Article:
Martin, Daryl, Brown, Nik, Buse, Christina et al. (2025) An architecture of risk: how the past breathes in the design of future clinical space. Ephemera: theory & politics in organization. ISSN: 1475-2866

ephemera
theory & politics in organization

ISSN 1473-2866 (Online)
www.ephemerajournal.org
volume 25(2)

An architecture of risk: How the past breathes in the design of future clinical space

Daryl Martin, Nik Brown, Christina Buse, Sarah Nettleton, and Alan Lewis

abstract

This paper opens up questions of infection control, architectural atmospherics and embodied practices in clinical space today. Additionally, it traces how echoes of the past inform designs of clinical space for the future. Specifically, we review the example of Skane University Hospital's Infectious Disease Unit, in Malmö in Southern Sweden. This is a building in which design becomes an articulation of infection control, its architects responding to shifting understandings of what clinical space might look like in a post-antibiotic era. It is also an example where future-proofing a clinical building is related to a longer view of medical practice and hospital design. Conceptually, we draw on theoretical writing from Sloterdijk, Yaneva, and others that relate architectural design to questions of air and immunity. Empirically, we use documentary sources and an interview with the building's lead architect to trace the changing arrangements, organisational imperatives, and affective atmospheres of patient safety and ward design - all issues that are especially pressing in light of the challenges of the Covid-19 pandemic. Doing so allows us to explore how mutable spatial organisations enact changing ideas of disease management - from the control *of* space and air to tactically limiting contact between people *through* spacing protocols and strategies. Locating our contemporary case study alongside historical examples allows us to develop a greater understanding of the role of materialities, mobilities and design in the social construction of risk in a post-antibiotic age, and affords an understanding of how previous models of hospital design continue to inform present thinking about clinical space.

Introduction

> Breathing air, once a pristinely implicit environmental act, becomes fundamentally *critical* (what or *whose* air am I breathing? Where does my air and another's begin? Could theirs have brought this, or a, virus? And how can I read it in their breath?). (Dutton, 2022: 153)

In our contribution to this special issue, we wish to explore the issues and tensions inherent in architectural designs that are driven by the need to protect the safe exchange of air flows within buildings. We consider how questions of air and atmosphere prompt a re-configuring of common spatial typologies (Borch, 2008) and, also, an emergence of new forms of caring practice that, in their way, hold within them trace memories of previous understandings of health and illness. In this, we start with acknowledging the hitherto understated importance of breath as a prism through which to approach matters of care (Puig de la Bellcasa, 2017), given how the everyday act of breathing affects the temporal and spatial experience of a range of illnesses (Oxley and Rusell, 2020). It is in the (often lonely) experience of those with respiratory conditions that the latent assumptions of mainstream medical care are exposed, when the act of breathing itself – involuntary and unthinking for most – has to be considered, planned, and cared for. Air, ostensibly implicit, internal and personal, becomes explicit, environmental and collective (Sloterdijk, 2009); air is 'now part of an air-conditioning system that makes our life possible' (Latour, 2006). As Jane Macnaughton has argued (2020: 36), as well as 'a first-person encounter with one's own body, breathing is also a social phenomenon, and is experienced, and perhaps brought into greatest awareness, through interaction with others'. Breathing is an institutionalised action too, subject to cultural norms and customs (Lande, 2007), not to mention metaphorical understandings of social life (Soffner, 2023); as Ingold gracefully notes, 'in the sharing of breath, lies the very essence of human conviviality' (2023: 103). One implication of this idea of sociability mediated through air is that the built environment becomes a key point of tension when exposure to risk happens atmospherically, through the exchange of air, in the encounter between bodies within particular buildings (Garnett, 2020), such as hospitals (Brown et al., 2020; 2021a; 2021b). What happens when the buildings that have been designed to bring people – professionals and patients – together in a quest to cure have to separate

people as a principle of care (Buse et al., 2020), as is the case where infections between members of highly vulnerable medical groups spread through the air that they share?

In this paper, we look at how infection control is influencing the design of clinical space in contemporary hospitals. Specifically, we trace the emergence of new thinking in healthcare design within the wider context of antimicrobial resistance (AMR). Put simply, because of AMR, we are witnessing the re-thinking of the architectural logics of the mid-twentieth century hospital, which was premised on the widespread introduction of antibiotics to manage medical conditions, and which in turn facilitated closer physical connections between staff and patients in high density hospitals (Brown, 2020). The rapidly reducing efficacy of antibiotics in the current period, and their increasing inability to keep clinically vulnerable bodies safe from new strains of illness and viruses, has necessitated a re-evaluation of hospital estates across Western societies by architects and clinical staff, and the emergence of post-antibiotic architectural planning. In light of aims to future-proof such buildings for medical pressures to come, we will necessarily consider how the design of contemporary space looks forward and anticipates questions of care, medicine, and illness. To do so, we draw on important research taking as its starting point the Covid-19 pandemic, in order to trace the increasing import of clinical norms into the design of buildings, and cities more generally, in the present day and for the future (Yaneva, 2023).

However, in order to understand the contemporary situation, we need to take a longer view, situating new clinical buildings within historical traditions of using space to control disease and nurture wellbeing. Much of what we consider to be innovative in architectural thinking is often haunted by previous ideas about how to lay out our buildings. Indeed, sometimes very specific historical ideas about health, illness, and the patient still shape contemporary spatial design. We follow Henri Lefebvre's 'regressive-progressive' methodological approach to the deciphering of the social practices hidden in the spatial forms of the present; as he argues, 'the genesis of the present' can only be discerned by 'working our way back to the past and then retracing our steps' (1991: 65-66). Hence, we will oscillate in our analysis of contemporary hospital design between past, present, and future visions of medical space and, moreover, between the specifics of hospital design and the

more generalised architectural typologies – domestic and public - that hospital design influences. Beatriz Colomina has argued that carefully reading modern architecture from the early 20th century tells us that leading architects considered themselves to be akin to doctors, 'practising a form of preventative medicine that nurtures and rebuilds the body and psyche' through their buildings (2019: 30) - not only in terms of hospital design, but also in terms of wider urban design. In this, domestic and public architecture throughout the twentieth century articulated and advanced spatial strategies of immunisation and air regulation or conditioning, in a conceptual as well as literal sense (Sloterdijk 2016).

In this paper, we will read through the planning of one particular hospital building a link between past and present architectures of care, but also a glimpse of more generalised patterns of urban design coming out of the Covid-19 pandemic (Yaneva, 2023). Specifically, we will focus on Skåne University Hospital's Emergency and Infectious Diseases Unit (IDU), which is located in Malmö in Southern Sweden. The IDU was designed by CF Møller, a Danish practice, working in collaboration with LINK Arkitectur, a firm based in Malmö. It is a striking spherical and iconic building (Figure 1), designed as a landmark for the hospital and city (Holmdahl and Lanbeck, 2013: 36). It is also an important building more widely, as it received funding from a range of municipal and regional authorities to act as a state of the art facility and a test bed for handling future pandemics. The Unit was commissioned in the recent aftermath of the SARS epidemic, and with the knowledge that hospital-acquired infections contributed significantly to its spread in different regions; thus, the Malmö IDU was designed to anticipate future outbreaks of SARS-like diseases, but also ebola, pandemic flus and tuberculosis (Holmdahl and Lanbeck, 2013). The result is, fundamentally, a building in which design becomes an articulation of infection control, and in which clinical space is re-shaped within the context of antimicrobial resistance now and into the future, when we no longer rely on antibiotics as the primary treatment route for many conditions. We locate this contemporary building within a wider history of hospital architecture and use its design, alongside an interview carried out with its lead architect (who was involved at all stages of the building's development, especially with respect to its design and planning), in order to trace how the arrangements of ward design reflect changing clinical practice

in terms of risk management, ideas of the patient, and medical cultures more widely. For us, the building expresses the fine balance between designing in elements of laboratory settings to other architectural spaces to minimise risk and the spread of future viruses in the built environment – what Yaneva calls the 'lab-like dispositif' (2023: 50) – whilst keeping a focus on the atmospheric qualities of the space in order to maximise the feelings of comfort offered to patients within the hospital (Martin, 2021). Before focussing on the Malmö Unit, we will outline some significant themes emerging from research of trends in hospital design that offer context to this particular building.

Figure 1: Malmö Infectious Diseases Unit (Source: C.F. Møller Architects + Jørgen True)

Hospital design, and architectures of risk: A regressive-progressive review

To better understand the challenges of post-antibiotic medicine in the present day, it helps to review histories of hospital architecture, because care

is typically carried out in buildings hard-wired by previous ideas of disease, illness, well-being, the patient and the medical professional. Sociological research on the development of modern hospital architecture using archival methods and documentary analysis shows how architectural design actively shapes the institutional identities of medical patients and professionals (Prior, 1988; 1992). Hospital buildings are implicated in the legitimation of professional knowledge and practices; at various points in time, they have served to enshrine the authority of some professionals over others, elevate the status of certain disciplines and specialisms over others, and situate the patient within these hierarchies of medical knowledge and clinical practice (Martin et al., 2015). For Lindsay Prior, buildings are 'as solid a form of discursive enunciation as are texts or speech' (1988: 92). Because of this, he makes the case for sociologists conducting archival research with architectural plans, because these embody 'a genealogy of medical knowledge' with respect to ideas of the patient and ideals of clinical practice (1988: 93). Prior was particularly interested in the 19th century, where the emergence of the pavilion hospital, whose spatial norms were intended to directly address miasmic theories of disease and control the spread of disease accordingly, through the use of large windows and open corridors throughout these buildings.

Theories of disease change over time, as do medicines and methods of treatment. Nick Fox's study of the operating theatre environment analysed the movements of staff, patients, and medical equipment to understand how the physical layout of the surgical space shapes clinical interactions and creates a kind of covenant of patient safety (1997). This analysis of an operating theatre environment joins other studies that analyse how principles of sterility actively direct practices of care in the contemporary hospital (Mesman, 2009). Additionally, the need in hospital buildings to accommodate ever more complex and costly technologies shapes the spatial experience of the patient, with clinical logics overwhelming other logics of care (Mol, 2008) and, indeed, medical expertise (Blaxter, 2009). Moreover, there are other logics at work in the contemporary hospital: within a Western context at least, many countries in the recent past have seen the import of retail, hotel and domestic spatial norms within their hospitals (Martin et al., 2015). Elizabeth Bromley's study of architects' use of person-centredness as a key motif in

hospital design documents a move by North American hospital architects to avoid institutional spatial triggers, where possible, and instead include 'homey environments and hotel-like services' within their designs (2012: 1057). The hospital that is designed along the lines of a hotel leads to a more privatised model of care, underwritten by mall aesthetics and retail logics (Jones, 2018).

One issue, among others, with importing retail logics into hospital settings is practical, when we consider patients with diseases which spread because of contact between people, and where antibiotics do not offer the same hope of containing viral strains as they once did. Just think about the spatial practices prompted by the Covid 19 pandemic and how the hospital became a restricted space to those without the most urgent need of emergency care in early lockdowns (Brown, 2020). Yaneva has charted the architectural and urban planning response to Covid 19, moving from the analysis of individual buildings to the scale of public space in cities more widely, and tracing the influence of spatial practices developed during the pandemic on architectural norms in general. Her analysis shadows the architectural profession as it pivots to designing spaces for the future, increasingly influenced by laboratory-like imaginaries. She argues that 'introducing lab elements and gestures into standard typologies, the virus has transformed all kinds of public space and amenity into *dispositifs* of capture' (2023: 2). Yaneva defines this pandemic dispositif as 'a physical mechanism and a heterogeneous ensemble consisting of architectural forms, spatial instructions, administrative measures, discourses, technologies and institutions' (2023: 2). She continues to describe the post-pandemic environment as like 'a skein', through which 'a new spatial choreography of daily life has unfolded' (2023: 2) – a choreography that is tentative, reticent, and ambivalent in its affects.

The hesitant use of clinical space in the pandemic by many echoed the quotidian use of hospital spaces by people with cystic fibrosis, where potentially fatal bacterial strains are spread through contact with other patients (Buse et al., 2020). Over many years, cystic fibrosis clinics had already operationalised the 'new spatiality of distance' and the shift to contactless and sanitised sharing of public areas that Yaneva found in her research into architectural models after Covid 19 (2023: 52), because of the risk to individual patients through constantly evolving bacterial strains of the

disease. Such strains are becoming ever more resistant to treatment by antibiotics and thus call for increased levels of vigilance against cross-infection in medical encounters (Brown 2017). Whilst it was not designed as a cystic fibrosis clinic, but rather a unit for the management of pandemics and infectious diseases in general, this is the wider antimicrobial context that has informed the design of the Malmö IDU. Therefore, we locate the paper within the wider learning of our research on cystic fibrosis clinics in the contemporary period (Brown et al., 2020; 2021a; 2021b); indeed, the interview with its lead architect and analyses of its architectural plans were included as part of our scoping work for the larger project, given the lessons the IDU offers for thinking through healthcare design in a post-antibiotic age. We will now turn to the Malmö IDU as an expression of this contemporary sensitivity to antimicrobial resistance, keeping alert to some of the architectural precedents that haunt the construction of the now and the practices of new modes of patient safety and care.

Malmö Infectious Diseases Unit: Or, 'What is the envelope of this space?'[1]

The Malmö IDU is striking in its appearance, but also in other ways, as it departs from the prevalent tendency elsewhere to dissolve the boundaries between hotel, home and hospital. The Malmö building's spatial logics let us know that we are very much in clinical, rather than commercialised, space. In this building, there are pronounced architectural interventions speaking to the need to proactively hold patients, when needed, in highly isolated settings – as medical researchers tell us, in 'a 'post-antibiotic era', more patients have to be isolated to avoid spread of resistant bacterial strains' (Holmdahl and Lanbeck, 2013: 28). In this sense, it is a building within which 'life and sociality depend on immune systems and immunity strategies', enacted through an architectural design that has been carefully thought through in order to 'manage the atmospheric conditions' that allow patients to be safely together, at a distance from each other (Borch, 2008: 555, 559). In its architectural logics, the IDU offers a striking example of the immune systems that Sloterdijk characterises as foam architecture (2016), which refers to

[1] From Latour (2006).

building forms designed around principles of co-isolated adjacency. In this building, because of the risks of airborne infections amongst clinically vulnerable populations, acts of breathing for these groups of patients become withdrawn from shared space, more privately self-contained and less likely to take place between and amongst shared and entangled airs, than they are to take place in more hermetically contained atmospheres. In a sense, the architectural logics of this building ventriloquise Sloterdijk's anatomospheric theory (Brown, 2017); that is, the building seems to tell its patients that, because of the risks in the very air that they breathe, 'You are on life support, it's fragile, it's technical, it's public, it's political' (Latour, 2006), and that the building will protect them from their atmospheric anxieties.

Hospital authorities in the region decided in 2005 to replace an old Infectious Diseases department with a new facility with better capacity for dealing with outbreak of pandemics, with a requirement for high levels of flexibility within its spaces for combating diseases in the future with, as yet, unknown modes of transmission (Holmdahl and Lanbeck, 2013: 32). And yet, there were precedents for thinking about future proofing the building: as the lead architect confirmed, this design was conceived with SARS as a guide. In their account of the building's development, Holmdahl and Lanbeck note how ventilation technologies in hospitals facilitated the spread of SARS, and how knowledge of this informed the design of the Malmö IDU. Changes in building design have been widespread in architectural practice since SARS, especially with respect to natural sources of ventilation to complement air-conditioning systems, and the ability of buildings (hospitals in particular) to lock down certain areas to contain instances of infection (Yaneva, 2023: 24-5). These features are all evident in the Malmö design, whose lead architect spoke about the constraints this placed on the design. For him, these different considerations prompted a circular structure, an idea that distinguished their design from other firms competing for the contract. On each floor, the unit uses open-air decking along its outside to enclose the next layer of patient space and, further in, an internal staffing core, with sightlines that can allow staff to monitor patients in their room (Figure 2). The circular structure of the Infectious Diseases Unit is connected to the rest of the hospital, and subsequently the wider city, through a series of spaces that can be closed off and segregated in the interests of patient safety and minimising the risk of

cross-infection; giving a sense, years in advance of Covid, of the control through 'segregated design' of urban risks in routine social encounters for vulnerable patient groups (Yaneva, 2023: 25). In Malmö, there is an entrance area on the ground floor for patients with infectious diseases, distinct to a separate emergency department open to all. There are individual entrances to exam rooms where ambulances can drive up to deliver patients with infectious diseases, who then have dedicated elevators to upper floors (Figure 3). There are then three floors that are the IDU wards, with 17 bedroom areas designed as single bedrooms but with enough space for a second bed if required. Each patient room can be entered from the outside decking via an outer ante-room. Then each bedroom leads, via a sequenced series of secure and ventilation spaces, towards the central staffing area, which is a protected zone, locked down if needed, and accessible via dedicated stairwells for staff. There are two further administrative floors, with a top floor housing ventilation technologies.

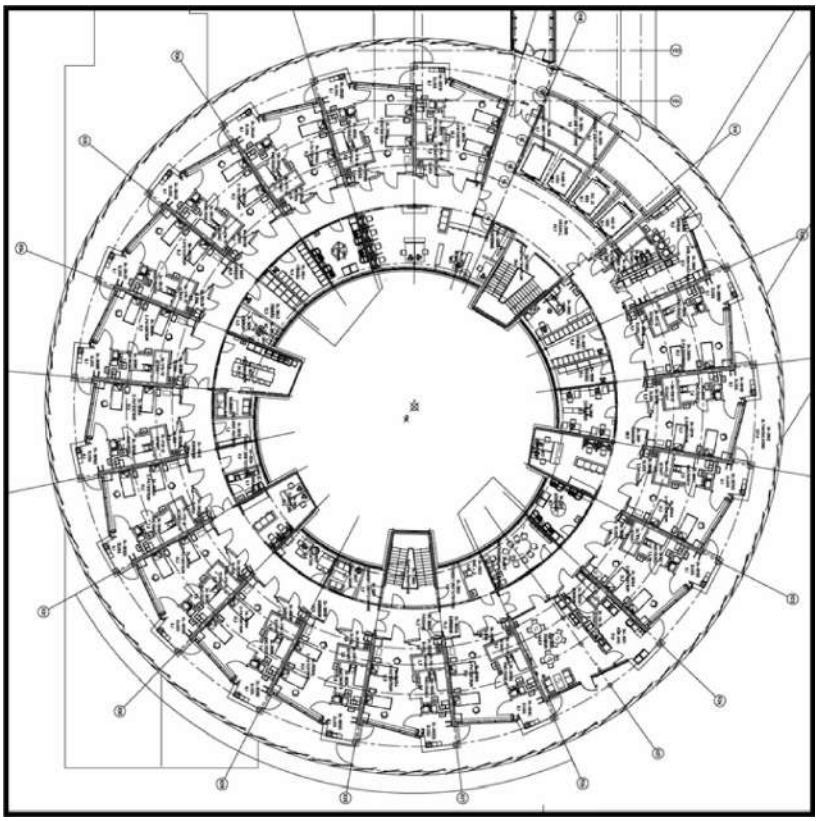

Figure 2: Ward Design (Source: Holmdahl and Lanbeck, 2013)

Figure 3: Ground floor entrance area, Malmö IDU (Source: Skane University Hospital)

A research article by two doctors who worked at the unit at the time of its development, Torsten Holmdahl and Peter Lanbeck, detail the decision-making and consultation processes during its construction period between 2008-2010, which followed planning discussions from 2006 (2013: 36). They identify three key principles – *Far Away Yet Nearby*, *Flexibility*, and *Defined Links* – behind the design that are worth quoting at length:

> Far Away Yet Nearby…isolation wards… traditionally have been located as freestanding facilities on the outskirts of… hospital grounds. However, modern standards for ID patients require close proximity to main hospital functions such as ICU, radiology, surgery, and emergency medicine. The new facility was placed close to the emergency room but also the ICU… [using] technical solutions like separate and advanced ventilation, isolated elevators, separate sewage systems, and exterior entrances to patient rooms (and outdoor air) via circulation balconies.
>
> Flexibility…patient rooms can be used both for everyday care and high-risk isolation. Furthermore rooms are of a flexible size, allowing higher occupancy during seasonal variation situations and in outbreaks.

> Defined Links…it should be possible to separate the flow or circulation of patients with contagious diseases from other patient circulation. There should also be defined links for transporting these patients between the ID ward and other facilities such as the emergency department and radiology department. (Holmdahl and Lanbeck, 2013: 35-36)

Clearly, the architectural firm received a brief that was complex in its requirements for spatial segregation whilst remaining proximate to the central services of the hospital, with significant requirements for an outdoor admissions system for patients; securitised pathways between the different parts of the building to protect patients and staff alike; highly specified mechanical ventilation systems within and outwith patient bedrooms, as well as room sizes that were more generous than typical single rooms, for the comfort of their residents (Holmdahl and Lanbeck, 2013: 30). We will review the complexity of the IDU design in relation to two particular features of the bedroom design: the use of daylight in patient bedrooms, and the use of anterooms to protect the flow of air within patient rooms.

Daylight in the bedroom: Or, 'How do you become aware of the living conditions inside this glass house?'[2]

For Yaneva, reflecting on the impact of the pandemic in contemporary architecture and urbanism, the matter of ventilation has become 'primordial' (2023: 62), especially with respect to how natural sources of ventilation relate to mechanical systems of air-conditioning. This contemporary concern echoes the physical traces left by designers of nineteenth century hospitals, who included open corridors and large windows in their buildings as responses to miasmic theories of disease (Prior, 1988), using architecture as a means of infection control in the pre-antibiotic era. In the Malmö Unit, patient accommodation is located along the outer deck of the building, echoing pre-antibiotic era traditions of outside entrance areas to patient rooms (Holmdahl and Lanbeck, 2013: 34). Full length windows allow a great deal of access to daylight for resident patients. There is also 'abundant daylight from large windows overlooking the inner courtyard of the circular building' (Holmdahl and Lanbeck 2013: 45). For Holmdahl and Lanbeck, the decision to allow such a relatively generous provision of light to both patients

[2] From Latour (2006).

and staff was in accordance with principles of evidence-based medicine (EBM), and their article is fully bolstered with citations from healthcare literature to back up the use of such large windows in patient bedrooms (2013: 39). Malmö hospital authorities interviewed Roger Ulrich as part of the information gathering process for the build of this unit (Holmdahl and Lanbeck 2013: 30) – Ulrich has been the key academic authority on the use of natural lighting in hospital space since his research in the 1980s on views from recovering patients' beds (Ulrich, 1984), and more recent research on evidence-based design for infection control (Ulrich and Wilson, 2006).

When directly asked about the use of evidence based medicine in his design, the lead architect told us that decisions about the levels of lighting derived from EBM 'working side by side' with a more fundamental architectural choice driven by his obligation to patients who may be in these rooms for long stays. For him, this created a need to allow the patient as much access to outside views as possible, in order to improve the architectural atmospherics of the setting, whilst protecting the space on clinical grounds. The architect stressed the importance of a 'clear view from the bed', echoing the approach of Alvar Aalto in his design for the Paimio Sanatorium in Southwest Finland. This building, constructed between 1929-1933, is considered to be one of the most important designs in the development of healthcare architecture, whose primary purpose Aalto characterised as 'to function as a medical instrument… The room design is determined by the depleted strength of the patient, reclining in his bed' (1956, in Colomina, 2019: 65). Indeed, Aalto's sanitorium has had a profound impact on the development of modern architecture more generally, with Colomina going so far as to claim that, after buildings such as Paimio, architectural practice shifted from a concern with the vertical person to a focus on the horizontally inclined figure, stretching always towards the light of the sun (2019: 67). In the Malmö IDU, there was a phenomenological sensitivity in the way that the lead architect spoke about trying to anticipate the experience of eventual users inhabiting this space, which was in tension with the other commissioning and commoditising logics that we know are wrapped in the planning of bed spaces and bedrooms in care settings (Nettleton et al., 2018).

The Malmö IDU architect spoke about the weather in the southern Swedish landscape and how it changes significantly through the year; he spoke about

the risks of such an open outlook as in this design, especially in terms of exposure to wind, rain and snow. However, rather than creating an enclosed glass corridor, these risks are reduced and the views left open by the architects' use of glass panels, or lamellae, placed at an angle to the balconies in order to allow external air flow through the external decking area (Figure 4). For the lead architect, this glass panelling was a design decision aimed at creating a particular architectural affect for eventual users, through the creative use of particular materialities (Buse et al., 2018; Martin et al., 2019) – the glass that allowed openness as well as protection to the bedroom spaces. As a glass-fronted building, the Malmö Unit positions itself within a long tradition of modern architecture shaped by principles that Sigfried Giedion named in the late 1920s as 'Licht, Luft und Öffnung' – or, light, air and openness to promote health and wellbeing amongst building users (Overy, 2007). This commitment to transparency is named by Colomina as x-ray architecture, where she argues that in modern architecture it is 'not so much that the inside of the building is exposed, but that the building represents exposure' (2019: 135). She traces the history of glass-fronted modern buildings being photographed at night with all their lights on, so that they glow like rib-cages in an X-ray image. More than an accidental trope in architectural photography, Colomina suggests instead that images such as these are symptoms of 'a deep-seated philosophy of design deriving from medical discourse' (2019: 137), even if the use of glass needs to be carefully considered in care settings because of its implications for capturing heat (Lewis, 2018). The Malmö building, with its clever use of glass fronting, continues this tradition, carefully bringing cooling and elements of the weather within the building, as well as maximising the exposure of daylight through its use of glass panelling (Figure 4).

Figure 4: Glass Lamellae at angles to allow natural ventilation (Source: C.F. Møller Architects + Jørgen True)

Anterooms: Or, 'Through which door do you get in and out? What sort of air do you breathe in it?'[3]

Next, we move onto the use of anterooms in this design, which create a sequence of protected spaces around the inner bedroom area. Figure 5 gives a sense of the choreography of patients, staff, objects and waste centred around the bedroom in these wards. To explain the flows of objects and people: different ventilation zones are indicated in the numbers 1-4, with 1 indicating an open ventilation source of external air, and the other spaces indicating an increasingly protected series of air-regulated and sterile zones, from (2) the ante-rooms to (3) the bed-room and including (4) the en-suite bathroom. A indicates the route of patients into the bedroom; B indicates the route of medical staff into the bedroom; C indicates the route of carers or relatives; and, D indicates the route of waste away from the bedroom, taken to dedicated

[3] From Latour (2006).

lifts. When we look at this diagram, we can see an orchestration of care – or, to use Nick Fox's phrase (1999), a circuit of hygiene - in these rooms to create a covenant of patient safety. We also, it might be argued, can see the 'lab-like *dispositif*' identified by Albena Yaneva that characterised the use of building design and public spaces in urban settings to combat the spread of the Covid 19 pandemic (2023), specifically her identification of architectural space being used as physical object and as the facilitator of discourses, protocols, processes, material affordances, and social exchanges that assemble to minimise risk of the virus spreading. Figure 5, which predates the pandemic by approximately one decade, hints at the choreography of staff and carers entering patient bedrooms over the course of any day, again to minimise risk. There are safety processes around which doors can be open and which should be closed at any given time, in order to regulate the number of air-exchanges amongst patients with highly contagious conditions. In a sense, the ante-rooms offer a striking parallel example to the defensive typologies discussed by Christian Borch in his elaboration of Sloterdijk's foam architectures (2008); certainly, the ante-rooms work to defend the internal bedroom from outside risks through securitised, semi-public and sub-divided spaces that, together and separately, act as 'a psycho-social immune system that can regulate the degree to which it is sealed off from the outside world as it requires' (Sloterdijk, 2004:578, in Borch, 2008: 562). Tellingly, these features were piloted by the use of a full-scale mock-up in the early design stages, complete with functioning ventilation technologies, water supplies and sewage systems, in order to test the placement of furniture and technologies in situ, under somewhat laboratory-like conditions (Holmdahl and Lanbeck, 2013).

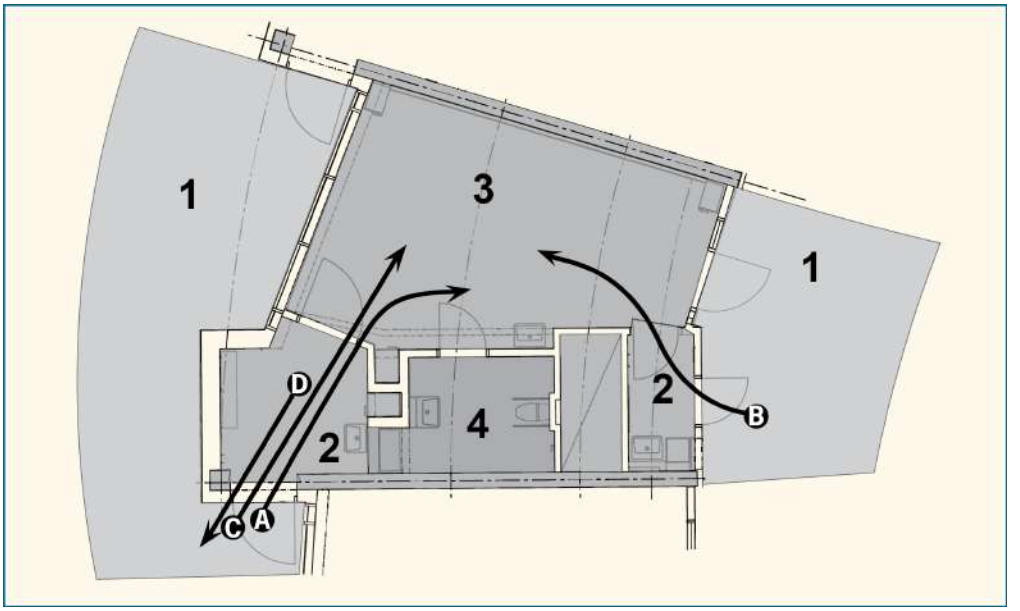

Figure 5: The patient room with outer and inner anteroom and toilet (Source: Holmdahl and Lanbeck 2013)

The use of ante-rooms relates to the question of minimising risky air exchanges and, additionally, of promoting hand-hygiene amongst all visitors to the room (after testing through the mock-up design, sinks and dispensers were placed in each of the anterooms, in addition to the bedroom and bathroom areas). For contemporary patient care and safety, the ante-rooms in the Malmö building offer a high level of protection to the bedroom area, as they stabilise air pressure levels and can effectively act as an airlock between the patient area and the staffing core (Holmdahl and Lanbeck, 2013: 41), isolating patients in the bedrooms as they simultaneously act as a protective barrier for staff (cf. Buse et al., 2020). For the doctors working in the unit, the ante-rooms in this unit also recall the use of anterooms in the prebiotic era, where they were used to protect a healthy circulation of air (Holmdahl and Lanbeck, 2013). Architecturally, there is a history of design based around optimal air-flows, linked to the development of modern design around the time of tuberculosis. Le Corbusier, in his book *The radiant city*, originally published in 1930, equated the 'genuine goals of architecture' with 'the need to provide exact air' through building and urban design (1967: 40). Architecture, to quote Le Corbusier, was concerned with giving 'the lung the constant which is the prerequisite of its functioning' through the manufacture

of 'exact air: filters, driers, humidifiers, disinfectors. Machines of childish simplicity' (1967: 42). Of course, the highly protected character of the design in this space connects with Sloterdijk's analysis of apartment design in the 20th century as emblematic of his wider theory of foam architecture, whereby:

> residential cultures of the future will assume increasingly explicitly that livable external climates must be created by technical means. Air conditioning, in the literal sense, will establish itself as the main space-political theme of the coming era. (2014: 961)

Indeed, given the airlock technologies and protocols surrounding the bedrooms, one could even make the connections with Sloterdijk's reflections on space stations as 'anthropological demonstration fields' of ways of living that are air-conditioned literally, conceptually, and more generally (2016: 299). In Dutton's analysis, we:

> are all in a technically determined (outer) space, conditioned by the air that we have brought into existence – from the explication of its particles, to the fabrication of novel coronaviruses and poisonous particles into them, to the simple act of attempting to partition (or quarantine) space, cleaving *my* air from yours. (2022: 164)

Reflecting on practical issues, the lead architect of the Malmö IDU spoke of his experience of designing hospitals in Denmark, Germany, and Sweden, and the different traditions in how ante-rooms are used in different places. So, in Germany, for example, ante-rooms tend to be much larger, because they accommodate large equipment whereas in Denmark this was not the case because of the use of different technologies to regulate the environment. The size of ante-rooms is not a mere technicality, as their size will eat into the footprint of the bed-room, and thus the quality of environment for the patient. As the architect reflected, with reference to his German experience in particular, 'it is hard to do good architecture because of so many small rooms'.

Figure 5 gives some indication of the generous space in each bedroom relative to the typical floor areas of single hospital rooms. Holmdahl and Lanbeck explain this decision with respect to previous findings in research into hospital settings, framing this as a feature of evidence-based design (2013). The lead architect noted the need to design in the most flexible way as a way of future-proofing the design, allowing the intended single bedroom to

convert to a small shared space to accommodate family members during future pandemic outbreaks, and hence mitigate the possibilities of loneliness for patients. Of course, it needs to be acknowledged that these plans tell us only of the intended use of the bedrooms, with suggested protocols for which types of air flows in each space are permitted at any one time; in this, Figure 5 resembles the modelling pollution scientists create to predict safe levels of exposure to airborne toxins in contemporary buildings. As research in those settings has shown (Garnett 2020), the simple act of opening windows to create natural sources of ventilation can be difficult to predict (and eliminate) in terms of its disruptive effects on the carefully calibrated safety protocols through air exchanges intended by professionals. And, indeed, with respect to single patient bedrooms, although this was the clear intention of architect and client, within only a few years of use on two of the three floors, the majority of individual rooms had been given over to multiple patient occupancy to deal with the general shortage of beds in the hospital (Holmdahl and Lanbeck, 2013: 49).

This speaks to a much wider argument about the interpretive flexibility of buildings (even those designed with laboratory principles in mind), because the use of architectural space can never be predetermined, and the intentions of designers are always subject to revision by building users (Gieryn, 2002). With respect to the flow of people and objects in and out of the rooms in the Malmö building, Holmdahl and Lanbeck reported that there were difficulties in staff adjusting to the door access regulation system in the early use of the unit (2013: 49). As has been argued with respect to this building, it is not credible ‘to completely maintain that pure threshold between the outer world of patients, their visitors, and the inner world of hospital staff’ (Brown, 2017). Thinking about the wider lessons for architecture, Nerea Calvillo’s argument that the use of buildings will always be provisional, and indeed should be considered experimental, is important and persuasive (2018). Calvillo borrows thinking from Sloterdijk on the use of air to understand questions of design, but ultimately rejects his ‘metaphorical reading of architecture as enclosure’; instead, Calvillo argues that we consider architecture ‘not simply as creating envelopes for climate control, but as involving the actual design of atmospheres where the air is not only a conditioner of well-being but also a material for the construction of certain modes of sociality’ (2018: 44). For us,

this prompts us to think about the *dispositif* of capture (Yaneva, 2023) as always contingent, never completely determined by design; again, we agree with Calvillo's suggestion that we 'reduce the expectations of architecture and shift from *constructing the social* to *facilitating socialities*' instead (2018: 42), as these are more open to the future, and its different understandings of health and models of disease.

Discussion

Holmdahl and Lanbeck suggest that the use of ante-rooms and the entrance area directly from the outside are two examples of how 'architectural design precedents from the pre-antibiotic era… were found highly relevant for the post-antibiotic era' (2013: 35). Thus, they write that in order to 'better anticipate the coming 25 years, we chose to look back 25 years' (2013: 31). But, when considering precedents in hospital design that help to understand contemporary trends, we can go further back in time to think about the concern with air flows throughout the Victorian period, and the influence on hospital architecture at that time (Prior, 1988). In this paper, we have more often made connections between the Malmö IDU and the precedents of modern architecture in the early twentieth century. Drawing on the legacy and influence of Le Corbusier's philosophy of modern architecture in particular, Colomina suggests that approximately one century ago, the:

> architect-doctor became a bacteriologist, generating design principles out of the laboratory scrutiny of microbes. Architecture itself became bacterial. (2019: 73)

She continues to argue that the 'age of bacterial diseases – particularly tuberculosis – gave birth to modern architecture… when the discovery of antibiotics put an end to that age, in the postwar years, attention shifted to psychological problems' (2019: 182). Yaneva's analysis picks up where Colomina's ends, and takes the Covid pandemic as an inflection point, architecturally; technologies and materialities central to mitigating the spread of the virus:

> turned contemporary buildings into subtle *dispositifs* organized around the human hand and physical contact. This trend gradually translated into a spatial architecture that is about distributing flows of movements, regulating

> distances, avoiding contact, impeding touch and dispatching energies, rather than containing bodies or setting out explicit programmes of use. The ability to avoid contact and ensure distance in enclosed spaces slowly challenged established protocols of sociality and, ultimately, the architectural concept of a container. (2023: 80)

Yaneva continues to argue that the objects and artefacts deployed in everyday urban settings during the pandemic – perspex screens, hand sanitiser stations, people counter sensors – 'slowly and gradually became 'a pattern giver' to contemporary architecture' (2023: 80). Moreover, these objects and artefacts worked to dissolve 'the boundaries of architecture, the structure, the container, the form and defied all static understandings of space, prompting the development of a new architectural sensitivity' (Yaneva, 2023: 80). Putting aside speculations to where the next pandemic will arise from and what form it will take, this argument begs the question of what will happen to architecture and spatial design in an era of antimicrobial resistance. In large part, we argue, the architecture of the future will necessitate increased sensitivities to the atmospheric qualities of buildings in all senses of that word, ranging from concerns with the affective charge of particular spaces (Martin et al., 2022) to the very air that flows through (Brown et al., 2020).

Conclusion

In this paper, alongside considerations of how medical technologies and experiences of present day medical crises influence architectural imaginaries, we have argued that it is important to situate new clinical buildings within historical traditions of using space to control disease. Following Lefebvre (1991: 66), we have sought to understand 'the genesis of the present' by retracing previous steps in hospital design to arrive at the hospital today. Of course, there are differences between the pavilion hospitals of the Victorian period, the sanatorium designs of the early twentieth century in Northern Europe, and the ward design we see in Malmö - not least in terms of the generosity of personal space written into the bedroom plans. But it is the similarities, between the past and present of risk, that stand out, with respect to the materialities shaping the design of the space and the mobilities of people and objects that this architecturally induced, intricate choreography of care afforded through this building's design encourages. Through an

examination of architectural plans, we have offered an analysis of the role of materialities (glass-fronted bedrooms), mobilities (patient, staff, and waste flows in and out of these bedrooms), and design in brokering protocols for patient safety in the Malmö Infectious Diseases Unit. We have reflected upon this building as emblematic of Sloterdijk's theories of foam architecture, where spatial logics are premised around principles of co-isolated adjacency (2016); the tensions Sloterdijk identifies in many general architectural typologies are heightened in the Malmö building, where patients need to be isolated and yet visible to medical staff. We have reflected upon this building as a space where the threats posed to imagined patients' bodies shape the plan to such an extent that the distinctions between bodies and environments can be said to effectively dissolve in the anticipated exposure to airborne risks (Garnett, 2020: 56), where the design of bedroom spaces serve to defend the patient in the room (and staff elsewhere in the building), and where systems of air-conditioning and cultures of immunity reinforce each other (Borch 2008). We have considered how building plans are complicit in the social construction of risk, and probed the nuances implicit in architectures that are designed to contain viruses, hold breathing bodies in secure spaces, and spatially regulate the exchange of airflows - all in the name of patient safety and infection control (Yaneva, 2023). And we have signalled, through our case study of the Malmö IDU, how care is enacted through a relational web of more-than-human agencies (building plans, air-conditioning systems, the flow of external air through glass-fronting, and so on), intersecting routinely, and anticipated through architectural design (cf. Puig de la Bellacasa, 2017). Practices of care are enabled through their material environments, and the spatial contexts that orchestrate them (Martin, 2016; Buse et al., 2018).

Tensions arise, as we learned from speaking with the building's lead architect, in striking a balance between designing spaces that facilitate the segregation of patients for their safety from others for extended periods of time, alongside carefully creating spaces that are comfortable during those periods of isolation. As is often the case in health and social care buildings, the architect's plans for this building began by designing from the bedroom outwards (Nettleton et al., 2018) - in this case, envisaging an end-user for whom the act of breathing itself may be fraught with risk. Breathing, typically an unremarkable and unnoticed action for most, becomes heightened and a

very visible problematic in this particular design. 'Breath is not invisible to those for whom breathing is difficult', Macnaughten writes, 'but their situation brings particular kinds of absence and isolation which are complex to address' (2020: 31). In this building's design, we find affective atmospherics at play which aim to create aesthetics of comfort, protocols of care, and spaces to safely catch one's breath within the patient bedroom, a place apart from the threats elsewhere in the wider hospital and, indeed, the city (Brown, 2020). In previous work, we have highlighted the connection Gernot Böhme draws between the act of breath and the absorption of the atmosphere of a place (Brown, 2017). For Böhme, the atmosphere of a place should be 'conceived not as free floating but on the contrary as something that proceeds from and is created by things, persons or their constellations' (1993: 122), such as the uncertain socialities and dynamics created in architectures cognisant of the ambiguous politics of breath, breathing, and the air.

The architecture of the Malmö Infectious Diseases Unit is an intriguing building for us, as following its planning involves shifting our perception of 'architecture as an object to dynamic atmospheres' instead (Calvillo, 2018: 59). Albena Yaneva is surely right where she identifies, arising from the Covid pandemic, architectural designs characterised in terms of processes of 'spacing and transforming, rather than moving *in* space' (2023: 81) – or, we might add, moving away from visions of the control *of* space and air to tactically managing people's contact with each other *through* spacing protocols and strategies. The Malmö building's design predated these strategies by more than a decade, through its sensitivities to new understandings of immunity, whereby it is as if 'the former blood ties of family… [have] turned outward from one's person to now include the breathing space of those whose individual immunitary designs most closely match one's own' (Campbell, 2011: 97). The Malmö building is therefore an emblematic design of its time, informed by hospital designs from the pre-antibiotic period, for a new and experimental architecture of the post-antibiotic, and post-pandemic era.

acknowledgements

The authors would like to thank audience members who commented on early versions of this paper at the White Rose Vital Circulations online symposium in January 2022, and British Sociological Association Medical Sociology Conference at Lancaster University in September 2022. The comments we received from Hannah Grün and the two anonymous referees during the Ephemera review process have greatly improved the paper. We would also like to thank Kristofer Hansson, Torsten Holmdahl, Peter Lanbeck, and colleagues from CF Møller for their support of the paper. Our interest in the complexities of healthcare design arises from the pioneering research of Lindsay Prior, who sadly passed away in November 2021. Lindsay was generous in his encouragement of our work in this area, and we will be forever grateful for his advice and support. He is sorely missed.

references

Blaxter, M. (2009) 'The case of the vanishing patient? Image and experience', S*ociology of Health & Illness*, 31(5): 762-778.

Böhme, G. (1993) 'Atmosphere as the fundamental concept of a new aesthetics', *Thesis Eleven*, 36(1): 113-126.

Borch, C. (2008) 'Foam architecture: Managing co-isolated associations', *Economy and Society*, 37(4): 548-571.

Bromley, E. (2012) 'Building patient-centeredness: Hospital design as an interpretive act', *Social Science & Medicine*, 75(6): 1057-1066.

Brown, N. (2017) 'Anatomospheres: A "respiratory politics" of buildings and breath', *Discover Society*, 47.
[https://archive.discoversociety.org/2017/08/02/anatomospheres-a-respiratory-politics-of-buildings-and-breath]

Brown, N. (2020) 'Architecture and design for a post-antibiotic/post-covid-19 world', *Discover Society*.
[https://archive.discoversociety.org/2020/06/16/architectures-and-designs-for-a-post-antibiotic-post-covid-19-world]

Brown, N., C. Buse, A. Lewis, D. Martin and S. Nettleton (2020) 'Air care: An 'aerography' of breath, buildings and bugs in the cystic fibrosis clinic', *Sociology of Health & Illness*, *42*(5): 972-986.

Brown, N., C. Buse, A. Lewis, D. Martin and S. Nettleton (2021a) 'Pathways, practices and architectures: Containing antimicrobial resistance in the cystic fibrosis clinic', *Health*, 25(2): 196-213.

Brown, N., S. Nettleton, C. Buse, A. Lewis and D. Martin (2021b) 'The coughing body: Etiquettes, techniques, sonographies and spaces', *Biosocieties*, 16: 270-288.

Buse, C., N. Brown, S. Nettleton, D. Martin and A. Lewis (2020) 'Caring through distancing: Spatial boundaries and proximities in the cystic fibrosis clinic', *Social Science & Medicine*, 265: 113531.

Buse, C., D. Martin and S. Nettleton (2018) 'Conceptualising "materialities of care": Making visible mundane material culture in health and social care contexts', *Sociology of Health & Illness,* 40(2): 243-255.

Calvillo, N. (2018) 'Inviting atmospheres to the architecture table', in N. Marres, M. Guggenheim and A. Wilkie (eds.) *Inventing the social*. Manchester: Mattering Press.

Campbell, T.C. (2011) *Improper life: Technology and biopolitics from Heidegger to Agamben*. Minneapolis: University of Minnesota Press.

Colomina, B. (2019) *X-ray architecture*. Zurich: Lars Müller Publishers.

Corbusier, L. (1967) *The radiant city: Elements of a doctrine of urbanism to be used as the basis of our machine-age civilization*. London: Faber and Faber.

Dutton, J. (2022) 'Objective breathing: Peter Sloterdijk's atmospheric mediation', *Cultural Politics*, 18(2): 151-172.

Fox, N.J. (1997) 'Space, sterility and surgery: Circuits of hygiene in the operating theatre', *Social Science & Medicine*, 45(5): 649-657.

Garnett, E. (2020) 'Breathing spaces: Modelling exposure in air pollution science', *Body & Society*, 26(2): 55-78.

Gieryn, T.F. (2002) 'What buildings do', *Theory and society*, 31(1): 35-74.

Holmdahl, T. and P. Lanbeck (2013) 'Design for the post-antibiotic era: Experiences from a new building for infectious diseases in Malmö, Sweden', *HERD: Health Environments Research & Design Journal*, 6(4): 27-52.

Ingold, T. (2023) 'A breath of fresh air: Or, why the body is not embodied', *SubStance*, 52(1): 100-107.

Jones, P. (2018) 'Private finance initiative hospital architecture: Towards a political economy of the Royal Liverpool University Hospital', in C. Buse, D. Martin and S. Nettleton (eds.) *Materialities of Care: Encountering Health and Illness Through Artefacts and Architecture*. Oxford: Wiley-Blackwell.

Lande, B. (2007) 'Breathing like a soldier: Culture incarnate', *The Sociological Review*, 55(1_suppl): 95-108.

Latour B. (2006) 'Air', in C. Jones and B. Arning (eds.) *Sensorium: Embodied experience, technology, and contemporary Art*. Cambridge, Mass.: MIT Press.

Lefebvre, H. (1991) *The production of space*. Oxford: Blackwell.

Lewis, A. (2018) 'Insight: Mitigating overheating', in J. Park and J. Porteus (eds.) *Age-friendly housing: Future design for older people*. London: Royal Institute of British Architects.

Macnaughton, J. (2020) 'Making breath visible: Reflections on relations between bodies, breath and world in the critical medical humanities', *Body & Society*, 26(2): 30-54.

Martin, D. (2016) 'Curating space, choreographing care: The efficacy of the everyday', in C. Bates, R. Imrie and K. Kullman (eds.) *Care and design: Bodies, buildings, cities*, Oxford: Wiley-Blackwell.

Martin, D. (2021) 'Between bodies and buildings: The place of comfort within therapeutic spaces', in D. McNally, L. Price and P. Crang (eds.) *Geographies of comfort*. London: Routledge.

Martin, D., C. Buse, N. Brown, S. Nettleton, A. Lewis and L. Chapman (2022) 'Assembling atmospheres, encountering care: Risk, affect, and safety in the cystic fibrosis clinic', *Wellbeing, Space and Society*, 3: 100077.

Martin, D., S. Nettleton and C. Buse (2019) 'Affecting care: Maggie's Centres and the orchestration of architectural atmospheres', *Social Science & Medicine*, 240: 112563.

Martin, D., S. Nettleton, C. Buse, L. Prior and J. Twigg (2015) 'Architecture and health care: A place for sociology', *Sociology of Health & Illness*, 37(7): 1007-1022.

Mesman, J. (2009) 'The geography of patient safety: A topical analysis of sterility', *Social Science & Medicine*, 69(12): 1705-1712.

Mol, A. (2008) *The logic of care: Health and the problem of patient choice*. London: Routledge.

Nettleton, S., C. Buse and D. Martin (2018) '"Essentially it's just a lot of bedrooms": Architectural design, prescribed personalisation and the construction of care homes for later life', *Sociology of Health & Illness*, 40(7): 1156-1171.

Overy, P. (2008) *Light, air and openness: Modern architecture between the wars*. London: Thames and Hudson.

Oxley, R. and A. Russell (2020) 'Interdisciplinary perspectives on breath, body and world', *Body & Society*, 26(2): 3-29.

Prior, L. (1988) 'The architecture of the hospital: A study of spatial organization and medical knowledge', *British Journal of Sociology*, 39(1): 86-113.

Prior, L. (1992) 'The local space of medical discourse', in J. Lachmund and G. Stolberg (eds.) *The social construction of illness*. Stuttgart: Franz Steiner.

Puig de La Bellacasa, M. (2017) *Matters of care: Speculative ethics in more than human worlds*. Minneapolis: University of Minnesota Press.

Sloterdijk, P. (2009) *Terror from the air*. Los Angeles: Semiotext(e).

Sloterdijk, P. (2014) *Spheres II: Globes*. South Pasadena, CA: Semiotext(e).

Sloterdijk, P. (2016) *Spheres III: Foams*. South Pasadena, CA: Semiotext(e).

Söffner, J. (2023) 'The freedom to breathe', *SubStance*, 52(1): 145-152.

Ulrich, R.S. (1984) 'View through a window may influence recovery from surgery', *Science*, 224(4647): 420-421.

Ulrich, R.S. and P. Wilson (2006) 'Evidence-based design', *Public Service Review: Health*, 8: 24-25.

Yaneva, A. (2022) *Architecture after COVID*. London: Bloomsbury Publishing.

the authors

Daryl Martin is Lecturer in Sociology at Maynooth University, with interests in the intersections of architecture, embodiment and healthcare.
Email: daryl.martin@mu.ie

Nik Brown is Professor in Sociology and Head of Department at the University of York, where he works on the sociology of immunity, antimicrobial resistance, and healthcare architectures and infection control.
Email: nik.brown@york.ac.uk

Christina Buse is Lecturer in Sociology at the University of York, with research interests in the areas of embodiment, ageing, dementia, and sensory methodologies.
Email: christina.buse@york.ac.uk

Sarah Nettleton is Emeritus Professor in Sociology at the University of York, with research interests over three decades on issues relating to medical knowledge and practice, sociology of the body and embodiment and healthcare architecture.
Email: sarah.nettleton@york.ac.uk

Alan Lewis is Head of Architecture at the University of Manchester, with research interests in the implications of an ageing population for housing design and the impact of building design on occupants' health.
Email: alan.lewis@manchester.ac.uk