

Interior Resistance

Abstract

The interior frequently masquerades a resistance to being clean, often demonstrating different levels of hygiene, containment and control. Yet, it is the-body-inside that simultaneously resists and distributes infection within the mineral contexts of the building. Ever since Van Leeuwenhoek's (1677) discovery of a strange microbial world of bacteria and protozoa, societal, bodily and spatial interpretations of clean have shifted. Evolving levels of cleanliness continually reposition the interior to become progressively more visually hygienic and meticulously super-clean. While medical need often leads and intensifies infection control, it is personal fastidiousness, compulsion and media image that shape human attitudes and cultures to grime and dirt. Historically, 'homes-of-the-future' reinforce a technologically sanitized prototype, a strain of which persists in the sterility of the ordered 'show-home'. Each avoids the pathogenic realities of the-body-inside revealing aesthetic traces of the Modernist ideals of clean lines and clean living that recur in contemporary images of minimal occupation. As we move to develop new hyper-clean and locked-down pandemic-proof interiors capable of immunizing and shielding occupants, this paper re-evaluates what it means to be clean and how the interior helps to resist and mediate these efforts. As concerns over antimicrobial resistance and interior *touching* increases, our protection from allergy, disease and contagion are changing. The interior is increasingly playing a critical role in arbitrating biological infection, either through intelligent cleaning systems, infrastructure or material science. This paper sets out the existing resistance to, and the conditions for, a new *clean* interior and posits where and what the future might conceive, including the advancement of immunology by reintroducing "dirt" back into interiors (mirroring Edward Jenner's deliberate infection of humans to develop resistance to smallpox) enabling better biological resistant to the outside world.

Keywords: Infection, resistance, Modernism, identity, immunology.

Interior cleansing

A primary tenet of a modern interior is that when forming new constructions of space¹ (Massey 2005, 9), it manifests itself as comfortable, ordered and clean. This is the basis for the majority of aspirational interior spaces that are presented as the vision of spatial utopia. There is a long history of architectural 'homes-of-the-future' and other visionary prototypes in which the interior is both technologized and sanitized, liberating inhabitants from domestic drudgery and infection-free – an environment of clean-lines and clean-living redolent of the efficiency and order promoted by Modernist ideals. Yet a persistent image of contemporary and minimal interiors is at odds with underlying obsessive behaviours such as compulsive hoarding and extreme cleaning. Often the idealized image of an interior will be tidy, uncluttered and harmless in its arrangement, environment and surface. That is the premise, but as the interior strives for a *clean* and *untouched* aesthetic, questions arise about how the sanctity of this aseptic interior will operate at a time of increasing concern about pathogenic contamination and microbial infection.

Whilst there is much discussion (through branded cleaning products, Figure 1) that interior spaces can become super clean, minimising and resisting bacterial infection. There is also an alternative strategy that could see the interior emerge as a significant participant capable of mediating and combating the pathogens, diseases and caprices of modern lifestyles. Here the interior is set apart from architecture, creating a clean/ dirty binary, separating and dividing the built environment. In truth, physical contact with architecture is limited to the handshake of the door (Pallasmaa 2012,62) and the caress of the balustrade. Most architecture is manufactured from hard, solid and external materials designed to protect us from the vagaries of the climate, but the interior palette is more nuanced, tactile and absorbent. Our bodies, it can be argued, come into contact with the interior in profoundly different ways than our encounters with other external forms of architecture. There are natural and cultural variations to this such as interior activity, human density and whether it is a commercial or domestic space, but the key principles remain. The natural inclination is to scrub our interior spaces as clean as possible, almost obsessively so, working hard to eradicate every last microbe that might bring us pathological harm (particularly in the current climate of COVID-19).

Figure 1. Branded Cleaning Products (Source: Good Housekeeping²)

In defining the objective of the human desire to clean and purify, it is pertinent to draw on ideas articulated by anthropologist, Mary Douglas in her seminal work, *Purity and Danger*. She equates dirt with disorder, characterising it less as a harmful intrusion on the body, and more as something that offends against the human desire to control the spaces we occupy. 'Dirt', she says, 'offends against order. Eliminating it is not a negative movement but a positive effort to organise the environment'. She then continues by suggesting further classification: 'Dirt is the by-product of systematic ordering and classification of matter' and defines the contradiction of dirt as 'Shoes are not dirty in themselves, but it is dirty to place them on the dining table; food is not dirty in itself, but it is dirty to leave cooking utensils in the bedroom, or food bespattered on clothing' (Douglas 2002, 44-45). She clarifies the relationships between dirt and matter and how our attitudes towards it change as it is recognised throughout the interior spaces. Examining the origins of dirt as culturally constructed rather than a material reality, Douglas famously proposed that, 'dirt is matter out of place' (44). When applied to interior sensibilities, the notion of dirt as disrupting and disorganising puts it at odds with the modern interior or, at least with its media image. By failing to address our fears and anxieties about hygiene, the modern interior has become synonymous with a sense of illusionary *life-style* perfection, order and control that appears to be inextricably bound with the elimination of dirt.

The interior allows for a continually flexible spatial experience that accommodates a fluid set of human behaviours, residues and grime that reflect the vagaries of human occupation. A key motivation for its existence and flexibility is that it filters, absorbs and accommodates the human body, allowing for its needs, fragility and diversity. These desires are suggested by Canter (1975, 9) '*...the built environment should be considered a filter. A building, for example, allows in the light and the fresh air which we require, but keeps out the nasty noises and the rain.*' The interior forms a dialogic resistance against the architecture, often creating a powerful dualistic state where a clean interior relentlessly battles to keep the dirt and grime of the *outside* out. In the article, 'Home but not alone', biologist Robb Dunn (who undertook the biggest DNA study of microbial eco-systems to date in 1430 homes) discovered a remarkable diversity of microbes and revealed how the home is also a natural filter for bacteria stating that in '*every nook and cranny of our houses and flats is invisible eco-system of bacteria, fungi and archaea. And it is only now that we are beginning to get a true picture of this eco-system.*' James Meadows, a researcher at the University of Oregon, describes the excretions of our leaky bodies onto the interior – 'chairs that hold the bacteria from the human gut and vagina' suggesting a rather different notion of the environmental 'filter' where humans continually leave traces across the spaces of their existence. Dunn reiterates some of that military rhetoric we'd recognise in our perpetual urge to vanquish dirt stating, '*We go to war against these invisible life-forms and we think we're creating an environment that's free from them. Instead, we're creating an environment in which we favour those few species able to withstand our assaults*' (Dunn 2015, 38).

Historically, the interior was considered as a consequence of architecture, forming as a result of architectural decisions and layout (Semper 2011 174-181). But Myerson (2004, 205) reiterates Duffy's claim, inverting the power of interior to be more responsive, suggesting '*Architecture, in the financial sense at least, is rapidly becoming a branch of interior design – The neutral shell within which the real drama is played out*' suggesting the actions inside the building create a new focus and thought for the built environment. The relationship between human occupants and the interior is a complex one. It operates as a diversified environment capable of reflecting and interpreting the-body-inside, human experience, and the occupations of space. This is highlighted through the discussion by De Botton (2007, 13) where he suggests how spaces affect our moods and shape our feelings. He highlights the built environment can have a significant impact on the human psyche '*we are never far from damp stains and cracked ceilings, shattered cities and rusting dockyards*' and questions '*what will we experience in a house with prison like windows, stained carpets and plastic curtains?*' He suggests that there is a derogation of experience and identity when we know that the spaces we occupy are dirty. This deepens when you consider the ideas of cleanliness, contagion and bacterial resistance. The interior is both a space filled with air, objects, or a myriad of surfaces all capable of harbouring germs and bacteria in different ways. But humans, like the interiors they occupy, assume a binary idea of dirtiness and cleanliness that is open to question.

Interior flexible resistance

The interior plays a semi-immunizing role, partially separating and dividing activities between the inside and outside the architectural shell, pushing and colliding with the occupants. Whilst there are increasing examples of a flexible resistance involving 'bringing the outside inside' in emerging and biophilic innovations, generally, the modes of human existence are still separated by climate, activity

and privacy. However, the internal space and surfaces are shaped by the human dimensions and mimesis inside and outside of the body. Of particular interest are the descriptions of the human skin and the layers of the body. Serres (2016, 50) describes *'The skin, a single tissue with localized concentration, displays sensitivity. It shivers, expresses, breathes, listens, loves and lets itself be loved, receives, refuses, retreats..... Skin flows like water through space'* engendering a delicacy and fragility to the external and interiority of the body. Pallasmaa (2012, 71-72) suggests that human interiority is shaped by the surface, skeleton and organs of the body and how the body fits and touches the inside of space. In his exploration of the importance of the senses and how the body moves, reacts and occupies the interior space suggesting the body *is* the space. These haptic relationships within the interior, where touching the interior is allowed and encouraged, reinforces a need to retune our normative ways of thinking of the interior, especially now the current global pandemic has redefined interior isolation and heightened the threat from external contagion. These situations promote a simple layered approach to interior resistance, using the stratum of the human body tissue to unfold a series of layers radiating out through the interior to the architecture. Serres (2016, 148) uses boxes to illustrate this process unfolding within the human condition, describing the built environment as a *'nested series'* highlighting its complexity and densities from the *'concrete to bed linen'*.... Finally coming all the way in, reaching *'our real skin'*. To contextualise this, the illustration (Figure 2) in Brand (2010, 34) helps to consider this layered approach to the *'protected interior'*. This simple illustration promotes a building assembly that centralises the interior environments that humans occupy. Lawson's interpretation (of Duffy's original) was used to show the hierarchical layering of building wear analogous to the layering of the garment to the body; building fabric to the occupant. Whilst it demeans the interior as mere *'stuff'*, it centralises and focuses the sealing and resistance of the interior, separating it from the concentric layers of the architecture and services. Lawson (2001, 202) uses this model to promote a constructivist approach to the built environment, suggesting that a building for human dwelling is like a conceptual Matryoshka formed by a series of *'nested'* layers concurring with the views suggested by Serres.

Figure 2. Lawson's (2001, 202) representation of the building model (based on Duffy, 1997 and adapted by Brand, 2010, 34).

Interior identity

As new interior spaces are formed, and existing spaces are being adapted to the impacts of social-distancing and COVID-19, there is a significant re-evaluation of what it means to be clean and how bodies interact with each other and the "stuff" of the interior. Sustainable interiors like the new Actiu HQ in Alicante, Spain³ bring new identities from recycled and repurposed interiors. Complete reuse and reengineering of materials for interiors are emerging as a critical component in the built environment, as the sector seeks to off-set its worrying contribution to CO2 emissions and realign itself to be more connected with the occupants and their long-term needs.

This can often be at odds with media narratives that emphasise leisure and residential interiors' complicity in conspicuous consumption and excesses. However, other paradoxes are revealed. The tendency to cosmetically age and artificially dirty an interior's surfaces has its parallels in the allure of *'pre-washed'* jeans, the verdigris patina of pre-oxidised copper cladding and the digital dirt in computer gaming experiences - a feature rarely transmitted into interior representations. Reliance on such staged deception offering an impression (as in a rubbing) of the interior whose well-worn patina elicit an illusory, but reassuring authenticity and atmosphere. The grimy patina of repurposed timber or furniture (however clean below the surface) repositions the nature of clean spaces replacing new hygiene with old artifice. This creates a hybrid interior with differing hygienic identities that align more to the users and the-body-inside space. While Serres (2016, 57-58) shapes an identity principally for space using *'mingled'* and *'invisible'* senses, Gosling (2009, 66) points out that subjective notions of identity bring a *'coherence'* to human lives, positioning identity as a delicate *'thread'* that *'ties the experiences of our past, present and future into one narrative'*. However, the interior is notoriously difficult to analyse and finding the optimum space where the interior and exterior are both coexisting and yet resisting each other is often difficult to pin down. Sparke, (2008, 2) suggests an *'ambiguous relationship with architecture'* highlighting the interiors multiplicity and its variability. The inside is a place of function and restraint, the outside is dirty and unregulated and the threshold is often the physical and ritualistic diaphragm between these two conditions, a buffer-zone that demands the procedural shedding of the outer grime. The inside can be controlled, choreographed, manufactured and designed for specific human use both in terms of its utility and materiality, whether artificial, faux-patinas or pre-aged timber finish. The outside is a place that is influenced by the vagaries of climate

and location providing a degree of permeability and protection. A consequence of this development was the manufactured interior, the place where everything could be imagined, mediated and measured, a place where the dirtiest objects in the room are often the human inhabitants, co-habiting pets, other foreign bodies on those bodies, migrating and transmitting infections from room to room. The interior environment can be conditioned to act like a sealed vessel, using smart or antibacterial surfaces and architectural membranes to contain an infection or resist a contaminant. The ability to not only create, but maintain a clean place often signifies societal and economic development.

A good example of an interior typology with a powerful identity and a stringent concern for cleanliness and hygiene is the hotel. An increasingly global phenomenon, the hotel is the most complex and integrated interior space but has an important role to play in meeting more slippery benchmarks for comfort and more visceral perceptions of hygiene as a part of their unique selling point, DNA and appeal. Highly transferable in terms of their cultural relevance, hotels offer a universal experience based on paying for an acceptable level of cleanliness and are often rated for cleanliness being the most important aspect of hotel room occupation⁴. Major hotel brands like Hyatt, Hilton and Marriot have high customer satisfaction ratings in which hygiene is critical, but the hotel room is a difficult environment to completely cleanse after each customer, especially when applying increasingly stringent pandemic restrictions, inhouse and state-imposed environmental standards. If we consider the development of cleanliness in high traffic interiors, then the hotel would be a useful context to introduce personalised and self-cleaning hygienic materials. As a public place built around private, intimate experiences, the hotel is saturated with ritualistic behaviours of arrival, occupation and location which also invites a potent mix of subjective customers perceptions to collide with objective ways of managing hygiene and cleanliness. The hotel actively promotes ideas of rest, leisure, welcome and wellbeing (even in a business context). This is supported through analysis and discussion of '*prospect refuge theory*' (Dosen and Oswald 2013, 18), the individual "mingling" of ritual (Serres 2016, 57-58), identity (Gosling 2009, 66) and the relationship between the '*potency of disorder*' and cleanliness (Douglas 2002, 117, 197).

Mark Wigley argues in his influential book, *White Walls Designer Dresses* that the unremitting whiteness of modern architecture exposes its role of in creating a distinction between so-called civilised and primitive cultures. That whiteness represents a sense of order and cleanliness that align architecture with the idea of civilised society, distinct from the sensual environments of so-called primitive society. He propagates that: '*the whole economy of hygiene remains fundamentally visual rather than sensual ... it is about bracketing the sensual out in favour of the visual*' (Wigley 2000, 6). Modernism's ideal of purification, casting out all that is superfluous or ambiguous, is borne through a stripping back of ornamentation, which recalls Adolf Loos identification of ornament with lower cultures. Wigley suggests that the modernist promotion of purity and whiteness is less about hygiene as such, but that it creates the appearance of such a condition. Similar to a medic's white coat, or a white tiled bathroom or a crisp white shirt, it is the signification of cleanliness, that is promoted through the dressing of the architectural skin. Creating a layer of signification to conceal what is going on beneath the surface, the whiteness serves to promote an image of physical hygiene as a measure of social purification. Inherent messages within the blankness of the white wall reinforce social divisions. '*Cleanliness was the visual effect that marked one's membership of a social class rather than the state of one's body*' (Wigley 2000, 6).

This leads to some questions about the interior: Does the ordering and purifying logic of Modernism mean that it is inherently connected to a denial of the sensual in favour of the visual? In doing so, is the interior caught up in a denial of transgression and ambiguity that serves to prevent its development? Does the denial of ornament constitute an act of casting out the matter that is out of place and in so doing show the design of interior spaces to be an inherently purifying act?

Cleanliness and health

Cleanliness, said John Wesley (1778), *is next to godliness*. Historical references to bodily hygiene are often expressed in religious rites, acts of ablution, resurrection and purification: sin equating with dirt with its class inference of the suspect social mass of the great unwashed. Religious spaces are seen as purified, exorcised of dirt, on pure-sacred-ground, clean or capable of a cathartic, metaphysical cleansing (of the soul) and therefore requiring an untainted architecture for prayer. The allusions here to iconic paired-back Modernist architecture seems clear as are their status as sites of architectural pilgrimage. Many aspects of religion are related to rituals involving cleanliness and purity. An architecture of ablution often involving the washing of the hands, the feet or the body and are

manifested in the wash-hand basin upon entering Villa Savoye strengthening the religious connotations of the architecture. The interior is often viewed as the embodiment of the inhabitant, the person, but such ocular-centric observations mask the odorous and other sensorial associations. The scent of spaces is also a signature note of an inner identity and a signal of its relative cleanliness or dirtiness. Cheatele refers to this in the context of Maison de Verre as the 'allure of ventilation' as being the true motif of modernity (not glass). This 'free flow of air' references the 1904 study by Konrad Meier's who stated, '*excessive amounts of water vapour, sickly odours from respiratory organs, unclean teeth, perspiration, untidy clothing, the presence of microbes due to various conditions, stuffy air from dusty carpets and draperies....cause greater discomfort and greater ill-health.*' (Cheatele: 2017, 181 citing Meier 1904). Gideon's critique of Corbusier's houses stated these '*...are neither spatial nor plastic: air flows through them! Air becomes a constituent factor! Neither space nor plastic form counts, only relation and interpenetration! There is only a single, indivisible space. The shells fall away between the interior and exterior.*' (Gideon:1928 in Vidler 2002).

Definitions of hygiene are often cited as in '*the eye of the beholder*' (17th Century English proverb cited in Forty 1986, 157) where '*cleanliness and dirtiness are almost as subjective as beauty and ugliness*'. This helps establish an important division different between a dirty human and a dirty interior. Ashenburg (2007, 7-8) creates a compelling lament arguing that the repetitions of bodily cleansing and resistance to the '*clean police*' create strange human anomalies: '*to risk smelling like a human is a misdemeanour, and the goal is to smell like an exotic fruit (mango, papaya, passion fruit) or a cookie (vanilla, coconut, ginger)*' and reinforces cleanliness as a panacea for the body hidden by fragrance. This can be applied directly to the interior. Beeton (2008, 37) simplifies interior cleanliness as a regular and thorough action '*...the general description of house-cleaning, must be under-stood, is turning out all the nooks and corners of drawers, cupboards, lumber-rooms, lofts, etc., with a view of getting rid of all unnecessary articles, which only create dirt and attract vermin; sweeping of chimneys, taking up carpets. painting and whitewashing the kitchen...*'.

Some of the early Modernist architecture and interiors were designed with separation from the earth in mind. Most of these were designed to be elevated on concrete pillars (Le Corbusier: Villa Savoye, Paris (1928) or Chermayeff / Mendelsohn: De a War Pavilion, Bexhill on Sea, UK⁵) which rise and resist the relationship to the earth. Enabling a disconnection with the dirt and contaminations of the soil but also tapping into an architectural manifesto and a social fascination for active pursuits, vitality and vigour and improving health. This period changed the nature of the spatial environment through the ideas of separation, division and exclusivity. Whilst the Modernist ideals were associated with purity and transformation, many of the core philosophies of Modernism were driven by horror, inhumanity and the filth of the war.

Spatial hygiene is a broad term used globally to describe the state of cleanliness of the interior. Either through the way we live our lives, our location or social class. Forty (1986, 167) raises the power of the humble bathtub as a barometer of the "hygienic rationalism" outlining the shift in the bathroom as a barometer of class. He uses two specific examples of the bath, one is its mobility. A fixed bath indicated a more serious level of hygiene, particularly when located in a 'bathroom'. The other was its coordination with other sanitary fittings like a sink and a toilet. Having a matching and panelled-in suite disguising the plumbing was a sure indication of middle-class status in 1930's Britain. The bathroom demonstrated how the interior elements began to separate into clean and clean(er) spaces driving further the level of cleanliness that was aimed at as the interior space resisted external contamination.

Two examples of architecture and interiors projects that were specifically designed to be hygienic and treat ill-health were:

Finsbury Health Centre – Tecton/ Lubetkin

This health centre was designed and build in a pre-war London 1937. It was located in a run-down part of north London with the primary aim to centralise health services and introduce better healthcare to this part of London. It was designed by Berthold Lubetkin embodying his principle that '*Nothing is too good for ordinary people*'.

The centre was developed to house a series of health services allowing the population freedom to access high-quality services all in one centralised place, decades before the arrival of the UK National Health Service. The centre was constructed from modern clean materials with the driving principle of

bringing light into the interior, brightening the internal spaces conveying a modern clean (hygienic) approach to the different spaces. Offices and clinics were placed in wings (Figure 3), angled to allow as much daylight in as possible. Medical clinics were given moveable partition walls to encourage a more democratic and flexible approach to space. The building services were hidden behind panels on the building's exterior to give the interior a more defined and uncluttered aesthetic. The colour scheme was bright and bold and was designed to be a beacon of modernity using red for the columns, sky blue for the ceilings and chocolate-brown for the floors. An introductory booklet (1937) to the building and the services suggested: '*Care has been taken to give to the whole structure a light and clean appearance, to make it an edifice to the splendid service it represents; a building which will inspire confidence through its thoroughly modern and up to date appearance.*'

Figure 3. Finsbury Health Centre, Finsbury, London. Sectional Perspective. Cullen 1937⁶.

Lubetkin's design reflected the prevailing ideas in medicine of air and light, aspects of a revised preventative health strategy that found that open-air treatments during the virulent Spanish Flu epidemic proved beneficial. In a 1918-19 case study, '*...some patients and staff were spared the worst of the outbreak. A combination of fresh air, sunlight, scrupulous standards of hygiene, and reusable face masks appears to have substantially reduced deaths among some patients and infections among medical staff*' (Hobday and Cason 2009). Whilst the role of face-masks here brings home, with some force, contemporary concerns of COVID-19, it would be misleading, however, to attribute exposure to fresh air, nature and sunlight as the innovation of Modernism or indeed of medicine. Webb suggested that 'the air bath, like so many other procedures in medicine, was first introduced by a layman Benjamin Franklin.' Writing to a medical friend in 1750, Franklin's eccentric use of 'air-baths' was described as a less abrupt process to the cold-water baths he'd witnessed in 18th century London. One may argue that its origins emerged not in the institutional urban or woodland clinical settings by Lubetkin or Aalto but in the intimate setting of the interior.

Lubetkin's use of glass bricks as a light-filtering membrane discretely veils hygiene and suggests modernity and a progressive moral stance. His use of glass-blocks links back to other modernist hybrids. Pierre Chareau's part home, part gynaecological clinic for Dr Jean and Annie Dalsace in the Maison de Verre (1932) uses glass as 'the ideal material of modernity' (Cheatle 2017, 77). Describing an unwitting and ongoing presence of dust as a metaphor for the body, Cheatle describes the formal classification of dust as a *material* due to its mechanised removability. Conceptualised as 'a mixture of building and body slough composed of the bodies left-overs' and theoretically gendered as *female* (to reflect the discrete gynaecological practices, its female clientele, and the role of the female cleaner), it is both an architectural *vitrine* and a *vessel* containing dusty clues as signs of its clinical and domestic past. Where Chareau was discrete, Lubetkin was didactic. Lubetkin's open planning for the interior of Finsbury Health Centre helped the organisation and flow, but the building was designed to be instructional. Walls have graphics murals telling visitors to "*Live out of doors as much as you can*" and '*Fresh air night and day*'. These supported the prevailing sentiment of encouraging the population to look after their health outside the experience of the building. The centre was a clinic, a health 'club' and conveyor of knowledge meant to encourage the notions of hygiene and build an interactive relationship between health providers and recipients.

As much as it provided a healthy and functional environment, Finsbury Health Centre serves another role, to promote the idea of cleanliness. An example of 'rhetorical Modernism' (Darling 2006, 45-174), the centre communicated its embodied ideals to a wider audience through its design and the media representation of it. Beyond the scientifically proven link to people's health, hygiene is as much a cultural idea as it is a scientific actuality, and the design principles of Modernism that Finsbury follows can be seen to actively promote notions of hygiene in its broadest sense.

Alvar Alto – Paimio Sanatorium, Finland.

As an architectural *gesamtkunstwerk* that addressed its program with quasi-scientific rigour, Aalto's starting point for the design of the tuberculosis sanatorium was to make the building itself a contributor to the healing process paralleling urban strategies that define civic parks and woodlands as the lungs of a city. Aligning with contemporary biophilic principles and predating current responses to architecture and well-being, Aalto's approach was also sensitively tuned to metaphorical allusions likening the building to a '*medical instrument*'. Using the programme and interior spaces as a way to heal chronic long-term conditions he paid particular attention to the design of the patient bedrooms. These generally held two patients, each with their own cupboard and washbasin. Aalto designed

special “silent basins” so as not to disturb others while washing. Sensitive to both natural and artificial lighting Aalto placed the lamps in the room out of the patients' line of vision, whilst using colour strategically. Relaxing greyish green tones were used on the ceiling to avoid glare, suggesting and consideration to patients lying horizontally, whilst pale-yellow staircases and soothing blue common spaces reflected a deliberate structuring of the patient's social interactions. Each patient had their own specially designed cupboard, fixed to the wall and off the floor to aid cleaning.

In the early years, the only known cure for tuberculosis was complete rest in an environment with clean air and sunshine. Whilst the success of such treatment was at best partial: to enter a sanatorium in the first decades of the last century was to face a fifty per cent likelihood of death within five years. It was only with the discovery of the antibiotic streptomycin in 1946 that patients finally began to have access to an effective cure (Woodman, 2018).

Hygiene and global infection

Global infection and pathogenic contagion have been redefined by the COVID-19 pandemic. Citizens of the world are now instructed to socially distance themselves from one another using new regimes of proximity, sanitation and health. The pandemic has fundamentally affected the way humans consider space, the surfaces of interior design and how to use space to protect against infection and contagion. At first, homes were reimagined as places of isolation and were converted for new and unexpected activities required their reorganization and adaption. The home became a sanitized lifeboat, protecting the inhabitants from harm and isolating them from their communities and families. Suddenly cleanliness was everything, where *outside* and *others* became threatening and alien and the interior became a place of sanctuary. The hopes and simplicity envisioned by the modernists seemed too pure, whilst the architecture protected the inhabitants, there was a need for more. The pandemic was here, unseen and intangible at the door. As the lock-downs were partially relaxed, there were changes to the long-term cleanliness of shared interior spaces. Experimental projects were instigated that could self-sanitise, started to be tested and realised (an example is this experimental student project of a door handle Figure 4)⁷. The spread of the virus has accelerated by the movement of people, the interior was used to defeat and resist the virus through sanitisation and ever more stringent concern over the contamination of space. The biological solution to the virus through vaccines and medicines has been widely reported, but the condition and location of the virus in the environment is also fundamental to its control and eradication.

Figure 4. Self-sanitising door handle (Student project) by Sum Ming Wong and Kin Pong Li (2019). James Dyson Award.

However, interior environments are layered and complex environments that are difficult to keep completely sanitized as humans distribute matter and cross-occupy the space. Interior matter is continually swirling through our interior spaces mixing as tiny airborne particles and dust (pollen, human and animal skin, hair cells, textile fibres, minerals) or as bacteria and fungi. Richard Corsi, co-director for the Center for Sustainable Development, describes this as the *indoor chemistry* where ‘...every moment of every day, chemical reactions are taking place in the air and on almost every surface of our homes.’ Human infection can be transferred quickly between surfaces in shared, sealed spaces (as demonstrated by the recent pandemic). A good example of how the-body-inside is affected is a crowded commuter train or aircraft. Whilst space may well be clean (indeed airlines strive to convince the air inside a plane is as filtered as an operating theatre) humans bring (mostly unseen) germs and infection into space almost continually (even though they are clean). Rings of infection can also be directly associated with the *interpersonal proxemic distances* developed by Edward T. Hall in 1966 (Figure 5) and also discussed through Sloterdijk's (2011, 46) discussion on globes and the *immunisations* of space. Whilst airborne infections are not as immediate as surface bacteria and not always guaranteed, there is a strong likelihood of infection in an enclosed interior setting as human bodies absorb and mingle with the surrounding air.

Figure 5: Graphic Illustration of rings and barriers related to the proximity of infection. Author.

However, to completely hygienically cleanse the body or an interior environment, whilst often very desirable, is not always appropriate or healthy. Indeed, Ashenburg (2016, 164) highlights that sixteenth-century English doctors urged peasants to clean their skin to ward off disease as most of them regarded dirty skin as protective and strengthening, even when, they were offered free bathing in the new communal baths of the day. Urban bathing promoted a reordering of personalised cleanliness driving general hygiene practices in domestic dwellings. As Douglas (2002, 3) suggests

'In chasing dirt, in papering, decorating, tidying, we are not governed by anxiety to escape diseases, but are positively re-ordering our environment' and (2002, 8) *'Our idea of dirt is compounded of two things, care for hygiene and respect for convention.'*

Lack of contact with micro-organisms in the dirt when growing up is often thought to be the cause of the rise in allergies such as asthma. The human immune system requires biological stimulation and exercise not unlike arguments posited by Franklin in 1750, and later by the physician Laennec to function properly and exposure to dirt and dust would re-establish resistance. Even when no visible dirt is present, contamination by micro-organisms, especially pathogens can still cause an object or location to be considered dirty. For example, a mobile phone or computer keyboard are especially dirty as they often contain more bacterial microbes than a toilet seat. The toilet whilst associated with being dirty is often cleaned more regularly than a mobile phone. The cleanest part of the house is often regarded as the kitchen work surfaces, not necessarily because they are the most sterile, but the fact that they get cleaned the most often. The bathroom is the place that is seen as the dirtiest household space simply because of the toilet and associated personal hygiene activity. Penner (2013, 286), whilst explaining the importance of the bathroom and its cultural significance and the nature of the *'flushing'*, strengthens the relationship between the environment and cleanliness by introducing the waterless urinal and dual flushing toilets.

Cleaning, Clutter and Hoarding

As Forty suggests (1986, 158) it is only recently (late nineteenth and early twentieth centuries) that society began to find dirt *'more alarming and to be increasingly anxious about cleanliness'* but also suggests that whilst concern about dirt increased, there is little proof to suggest that a *'greater dislike of dirt actually caused people to become cleaner'*. He also sanctions (163) that societal values and moral responses to hygiene practices create *'an optimum hygienic solution for every aspect of life, whether dress, housing or working environment'* suggesting that the hygiene is commonly ubiquitous and percolates most conditions of life and humanity. There are some spaces (hospitals, dentist and medical facilities) that have to be systematically cleaned to ensure that any harmful bacteria that can cause infection are removed. The surfaces are biologically cleaned, the air is filtered and all the aspects in these environments are controlled to limit any form of infection. The next level of cleanliness in interior environments is the kitchen, where food is stored and prepared. Storage and cooking facilities such as fridges and ovens are kept clean to ensure food preparation does not cause a bacterial infection. Different parts of the world employ different methods to store and prepare food. Refrigeration has transformed food hygiene, ensuring the storage of fresh foods is preserved. The cooking of food (particularly meat and fish) kills off bad bacteria to make it safe to eat. In a commercial setting, dirt is often a signal of poor quality and lack of basic hygiene.

There are two extreme human behaviours when considering interior spaces connected with cleanliness. Some humans may become obsessed with dirt and engage in obsessive cleaning rituals of themselves and their domestic environments. Jane Bennett's (2012) research on *'thingness'* reveals intriguing insights on occupants, objects and other placed-based pathologies. Offering an alternate position to De Botton, Bennett raises interesting questions of the assumptions, compulsion and the potential contagion seen through the hoarder impulses and their collections. Describing hoarding as a symptom of a hyper-consumptive body-politic: *'If the hoarder is a human body positioned at one end of a continuum, whose points mark degrees of positive attraction between a hoarder and a non-human body (objects) say from 'owner', to 'connoisseur', 'collector', 'archivist', 'pack-rat', 'chronically disorganised' to 'hoarder', then because the hoarder body forms an unusually resistant, intense and intimate bond with non-human bodies (i.e. objects-waste-detritus)- she may have broader access to 'thing-power', access from the inside-out so to speak'* (2011). This does not necessarily reflect a mental illness but suggests some hoarders might have special sensory access to the *'call of things'* and be preternaturally tuned to stuff and dirt in very different ways. Some behaviour is compulsive, in an attempt to eradicate all traces of bacteria from their environment that they live or work in. This is often associated with OCD (Obsessive Compulsive Disorder) where spaces are repeatedly tidied, cleaned and immaculately ordered. Items are often arranged in colour order or in specific lines. This behaviour can affect the way space is designed and arranged. This goes much deeper than just how the interior is designed, but the designer has to be aware of these kinds of human behaviours connected with spatial hygiene. However, hoarding and clutter also reveal a contemporary concern of the negative health, sustainable and the psycho-social impacts of *'stuff'* on the-body-inside behaviours. In *'The New Glut: Space in the Sustainable and Healthy Home'* Elena Marco recalls Guettarri's description of consumption as a *'desire-machine'* that feeds those

compulsions. Alison and Peter Smithson coined the phrase 'glut' in 1993 in relation to the ever-increasing amount of stuff that people collect. (Part of the EPSRC-WHO: Collaborating Centre for Healthy Urban Environments at UWE Bristol, UK, examined storage and trends in the domestic setting to encourage healthy and sustainable behaviours).

Summary: Future Resistance

As the pandemic alters perceptions of space, the *resistance* formed by the interior is becoming ever more apparent and fundamental. The pandemic has magnified the importance of the interior environment and its role to protect and nurture the human condition in all of its forms. The principles of Modernism were formed from a manifesto defined by physical conflict. Its clean lines and polished surfaces were set by the externality and chaos of war. Its functionality and purity helped to define a design revolution and an epoch. The pandemic is much more invisible and has forced a re-evaluation of microbial cleanliness, dirt and hygiene and has fundamentally changed human behaviours and tactility for the foreseeable future. Significantly, this is occurring in real-time, unfolding as the pandemic changes and migrates. This signals a distinct change in priorities for the interior and heralds a more directed and urgent relationship with the human health, where the interior operates more like a 'host' or 'filter' ordering the inside and the classification of matter (Douglas 2002, 44-45). This reveals how human beings introduce bacteria and dirt into interior spaces, forcing the interior to become more an environment of absorption and contamination rather than a protective, cleansed and aesthetic environment.

As the extent of the pandemic has emerged, the interior (domestic and commercial) has become manipulated, spacing out the activities and gatherings to thwart the movement of the virus. This often destroys any semblance of the original design and alters how people use and move through the space. The interior still protects and immunises the body from the exterior world, but the proximities and surfaces of the interior can pose an unseen threat. However, the internal surfaces do form an ideal weapon against further infections and can be the starting point for new forms of immunology. This echoes the work done by Edward Jenner (1798) on Smallpox vaccinations, where surfaces of the skin provided a basis for modern vaccines. Strikingly, this *invisible* microbiology is echoed today at a microbial level where Nano-technology enabled surfaces and minute swarm 'machines' (Kapsali 2019, 173, 220) clean interiors undetected. The scales of cleanliness have altered as the need for reassurance of being virus-free has increased. Whilst cleaning machines and chemical cleaners aim to eradicate dust particles and bacteria, a completely clean interior is often fundamentally impossible or impractical. However, like Jenner's experimentations that purposely infected humans, interior spaces could be contaminated with dirt and bacteria that boost human immunity, forming new vaccine forms that protect the body from the outside world. It is difficult to achieve genuine cleanliness for either the-body-inside or the interior space, but most interior surfaces could be used as artificial bacteriological 'skin' providing immunisations to the outside world (as demonstrated by this experimental student project, Figure 6)⁸.

Figure 6. A (student) project by Tashia Tucker (Design Futures Lab), that contained "hacked" bacteria that clean your feet as you walk on it (Image credit Nicole Koltick 2013).

As communities and interior spaces become biologically detached from the outside world, the exterior environment is increasingly being referenced within the interior. For many decades smells, aromas and therapies have synthetically and organically replicated the outside in the interior. The use of SMART materials can be used in several ways to change how the interior can be both hygienic and build resistance for human activities. Matter-emitting materials can bring significant therapeutic and biological medicines in the interior environment to sanitise the air, bringing relief of allergic and airborne pollutants and help combat the spread of the pandemic. These interior *scents* can be embedded as microencapsulated coatings in paint and inks where they are printed on paper and textile surfaces. Surfaces could be redecorated with anti-microbial decor (or dressings akin to a bandage), promoting a change in attitudes towards internal decoration, personalising infection control.

Hygiene through materials can be created through haptic technologies where surfaces are biologically sensitive, providing an anti-bacterial property, immunising each user as they interact with the material. This is particularly useful in high occupancy spaces like transport, retail and hotels. These automatically sanitize the surface killing any introduced bacteria (see Figure 4). These coatings could be further developed not as a microbial barrier but as administrators of medicine (similar to a transdermal patch) through the skin. The interior could become a ubiquitous place of healing (and

vaccination) using embedded materials (similar to wound dressings impregnated with Nano-silver or Manuka honey) to encourage quicker healing for hands and feet and the wider body. The new environment will have to contain levels of good bacteria to ensure that the interior does not become too clean. The interior can also be used to predict infections by showing what and where bacteria is in the interior (like fluorescent detections systems), allowing humans to select if they wish to be *contaminated* or not.

Reintroduction of dirt and infections (in very small quantities) back into the interior environment to create immunity-boosting spaces suggesting that “form will follow infection” (Ogundehin 2020). This concept could help humans to naturally combat disease and *cleanse* the body. Surfaces and textiles could be reverse engineered to harbour enhanced antibacterial or antimycotic (anti-fungal) matter which would, over time build resistance to infection. Dirt and biological matter could be signalled through the use of thermochromic signals, where the good dirt and bacteria create low-level heat signatures and are signalled through the material changing colour allowing users to target what they touch, forming a new breed of wearable VR (virus recognition) technologies that detect contagion in the interior. By embedding existing artificial intelligence technologies, the interior will locate key scientific and engineering concepts to become more intuitive at detecting human viruses and cancers in the future. It is imperative to continually redefine a cultural context for the interior concerning purity, dirt, cleanliness and society (Douglas 2002 124-159) and help designers to be more courageous when developing spaces that help safeguard the-body-inside.

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¹ Doreen Massey develops several concepts of space including the relationships to time and relativity.

² Good Housekeeping. <https://www.goodhousekeeping.com/home/cleaning/g5115/best-cleaning-products/> [Accessed 31/1/2020].

³ Actiu Furniture Company headquarters, Situated in Castalla, Alicante, Spain Actiu's headquarters, called the Technology Park, has become the fifth complex in the world to receive the WELL v2 certification for well-being. This award accredits how the headquarters has been built to ensure the health and well-being of its occupants, both inside and out. <https://www.dezeen.com/2019/10/25/actiu-hq-leed-platinum-well-v2/> [Assessed 31/1/2020].

⁴ Hotel cleanliness (and comfort) is rated with high importance: <https://www.thecaterer.com/news/hotel/cleanliness-is-top-priority-for-hospitality-guests-and-customers> [Accessed 15/1/2020] and <https://www.hotelbusiness.com/cleanliness-and-comfort-top-everything-else-in-hotel-selection/> [Accessed 15/1/2020].

⁵ For better understanding on scope, impact and range of Modernism, further reading should include: Bradbury, D. (2018) *Modernist Design Complete*. London: Thames and Hudson.

⁶ Finsbury Health Centre, Finsbury, London. Sectional Perspective. Cullen 1937. Lubetkin/Cullen - photomontage for Finsbury Health Centre, Architectural Review, January 1939. <https://www.pinterest.co.uk/pin/578290408374858147/>

⁷ A student project from 2019 of a self-cleaning door handle that won the James Dyson Design award. <https://www.dezeen.com/2019/10/09/self-sanitising-door-handle-handle-james-dyson-award/> [accessed 17/5/2020].

⁸ A student project from 2013 shows the beginning of this: <https://www.dezeen.com/2013/11/13/bio-surfaces-containing-hacked-bacteria-tashia-tucker/> [accessed 17/5/2020]. Student work exhibited here: <https://vimeo.com/79308002>. Tashia Tucker and the Design Futures Lab with photos by Nicole Koltick.

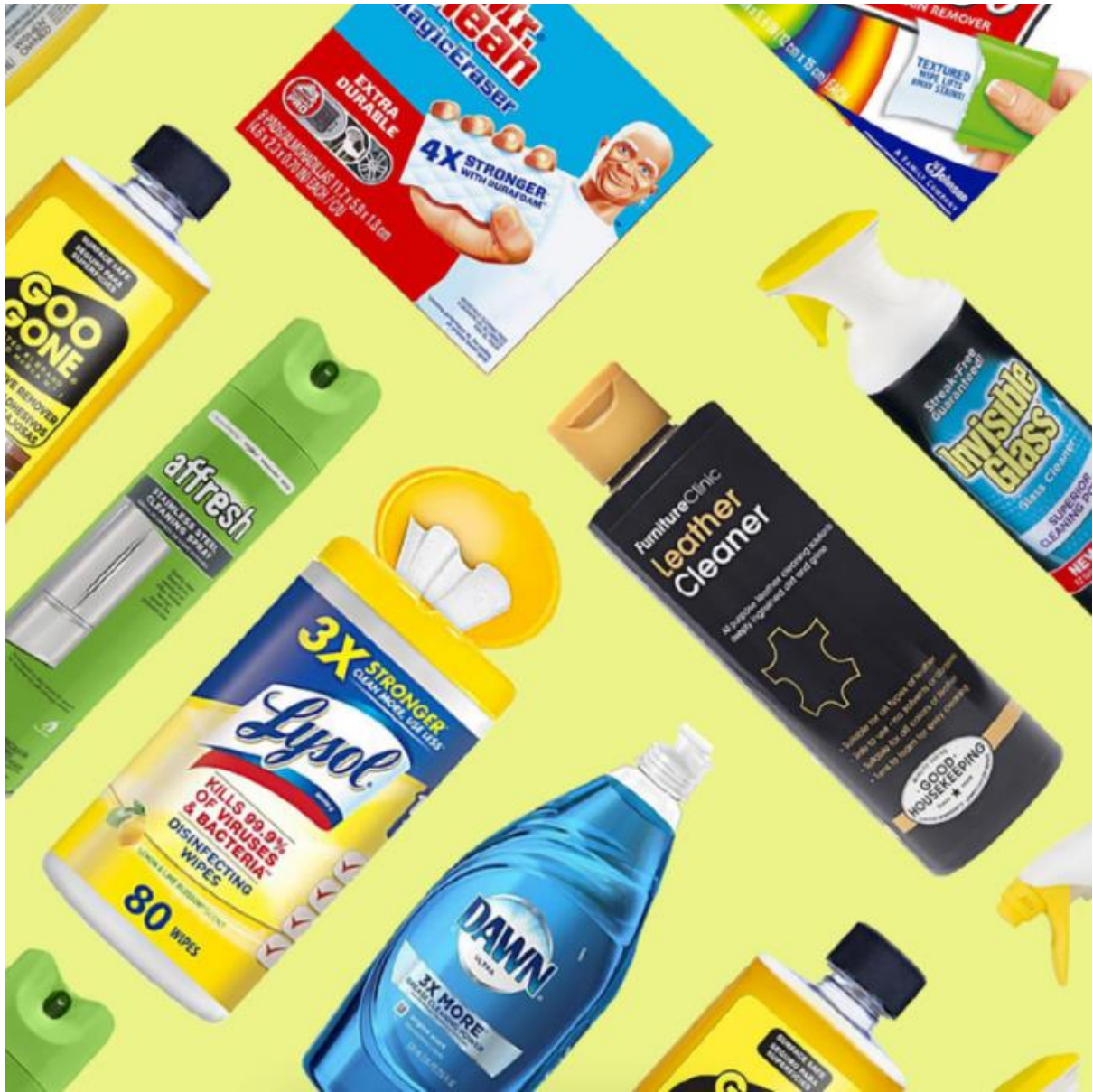


Figure 1 Branded Cleaning Products (Source: Good Housekeeping²).

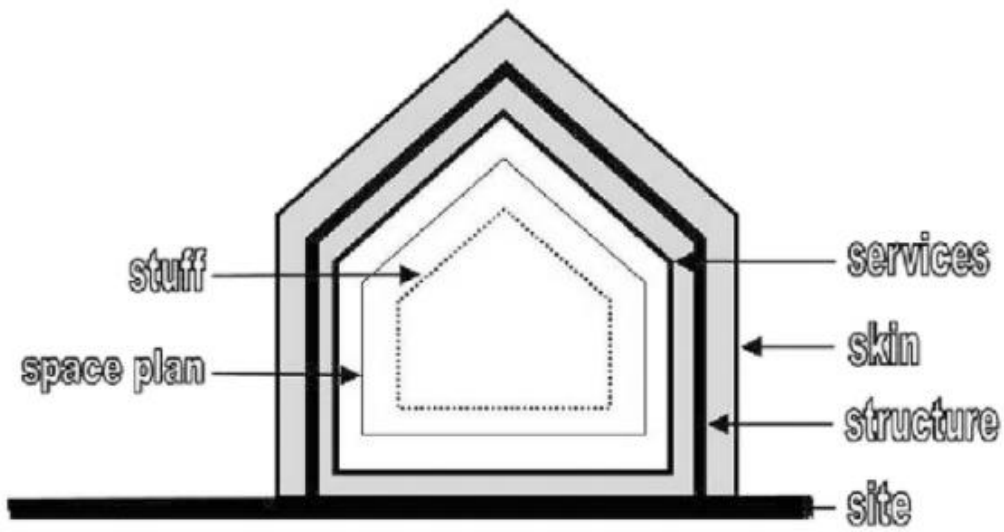


Figure 2 Lawson's (2001, p.202) representation of the building model (based on Duffy, 1997 and adapted by Brand, 20210, p. 34).

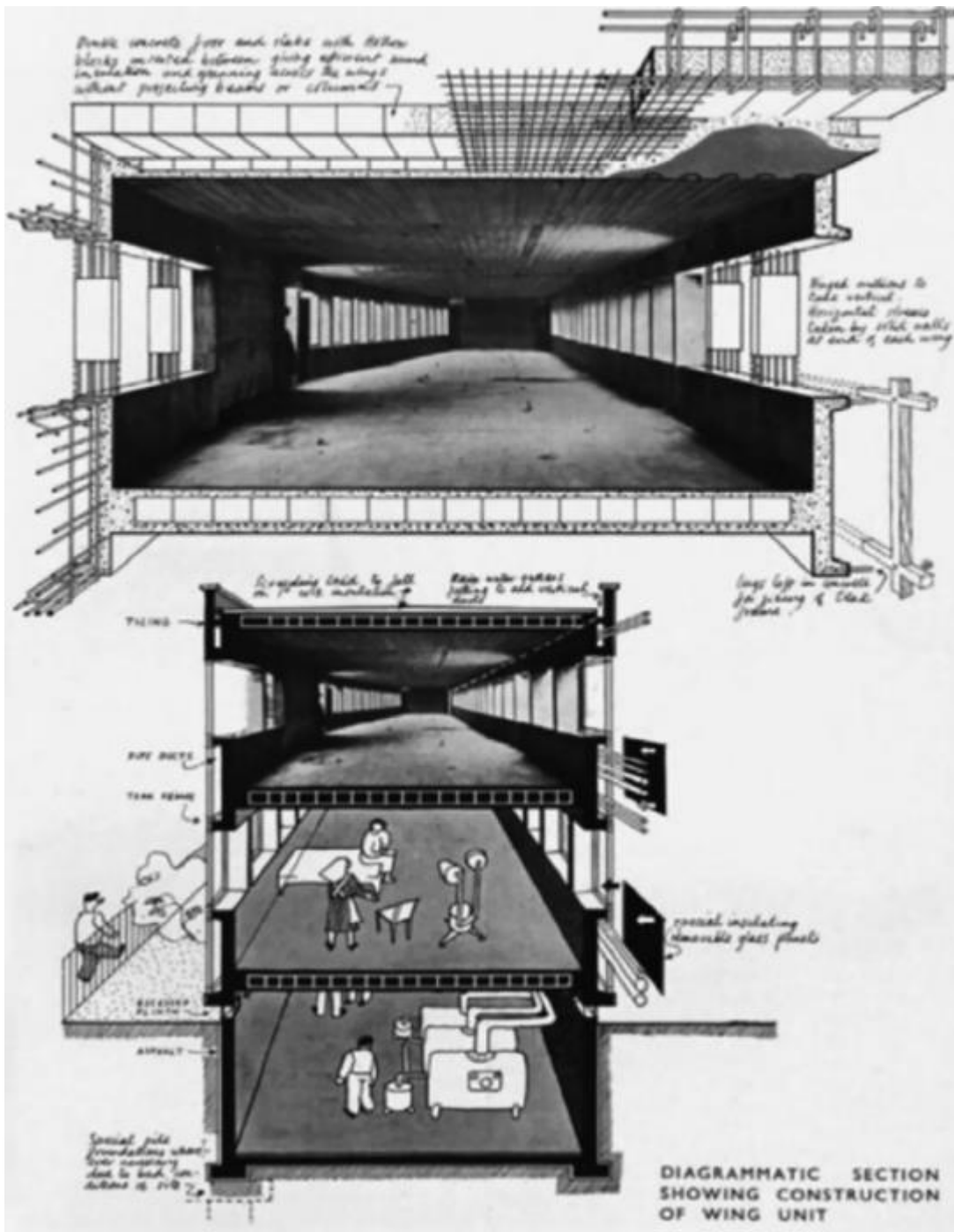


Figure 3 Finsbury Health Centre, Finsbury, London. Sectional Perspective. Cullen 1937.⁶



Figure 4 Self-sanitizing door handle (Student project) by Sum Ming Wong and Kin Pong Li (2019). James Dyson Award.



Figure 5 Graphic illustration of rings and the barriers related to the proximity of infection. Author.

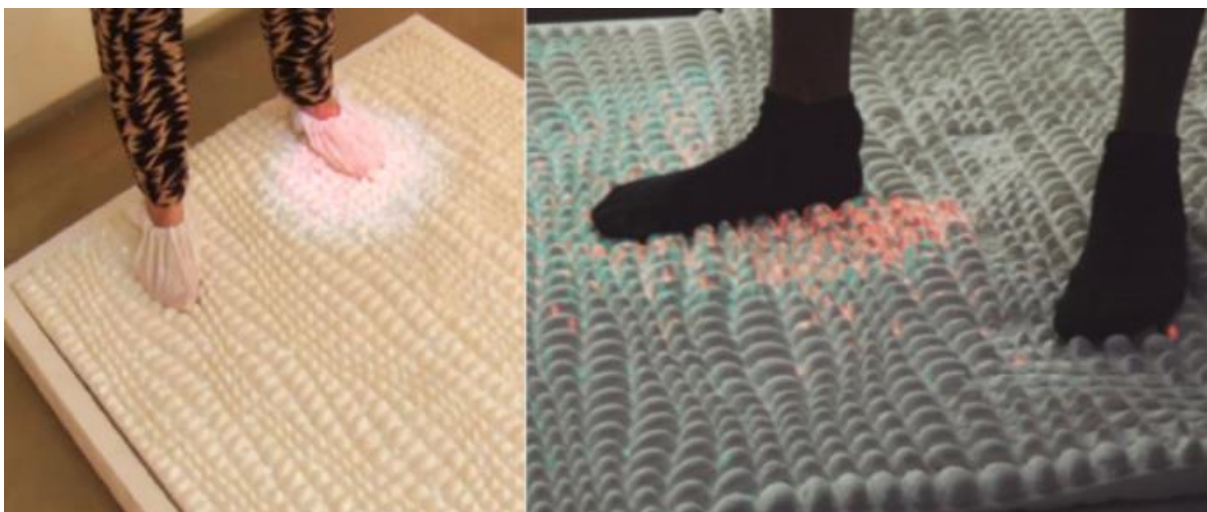


Figure 6 A (student) project by Tashia Tucker (Design Futures Lab), that contained 'hacked' bacteria that clean your feet as you walk on it (Image credit Nicole Koltick 2013).

