suggestions for enhancing the crisis resilience of housing and residential architecture in the wake of the pandemic. Based on the literature review, we discuss the possible long-term effects of COVID-19 on residential architecture and built environments.

Keywords:
Covid-19, pandemic, housing,
residential architecture,
literature review

Introduction

The COVID-19 pandemic had a major impact on societies and economies across the world. This has been most evident during the lockdowns with their many restrictions on social life, but what will be the long-term impact of the pandemic on society, everyday life and the built environment? Undoubtedly, COVID-19 changed all our lives, especially our home lives and how we used our homes while lockdowns and stay-at-home orders were in place. Previous pandemics and epidemics have led to guiding architectural principles such as the need for light, space and fresh air (Bech-Danielsen, 2022), many of which still shape how we build and live. It is therefore natural to speculate about the impacts on housing and residential architecture of the COVID-19 pandemic: How will it change how we use, choose and design our homes in the long run?

This article reviews the housing research literature published under and immediately after the pandemic lockdowns to gather insights, imaginaries and implications related to COVID-19 for housing and residential architecture. The aim is to analyse and discuss the lessons to be learned from the pandemic. It is based on the RESPOND research project, which focuses on the long-term implications of the COVID-19 pandemic on everyday life and the built environment in Denmark to identify, document and explore COVID-19-related transformations. The empirical and analytical focus of RESPOND is directed further by the question of how these transformations interrelate with three major societal challenges of our time: Social balance and equality, regional development and the green transition. RESPOND aims to contribute new knowledge on how “lessons learned” from the pandemic can help us in addressing these three societal challenges. In this way, the project aims to contribute to building up the resilience of societies and the built environment against future challenges such as new pandemics, climate change, economic crises, etc. After the literature reviews follows a discussion of how visions of post-pandemic housing and residential architecture clash with contemporary trends and critical societal agendas concerning how we build, live and interact, as well as our suggestions for how RESPOND and other research projects can explore this. While the RESPOND project focuses primarily on the Danish context, this article goes beyond national borders and includes literature from all over the world, published in scientific journals in the period 2020 to mid-2022. Bearing in mind that the nature and extent of pandemic consequences vary significantly across the world, and lockdown policies and durations vary much from context to context, the discussion zooms in and focuses on lessons and implications for housing and residential architecture relevant to the Danish context. Compared to other countries, lockdowns in Denmark were less extensive, with only two shorter periods of full lockdown, the first from March to April 2020 and the second from December 2020 to February 2021 and no curfews imposed (SSI, 2022). The conclusions of the article draw on both the global literature and the more local discussions,

and they are therefore pertinent beyond the Danish borders and applicable also elsewhere.

As currently promoted by the Organisation for Economic Co-operation and Development (OECD) and other stakeholders and policymakers, the pandemic can be seen as an occasion to 'build back better' (OECD, 2020). This concept originates from post-disaster reconstruction in the wake of earthquakes but has over the last couple of years also been applied to how societies can recover after the COVID-19 pandemic. Building back better is about not just returning to business as usual to restore economies quickly but about increasing society's sustainability and resilience in this process. According to the OECD, this cannot be done by technical solutions alone without considering behavioural changes, well-being and inclusion (OECD, 2020). If we are to build back better and not just build as we used to, we need to combine a profound understanding of human beings and their social relations with initiatives to create and innovate the way we live (Stender, Bech-Danielsen, & Hagen, 2022, p. 5). Paradoxically, existing research literature engaging with the theme of 'building back better' mainly applies it as a metaphor to spheres such as economy (Berger et al., 2021), health (Clark & Gruending, 2020) and education (Zhao, 2021), rather than focusing on the built environment.

There are however several reasons to scrutinize our life with buildings and the way we build: In Europe, we spend 90% of our lives inside buildings (Sarigiannis, 2014) and the built environment currently constitutes around 40% of global CO₂ emissions (Global Alliance for Buildings and Construction, 2019). Furthermore, we are over the next 40 years expected to be adding to the planet a built volume equivalent to that of Paris – every single week (Abergel, Dean, & Dulac, 2017). Through a review of the research literature, this article summarises what pandemic housing issues were researched and how post-pandemic housing was envisioned under and in the immediate wake of the pandemic. Thereby it reveals what most pressing issues were identified by scholars, who were suddenly observing their field through the lens of a global health crisis. This exploration of lessons learned from the pandemic can support us in preparing housing and residential architecture for future crises, clashes and conflicts that will most likely need solving within the years or decades to come.

The article proceeds as follows: First, the methods and materials forming the basis of the review are outlined. Then, we analyse the academic literature on housing and residential architecture published in the wake of the COVID-19 pandemic. The review offers an overview of the lasting impacts of the pandemic on our housing that researchers were anticipating, and extracts the lessons that can be inferred to enhance housing resilience against crises to come. The article finishes with a concluding discussion of the lessons extracted from the literature and explores

possibilities and challenges to learning from the COVID-19 crisis and building back better. The concluding discussion draws on the global literature but focuses on perspectives on the future of housing and residential architecture relevant to the Danish context.

Materials and methods

As part of the RESPOND project, a comprehensive search of scientific literature has been performed on housing and the COVID-19 pandemic using the SCOPUS and EBSCOhost databases in mid-2022. The databases were chosen to complement each other since SCOPUS is one of the largest article databases, albeit with a focus on the natural sciences, and EBSCOhost covers a broad selection of journals within the arts and humanities. The search terms used were: “housing” or “residential architecture” and “COVID-19” (including variations thereof) combined with being published in a scientific journal in the period 2019 to mid-2022. We then performed a search on the term “post-pandemic” in this dataset which returned 96 results. Since we were particularly looking for papers contributing with reflections on and recommendations for future housing and residential architecture, we furthermore conducted a qualitative exclusion process. We excluded articles that focused solely on technical aspects of indoor climate, infection spread and energy use since our focus is on broader architectural visions for post-pandemic housing.

We also chose to exclude papers focusing solely on working from home (WFH), as this branch of the literature is extensive and worthy of a literature review of its own (and having its dedicated work package in the RESPOND project). Thus, this review only includes WFH papers if they address the phenomenon in the context of broader questions on post-pandemic housing and residential architecture. Lastly, papers treating subjects irrelevant to the Danish context, building typology or housing forms were also excluded, examples being articles focusing on shantytowns, gated communities or very local vernacular building styles.

35 remaining papers that specifically deal with post-pandemic housing or residential architecture are included in the review. They are diverse – geographically, methodologically and thematically. Geographically, many papers focus on a European or North American context, but perspectives from Australian, Asian, South American and Middle Eastern housing research treating subjects relevant to the Danish context are also included. Methodologically, most papers apply mixed methods and draw on multiple sources, including literature/(mini-)review (13 papers), qualitative interviews (3 papers), case studies (9 papers) and surveys (4 papers). Other papers are more essayistic or design-oriented (13 papers). Thematically, the papers stem primarily from the fields of architecture, architectural engineering and urban planning, but sociological and

ethnographical papers meeting the inclusion criteria are also included, to allow for a more holistic view of housing as both a physical, emotional and social construct.

The 35 papers were analysed and categorized according to theme and scale. Four themes and three scales emerged from this process. The themes were: Health and well-being (treated in 20 of the papers), flexibility and multi-functionality (treated in 16 of the papers), privacy and safety (treated in 10 of the papers) and housing inequality and unequal exposures (treated in 16 of the papers). The three scales identified were: The dwelling, its immediate surroundings and the neighbourhood and broader surroundings. The following review is consequently structured according to the scale of the lesson learned from the pandemic and whether it relates to the interior space, design and use of the dwelling itself; to the immediate surroundings (e.g., outdoor spaces and shared accessways), or to the broader surroundings influencing the dwelling concerning questions of access, recreation, inequality and density.

To reflect on the limitations to our methodology, we are aware that the search process described is not a systematic search, but rather a qualitative exploration of literature published at a certain time, while the pandemic was still ongoing. Because we are looking at a “snapshot” of time, we also include articles from journals that have a shorter timespan for the review process, knowing that this might indicate that these journals are bordering on predatory. The focus on visions or imaginaries of post-pandemic housing favours articles that are speculative more than rigorously empirical, and we have therefore allowed these limitations to get a broader variety of voices.

Literature review: Lessons from the pandemic for future housing and residential architecture

The dwelling

The domestic space played a pivotal role as the primary space hosting all activities during the pandemic, as most countries requested citizens to stay home for long periods in the first two years of the COVID-19 pandemic. The home was already a place loaded with many meanings and functionalities when the series of lockdowns severely influenced our ways of being in and using the home. This section outlines lessons for the future of dwellings on three dimensions most prevalent in the literature: Privacy and safety, the healthy home and spatial and multifunctional needs.

Privacy and safety in the home

Much literature underlines how COVID-19 has consolidated the notation that the home is not only a physical frame but something that strongly

affects the psychology and emotional states of the residents (Alraouf, 2021; Aresta & Salingaros, 2021; El-Husseiny, 2021; Peters & Halleran, 2021). Several architectural researchers highlight the emphasized need for privacy and distancing, where the dwelling functions as a shield against the outside world, a defensible space providing safety in terms of social isolation (Alraouf, 2021; Alhusban et al., 2022; Alonso et al., 2021; Peters & Halleran, 2021). A study based on interviews with architects and planners from the Middle East recommends looking at how dwellings can be designed to prioritize privacy and facilitate social isolation, e.g., by including home appliances which reduce the need to leave the home, e.g., would private washers and dryers reduce the need for going to the communal laundry (Alhusban et al., 2022).

Privacy also relates to safety and while most of the literature thematizes safety as something offered by the home in times of a global pandemic, others (e.g., Aresta & Salingaros, 2021; Kourti et al., 2021), stress that the privilege of experiencing safety within the home is denied some, e.g., victims of domestic violence. During the pandemic, social, emotional and relational problems such as gender-based violence, miscommunication, abusive power relationships, verbal bullying, anxieties and fears, have increased (Aresta & Salingos, 2021), affecting the climate and experience of physical and emotional safety in the home. Ensuring safety in the home thus also calls for the tackling of social issues such as domestic violence, which increased during lockdowns (Kourti et al., 2021).

The healthy home

After a global pandemic and with the expectation of more mega-crises to come (Marani et al., 2021), some of the primary architectural needs of post-pandemic housing are related to hygiene, isolation and disinfection. Societal lockdowns and stay-at-home orders were the main societal weapons to reduce infection for a considerable time. However, avoiding contagion within the home proved very difficult, which was reflected in disproportional infection rates in disadvantaged areas, where many people lived together in small spaces (Joelsson & Ladru, 2021). Accentuated in the literature, especially by researchers from the fields of architecture and design, is the question of resilient future housing offering inhabitants a healthy home (Alonso et al., 2021; Gyurkovich, 2022; Peters & Halleran, 2021). In times of a pandemic, this for example involves dwelling layouts where it is possible to isolate a sick family member, including a private bathroom, which is recurrently stressed in the literature (Alonso et al., 2021; Megahed & Ghoneim, 2020; Spennemann, 2021). Other often emphasized measures are equipping dwellings with good preconditions and systems for disease prevention through ventilation, air-cleaning and disinfection (Alhusban et al., 2022; Bereitschaft & Scheller, 2020; Bettaieb & Alsabban, 2021; El-Husseiny, 2021; Peters & Halleran, 2021; Spennemann, 2021; Xu & Juan, 2021). An architectural element such as hallways for disinfection of shoes, outerwear, packages and goods is

also recommended – perhaps even with a washbasin – to avoid bringing infection into the home from the outside (Gür, 2021; Klochko, 2022; Xu & Juan, 2021). While some researchers recommend considering including such features in future residential buildings, the literature also points to enclosed economic, social and environmental challenges, which we shall return to.

A general trend in the literature is the call for a more general focus on health and well-being in post-pandemic housing (Alhusban et al., 2022; Alonso et al., 2021; Alraouf, 2021; El-Husseiny, 2021; Gillen et al., 2021; Peters & Halleran, 2021; Song et al., 2021). For example, Middle Eastern architectural researcher El-Husseiny (2021) analysed home adaptations during lockdowns through case studies, surveys and interviews, and argues that a well-designed future home would be one where physical and psychological well-being would be the priority of designers, implemented through new standards for ventilation, disinfection and workspace. In several papers, the question of a healthy home is also related to the home as a workplace (see e.g., Cuervo-Vilches et al., 2021) and the consequent need for an indoor environment that promotes productivity (Alonso et al., 2021:31; Peters & Halleran, 2021:22). This can be ensured, they recommend, through balanced ventilation, temperature, lighting, acoustics, etc. (ibid.). Other researchers focus more generally on promoting dwellings supportive of human comfort and well-being, necessitated by the fact that more time is spent at home and the possibility of new periods of lockdown or stay-at-home orders (El-Husseiny, 2021; Gillen et al., 2021). This, it is argued based on case studies, can be approached with more flexible home layouts, adaptable furniture and adaptable spaces made from lightweight building materials that can be re-adjusted according to emergency needs (El-Husseiny, 2021).

A particular building feature which has received much attention in pandemic architectural literature is windows, described as related to health and well-being in many distinct ways. They supply sunlight for disinfection (El-Husseiny, 2021), daylight promoting well-being (Alhusban et al., 2022; Gillen et al., 2021; Xu & Juan, 2021) and circadian regulation of sleep (Peters & Halleran, 2021). Windows also provide ventilation and fresh air when openable (Bereitschaft & Scheller, 2020; Bettaieb & Alsabban, 2021) and views of nature and public life, potentially minimizing the negative psychological effects of spending much time indoors and being isolated during lock-down periods (Alonso et al., 2021; Gillen et al., 2021; Peters & Halleran, 2021).

Considerations regarding the size of the dwelling and the size per household member is a crucial spatial aspect of post-pandemic housing. The research highlights both the general health risk related to overcrowded homes (Valenzuela-Levi et al., 2021) and how small dwellings affected well-being negatively during lockdown (Alonso et al., 2021, p. 30). Housing

sizes of a minimum of 40 sqm in total and 15 sqm per inhabitant, they mention, are lower bounds for enabling social isolation and ensuring precautionary measures in case of developing disease within the household (Alonso et al., 2021). Advice against more spacious future housing is however also present in the literature and shall be returned to.

Spatial and (multi)functional needs

In the literature, post-pandemic residential architecture is often defined by the imperative of fitting many functions into the dwelling unit, in anticipation of other pandemic lockdowns to come. In addition to the basic needs, such as shelter, space and amenities for cooking, personal hygiene and rest, the new or newly prioritised functions mentioned in the literature are working from home (WFH) (e.g., Cuerdo-Vilches et al., 2021; Roels, 2021; El-Husseiny, 2021), childcare and homeschooling/education (Alraouf, 2021; Delgado & Sattelle, 2020; Gür, 2021), physical exercise (Alhusban et al., 2022; Peters & Halleran, 2021; Rosa-Jimenez & Jaime-Segura, 2021), entertainment (on/off screen) (Bettaieb & Alsabban, 2021; Peters & Halleran, 2021) and possibilities for practising hobbies (Gillen et al., 2021). A survey study on the preferences of home buyers in China revealed changes in practices, for example, the increased prioritization of a home working environment (Xu & Juan, 2021).

The literature also emphasizes how introducing more functions in the home during the pandemic stressed a need for divisions between the different activities within the home, especially the division of home life and work life when they spatially overlap (Delgado & Sattelle, 2020). This includes both physical spatial partitions (Megahed & Ghoneim, 2020) and acoustic separation (Peters & Halleran, 2021). Further, based on survey studies, the literature identifies a need for psychological distance and privacy within the household (Alonso et al., 2021; El-Husseiny, 2021). Documented in both case studies (Rosa-Jimenez & Jaime-Segura, 2021) and survey studies (Alonso et al., 2021) from Southern Europe, and interview studies (Alraouf, 2021; Alhusban et al., 2022) and case studies (El-Husseiny, 2021) from the Middle East, is an emphasized need for privacy and distancing manifested within the home in times of lockdowns. Participants in these studies requested better shielding and more private space when working or learning from home in multi-person households (Alonso et al., 2021, p. 31; Rosa-Jimenez & Jaime-Segura, 2021, p. 54). On this basis, Alonso et al. (2021) and El-Husseiny (2021) recommend focusing on creating spaces for isolation, work and learning, through more flexible and adaptive interiors. In dwellings where there is not enough space to make such spatial divisions, researchers recommend solutions based on adaptability or flexibility, creating divisions in time rather than space (Alraouf, 2021; Bettaieb & Alsabban, 2021; Delgado & Sattelle, 2020; El-Husseiny, 2021; Gür, 2021; Megahed & Ghoneim, 2020; Peters & Halleran, 2021).

The literature further underlines the physical infrastructure to support the activities, especially electricity and internet connectivity (Alonso et al., 2021; Bettaieb & Alsabban, 2021; Cuerdo-Vilches et al., 2021; Delgado & Sattelle, 2020). As such, including new functions in the home not only requires spatial and timely changes in dwellings but also changes in the wider infrastructure beyond the dwelling.

The immediate surroundings of the dwelling

Even if post-pandemic residential housing must be prepared for new lockdowns, it cannot solely focus on the inside of the dwelling. The next section will look at issues and needs regarding the spaces where the dwelling and the outside world intersect and spill over, first in the realm of shared, semi-private indoor spaces such as staircases, elevators and corridors, which became places of risk during the pandemic. Secondly in terms of private and shared outdoor spaces such as balconies, terraces and gardens, highlighted as still more important for the mental health during lockdowns.

Shared indoor spaces as places of risk

When faced with a highly contagious disease and government decrees to avoid contact with not just strangers, but anyone outside your household, shared indoor spaces such as accessways in multi-family housing become a challenge. This challenge, the literature stresses, is two-fold, as it relates both to physical distancing from neighbours and avoiding meetings (Bereitschaft & Scheller, 2020; Megahed & Ghoneim, 2020) and to the risk of infection from shared physical contact points such as handles, buttons and railings, and the need for disinfection of such contact points (Megahed & Ghoneim, 2020; Spennemann, 2021). Especially “bottlenecks” such as elevators and narrow internal corridors are problematic and, in most buildings, difficult to change without major retrofits (Spennemann, 2021). When building new multi-story buildings, Megahed & Ghoneim (2020) argue for applying a principle of the touchless experience, allowing inhabitants to move from the front door to the apartment door without physical interaction with any surfaces or materials. They also recommend wider corridors and doorways and more staircases, which has the additional benefit of making the housing more socially sustainable, they argue, as it enables adaption to the changing needs of inhabitants (ibid.).

Amidst the urgency of distancing to avoid infection, some papers remind us that to get away from a worldwide crisis without loss of mental health, it is important to have possibilities for socialising with family, friends or neighbours in or near their home and feel as part of a community (Alraouf, 2021; D’Onofrio & Trusiani, 2022; Roels, 2021; Vyas & Warren, 2020). This could be enabled by bigger living rooms to facilitate adequate distance between guests (Spennemann, 2021), or outdoor facilities such as common roof terraces, courtyards or other shared spaces for social-

ising in or in the proximity of apartment buildings and housing estates (Peters & Halleran, 2021; Xu & Juan, 2021).

The importance of nature

Papers about post-pandemic housing show an almost unanimous prioritising of private outdoor and green spaces directly accessible from the dwelling (Alhusban et al., 2022; Bereitschaft & Scheller, 2020; Bettaieb & Alsabban, 2021; El-Husseiny, 2021; Gillen et al., 2021; Gür, 2021; Klochko, 2022; Megahed & Ghoneim, 2020; Peters & Halleran, 2021; Rosa-Jimenez & Jaime-Segura, 2021). A European survey study documented that 86% of the consulted were willing to pay extra for outdoor space connected to the home after experiencing a lockdown (Manso et al., 2021). Another survey study documented that just having a view of something green or otherwise interesting from the windows of a dwelling is desired and considered a major positive factor in times of lockdown (Alonso et al., 2021). As reasons, the literature accentuates the positive effects of outdoor spaces on mental health, well-being and quality of life (Bereitschaft & Scheller, 2020; Doering, 2021; Gillen et al., 2021; Klochko, 2022; Peters & Halleran, 2021). Further, the need for connectedness to nature in direct relation to the dwelling is reflected in a rise in pet ownership during lockdowns and renewed interest in gardening and birdwatching (Searle, Turnbull, & Lorimer, 2021). Therefore, the literature recommends prioritizing balconies, courtyards, terraces and public green spaces (Alhusban et al., 2021; Bereitschaft & Scheller, 2020; Doering, 2021; Gür, 2021) and integrating green spaces into buildings, for example, via rooftops and vertical gardens (Bereitschaft & Scheller, 2020; Bettaieb & Alsabban, 2021). Rosa-Jimenez & Jaime-Segura (2021) stress the importance of well-proportioned outdoor spaces suitable to facilitate activities and recommend building terraces of over 6 square metres if possible.

Both Gillen et al. (2021) and Gür (2021) mention how this is also a question of social inequality and housing inequality, as access to private or nearby green spaces is unequally distributed. Socio-economically disadvantaged households or neighbourhoods often also lack access to nature for recreation and physical activity (Gillen et al., 2021; Gür, 2021), which will be elaborated on in the next section concerning the post-pandemic neighbourhood.

The wider surroundings

The next section will examine how domestic spaces are nested in the wider surroundings and the influences and interactions relevant to post-pandemic housing and residential architecture. This section includes both lessons and recommendations relating to the dwelling's physical, social and economic surroundings, as it treats the following topics prominent in the literature: Density and mobility and housing inequalities.

Density versus de-urbanisation

Where and with what density post-pandemic housing should be built is also a topic in many branches of the pandemic literature. This is also a highly context-specific topic, in that the geography, demography, culture, politics and economics of a place interact with and set limits to possible transformations of housing and residential architecture. In a Middle Eastern context, architects and medical researchers have argued that single-family detached housing is the most pandemic-resilient type of housing (Megahed & Ghoneim, 2020). This observation follows the tendency described by researchers from other parts of the world of people moving out of the city during the pandemic towards suburban or rural dwellings (e.g., Bereitschaft & Scheller, 2020, in a North American context; Flynn, 2022, and Krüger, 2020, in a European context). Others argue for more dense housing in the light of the climate crisis, arguing it to be more sustainable, but stressing that it must still handle new needs for (periodically) distancing from neighbours (Gyurkovich, 2022).

However, quests for single-family detached housing and de-urbanization tendencies were not unchallenged. Pointing in the opposite direction, several researchers describe how compact, self-contained neighbourhoods have advantages when it comes to fulfilling post-pandemic needs. Gyurkovich (2022) writes about “hybrid urban structures” combining housing and other functions and reducing the need for travelling through the accessibility of functions. Camerin & Francesco Fabris (2021) describe Spanish “Superblocks”, accommodating all everyday needs (e.g., for shopping, going to school, etc.) and several authors advocate for “the 15-minute city”, where all functions in everyday life can be reached within 15 minutes of walking or biking (D’Onofrio & Trusiani, 2022; Majewska et al., 2022). Common for these three concepts are easy accessibility to local community services and reducing the need for motorised transport and traffic between areas. By having nearby shopping, healthcare, schools and social activities, dense neighbourhoods can be both socially and environmentally sustainable while still retaining the option to cord them off in a new quarantine situation.

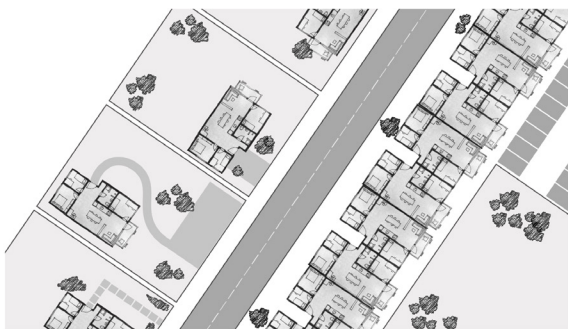
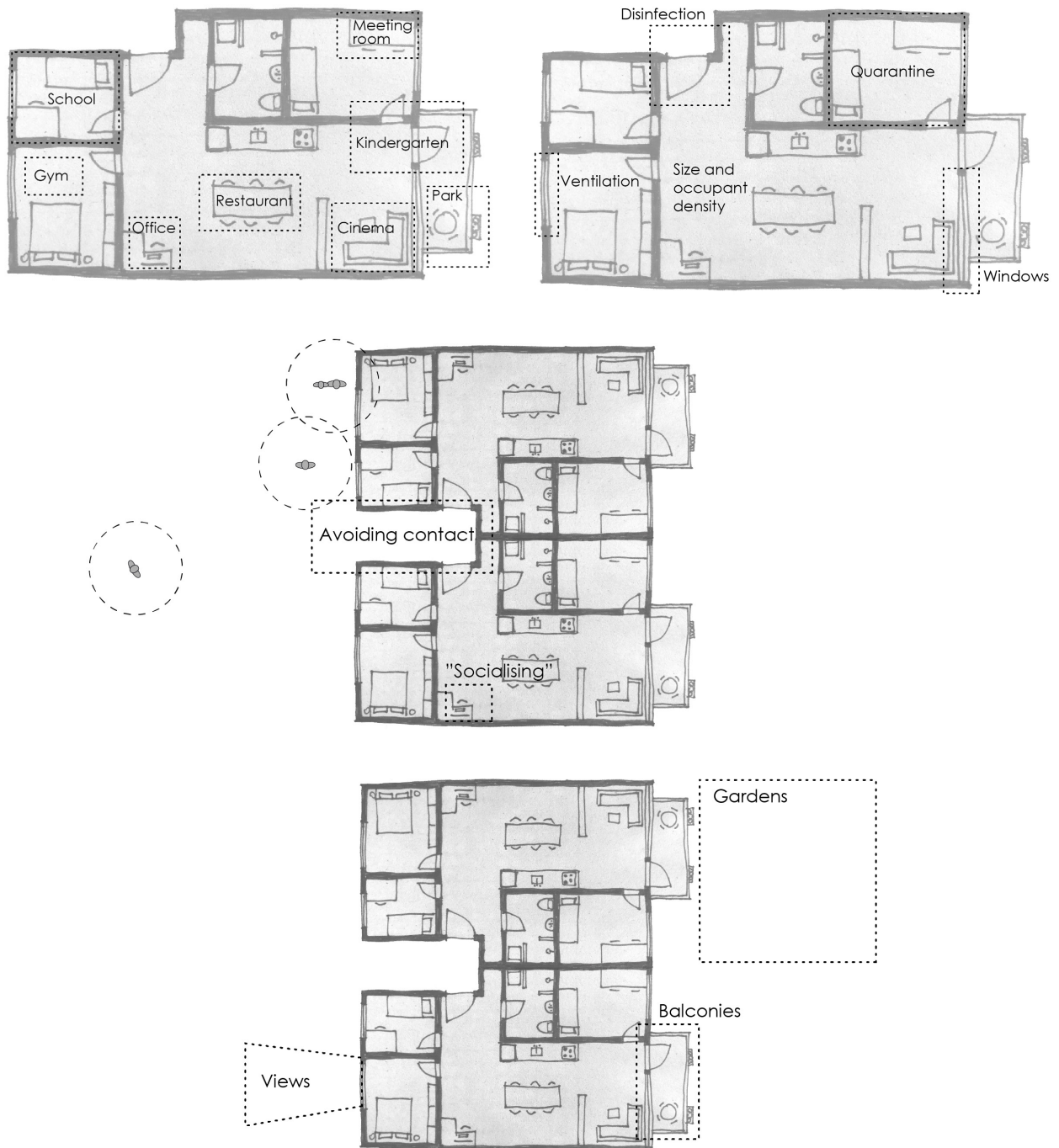
Another facet of the focus on walkability is related again to the need for access to nature, parks, foot and bike paths, playgrounds, etc. for both recreation and physical activity. On this topic, questions are raised concerning the amount of urban space used for traffic and parking (Camarin & Francesco Fabris, 2021); to overcome that, many shifted away from mass transport in favour of cars during the pandemic (Valenzuela-Levi et al., 2021); and how parks and other recreational areas are unequally distributed, favouring the already well off (Gür, 2021). Big investments are needed to create greener and more walkable post-pandemic neighbourhoods, and researchers argue that these are necessary for the health, resilience and social cohesion of the community (Alraouf, 2021; D’Onofrio & Trusiani, 2022).

Housing inequalities

As outlined, part of the literature argues in favour of spacious and detached housing to deliver crisis-resilient homes, while other researchers advise against it. This branch of the research points to wider social and economic issues that housing is deeply intertwined with. For example, German urban researcher Krüger (2020) anticipates that increased space requirements will impose long-term, negative planning consequences causing the post-pandemic city to be characterized by renewed urban sprawl and gentrification. Further, as a consequence of highly unequal housing markets, spacious homes are out of economic reach for many (Flynn, 2022; Valenzuela-Levi et al., 2021). The literature emphasizes how many people even saw their housing conditions worsen during the pandemic as a result of lockdown-related economic troubles causing failure to pay mortgages, evictions and foreclosures (described in a Middle-Eastern context by Alraouf (2021)). Thus, a recurring point is that across geographies, the pandemic has reaffirmed and worsened existing inequalities and revealed new weaknesses concerning housing (Alraouf, 2021; Doering, 2021; Flynn, 2022; Gillen et al., 2021; Joelsson & Ladru, 2021). The COVID-19 pandemic affected vulnerable groups more, and researchers anticipate that long-term impacts will further accentuate these groups' housing vulnerabilities (Joelsson & Ladru, 2021).

The literature demonstrates how housing issues, such as overcrowding, poor sanitation, areas with a lack of services, homelessness, housing insecurities related to affordability and tenure etc., severely aggravated the hardships of a pandemic situation for disadvantaged populations (Alraouf, 2021; Doering, 2021; Flynn, 2022; Gillen et al., 2021; Gür, 2021; Joelsson & Ladru, 2021; Murphy, 2021; Spennemann, 2021; Valenzuela-Levi et al., 2021; Vyas & Warren, 2020). Researchers, therefore, describe how post-pandemic housing must account for solutions to such housing inequalities, and call for regulations, standards and more humane housing (Alraouf, 2021) to ensure that the poorest are housed and deliver some level of equal housing access (Flynn, 2022).

Another dimension of housing inequalities is its interrelationships with health inequalities, which were brought out in the open as the pandemic disproportionately hit disadvantaged groups and neighbourhoods (Tunstall, 2021). For example, Joelsson & Ladru (2021) describe how housing segregation in Sweden has contributed to the unequal spread of COVID-19 infection, which further accentuated the stigma of living in poor and socially vulnerable neighbourhoods and fanned the flames of stereotyping and racialized conceptions. To combat disproportional infection rates and consequent marginalization in the future, the literature argues for addressing the challenge of concentrated urban disadvantage which puts inhabitants in certain neighbourhoods at greater risk of infection (Joelsson & Landru, 2021; Gillen et al., 2021; Gyurkovich, 2022).



Figures 1–5
The pandemic lockdowns severely influenced our ways of being in and using the home. Lessons learned for the design of future dwellings regard privacy, safety, health, spatial and multifunctional needs as well as access to nature and recreative spaces.

ILLUSTRATION BY THE AUTHORS.

Concluding discussion: Disrupting or accelerating pre-pandemic trends?

As demonstrated in the literature review, most scholars across different geographical contexts and disciplines stress the importance of housing qualities that were already considered important before the pandemic: privacy, sanitation, daylight, adequate space to avoid overcrowding and easy access to both nature and green spaces. Highlighted is also the importance of easy access to some sort of social life and services in the vicinity of the dwelling in times of crisis and pandemics limiting personal mobility. Similarly, the pandemic so far appears to have amplified many existing challenges related to housing, by reinforcing well-known inequalities and worsening the housing situation for already vulnerable groups. In many ways, the pandemic thus seems to have accelerated and reinforced pre-pandemic trends and challenges. The post-pandemic grey swans and fundamentally different conditions, envisioned by prominent scholars such as Krastev (2020) and Latour (2021), seem to have not yet landed in the research literature on the built environment published in the wake of the pandemic. However, COVID-19 is probably not the last global mega-crisis having consequences for how we use our homes and dwellings, heralding new needs that residential architecture must consider. There are significant gaps in existing knowledge on post-pandemic dwelling and residential architecture and looking at these in the context of a Danish-based research project on lessons learned from COVID-19, at least three large subjects call for closer scrutiny, if we are to understand how the pandemic may transform or even disrupt pre-pandemic tendencies and encourage a build-back better approach. These relate to dwelling size, density and shared spaces, how we live with nature and non-human species and to digitalization and new meanings of home.

Density, dwelling size and shared space

A range of studies on housing and the pandemic are concerned with density and dwelling size, which is related to the question of the healthy home, including dwelling layouts with disinfection and isolation facilities, to demands for increased multi-functionality in the home and to what types of dwellings with which distances between dwellings would be favourable. Such issues have wide-ranging social and environmental consequences: there are empirical gaps here, not least concerning Scandinavia and the Nordic countries. Dwellings in this part of the world are generally large and probably relatively well-suited for pandemic lockdown compared to dwellings in many other places. Furthermore, the majority of the Danish population lives alone and the share is increasing¹. Their dwelling conditions may be quite appropriate for isolation, though loneliness is also rising, which constitutes a severe health challenge². The pandemic may just fuel the existing tendencies of loneliness on the one hand and ever-larger dwellings with more rooms and in-house facilities on the other. Yet, this raises several concerns: First, even though Denmark and Scandinavia are relatively, socio-economically equal

- 1 <https://www.dst.dk/da/Statistik/nyheder-analyser-publ/nyt/NytHtml?cid=19041>
- 2 See NPE_National-Strategi-mod-Ensomhed.pdf

countries³, internal inequality is increasing, rendering it impossible for a growing part of the population to gain access to a big and ‘healthy home’ with adequate space for disinfection, isolation, working spaces, etc. So how do we ensure that creating healthy homes does not exacerbate housing and health inequalities? Further, if we spend more space for living, and even more people live alone, how can we create enough room without increasing energy consumption and CO₂ emissions as well as extending the built environment over green field land? This conflicts with key sustainability perspectives, and over the past couple of decades, density and smaller housing units have also been a dominating trend in urban contexts, supported by not just increasing urbanization and heated housing markets, but also by urban planning agendas of density as favourable both in terms of sustainability, public transportation, infrastructural services and urban life. In urban planning, the focus is however mainly on building density rather than population density, which is a paradox as building density is not necessarily sustainable if it just reflects that people live in larger dwellings. Nor so, if people living in the dense city also buy summerhouses or second homes in the countryside, where they can spend vacations and future pandemic lockdowns. We need substantial research on the ways we use and share the spaces we live in and how dwelling size and density can be sustainable in terms of both environmental, health and social concerns.

Living with nature and non-human species

As we have seen in the review, the pandemic caused renewed prioritising of nature. Green spaces directly accessible from the dwelling or even just having a green view are stressed in the literature together with the need for connectedness to nature in direct relation to the dwelling. It also led to a rise in pet ownership, renewed interest in gardening and birdwatching and people spending more of their spare time in nature. Denmark is characterised by quite scarce nature areas: 10% of the country can be defined as nature, but nothing is actual wild nature where natural processes unfold with no human interference (Ejrnæs & Pedersen, 2021). During pandemic lockdowns, a lot of people suddenly started hiking and camping in some nature areas, which caused severe problems with wear, trash, noise, etc. On the one hand, the pandemic thus fuelled a focus on and longing for nature and biodiversity, on the other hand, it also in some places harmed local ecosystems, challenged multi-species cohabitation and intensified battles over space in parks, woods and other green spaces. Whether these tendencies will continue, or decline is yet to be seen. Will more people choose to live closer to nature, further away from the cities? Or will we develop new ways of integrating nature into the cities, e.g., through vertical gardens and rooftop terraces as suggested in the literature? How can we ensure that not only the most affluent have access to green space and nature, and work from home and isolate themselves in nice and green surroundings? The current crises of climate and biodiversity call for better ways of relating to and preserving nature. Can

3 See e.g., <https://www.dst.dk/da/Statistik/emner/arbejde-og-indkomst/indkomst-og-loen/indkomstulighed> and <https://www.verdensmaalene.dk/sites/default/files/ulighedsrapport.pdf>

we build in new ways that create a more direct contact with nature or even develop our perspective in such a way that nature is not regarded as something outside, but rather integrated in a way, where our dwellings and built environment support our coexistence with non-human species like animals and plants? If there is one thing we should have learnt from the pandemic, it is, in Latour's words, that we share the Earth with other species including vira and must develop a *modus vivendi* (Latour, 2021). This raises a bunch of new questions regarding how we can dwell and build in ways that balance both biodiversity and human diversity?

Digitalisation and new meanings of home

Pandemic lockdowns have fuelled digitalisation, and though many people still cannot work from home, digital screens and media have entered and changed homelife in ways that will likely affect the form and functioning of dwellings and residential architecture in the future. It is worthwhile noticing here that Denmark is one of the most digitalized countries in the EU. 65% of the population use digital, public services at least once a week and 91% use social media⁴. Many already had the opportunity to work from home before the pandemic, but COVID-19 was a catalyst increasing the prevalence of digital meetings, online seminars, etc. The share of working from home increased by 41% from 2018 to 2023. In 2022, a third of the Danish population often (more than half of the days) worked from home, while two-thirds worked from home at least once in a while. If more people will continue to work from home in the future⁵, it may change where they will choose to live, but it may also change our dwellings radically. Not just in terms of requiring more space for home offices and/or more flexibility in dwellings, but also by changing the social and cultural status of the role of the home as primarily a private shelter for the family. The stay-home restriction made evident that the home is not always a safe haven: domestic violence increased and for many the home felt like a prison rather than a shelter. This stresses the importance of challenging prevalent notions of the home as a self-contained and secure place. It also calls for the exploration of new public-private boundaries: Whereas windows and doors facing public space used to be where the home meets the surrounding society, suddenly the screens have become a main representative sphere. If work and home are no longer delimited in space, they may neither be delimited in time: rather than working from home, we may come to feel that we are sleeping in the office? And digitalisation and working from home may impact gender roles, family dynamics and relations between adults and children as well. What does the increased use of digital media mean to our relationship with neighbours and engagement in local communities? Eventually, we must focus on how we want to live and how we can live in sustainable ways. If we are to build back better, we must first delve into what 'better' is, for whom and how!

4 <https://www.dst.dk/da/Statistik/temaer/digitalisering>

5 As is expected by e.g., the Confederation of Danish Industry: <https://www.danskindustri.dk/vi-radgiver-dig/personale/nyhedsarkiver---personaleforhold/nyheder-om-arbejdsmiljo/2023/3/post-corona-hjemmearbejde-er-kommet-for-at-blive/>

This article has taken a first step by exploring issues and suggestions raised in the pandemic and early post-pandemic research literature on dwellings and residential architecture. This literature engages with the home not only as a physical frame but as something that strongly affects the psychology and emotional states of the residents, and must comply with new spatial and (multi-)functional needs as well as emphasized needs for privacy, safety and distancing, where the dwelling functions as a shield against contagion with suggestions for equipping dwellings with systems for disease prevention. It also highlights the need to re-think the immediate surroundings of dwellings, both in terms of shared indoor and outdoor spaces, and how we can enhance the access and use of nature and green spaces, which the literature documents have significant positive impacts on our quality of life during crisis. Zooming further out, the literature identifies a need for renewed post-pandemic engagement with issues of dwelling density, neighbourhood mobility and housing inequalities to close on qualified answers to what ‘building back better’ could look like, for whom and how.

Statements and declarations

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