

Infrastructures of care: opening up ‘home’ as commons in a hot city

Abstract

What does it mean to be at home in a hot city? One response is to shut our doors and close ourselves in a cocoon of air-conditioned thermal comfort. As the climate warms, indoor environments facilitated by technical infrastructures of cooling are fast becoming the condition around which urban life is shaped. The price we pay for this response is high: our bodies have become sedentary, patterns of consumption individualised and spaces of comfortable mobility and sociality in the city, which we term in this paper ‘infrastructures of care’, have declined. Drawing on the findings of a transdisciplinary pilot study titled *Cooling the Commons*, this paper proposes that the production of the home as an enclosed and private space needs to be rethought as an infrastructure that potentially undermines more social, convivial and environmentally sensitive responses to a warming world. The paper asks what role design might now play in developing alternative infrastructures of care that start with the idea of ‘home’ as distributed proposition?

Keywords: urban cooling, design, commons, infrastructures of care, home.

Introduction

Suburban Western Sydney is undergoing rapid population growth and urban densification with a projected construction of 180,000 plus dwellings in the next 15 to 20 years (Greater Sydney Commission, 2018). Once covered in woodlands and bushy waterways, this region of the Sydney Basin is rapidly disappearing under asphalt and concrete, with a consequent loss of shade-giving tree canopy (Jacobs et al., 2014). Distant from coastal sea breezes, it is experiencing increasingly hostile, record-breaking summer temperatures that will be further exacerbated by urban development. Particular ‘hotspots’ with land surface temperatures of 50 degrees Celsius and beyond have been recorded and these often coincide with low socio-economic status (SES) areas (Penrith City Council 2015; SEIFA 2016; Amati et al., 2017).¹ Rising urban heat presents disruptive

challenges to being 'at home' in the world. In this paper we explore how these challenges are also opportunities to provoke us to design home-environments differently.

New houses in Western Sydney, as all around Australia, are being designed around air-conditioning to deliver thermal comfort. Air-conditioning is a driver of the move indoors, the broad implications of which are being explored in this Special Issue. In a national survey of human activity patterns in the US, Klepeis et al. (2001) found that people are spending around 90% of their time in an enclosed building or vehicle. But the structuring-in of air-conditioning as the primary response to urban heat is having multiple detrimental impacts on urban lifeworlds: the world as lived. Increased demand for energy derived from fossil fuels is contributing significantly to global warming, people are being forced indoors into increasingly individuated social spaces, and household energy bills are skyrocketing.ⁱⁱ With this move, the perceived need for publicly accessible infrastructures that facilitate a slower, more pedestrian-oriented city, is diminished. For those economically disadvantaged groups living in the Western Sydney region who have less capacity to access or pay for air-conditioning, liveability is increasingly compromised.

During the summer of 2016 a transdisciplinary team of researchers from the disciplines of design, geography, economics, landscape architecture and cultural studies spoke to a group of 14 active seniors, a group of 10 Aboriginal mothers with pre-school aged children and a group of 7 elderly carers living in the hotspots of Penrith City in Western Sydney. The particular heat vulnerability of the elderly, the very young and the economically disadvantaged is well-established in the literature (Loughnan et al., 2013). However we wanted look beyond the assumption of vulnerability to explore what people living in these 'hot spots' do during summer to cope with the heat. Our methods included observational site analyses and group interviews aided by visual prompts, including thermographic imagery. We sought to capture not only what people could say about what they do, but also the less conscious or 'tacit' dimensions of practical activity, as "we know more

than we can tell” (Polanyi, 2009, 18). The data produced helped us to understand how features of the environment influence people’s efforts to keep cool inside their houses and outside in public spaces. Thematic analysis revealed details about everyday practices as people attempted to work around these conditions, and the aspirations people held for the future of their city.

The accounts we gathered in the preliminary study titled *Cooling the Commons* complements the now a significant body of quantitative literature on the impacts of urban heat (Hughes et al., 2016; Lewis et al., 2017) and studies that identify key design considerations to ameliorate these impacts (Osmond & Sharifi, 2017). This study contributes key insights into the social, cultural and material contexts that inhibit or support cooling strategies or that “make space for individual agency” (Bell et al., 2014).

Our research findings point to the ways that individual and community capacity to cope with urban heat is constrained or enabled by housing design, housing tenure arrangements, the design of public spaces, networks and everyday material circumstances. Lives are lived within the enclosed confines and open avenues of a set of infrastructural relationships that circulate in, around and beyond the house. We can think of a particular set of infrastructural relationships as those that achieve *coolth*—the sensation of feeling cool in a heated atmosphere. In this paper we argue that technical infrastructures of urban cooling that privilege air-conditioning are threatening the provision of other infrastructures that afford experiences of coolth, namely shade, shelter, public water and places to comfortably rest and wait whilst moving about the city. We argue that there needs to be a concerted effort to intervene in this process for the future wellbeing of inhabitants of a hot city.

The paper proceeds with a critical discussion of how air-conditioning, as a technical cooling infrastructure, has shaped urban lifeworlds. We then introduce ‘infrastructures of care’ as social and technical infrastructures that can be made and shared by communities in their efforts to keep cool.

We end with a discussion of how our analysis helps to generate a provisional set of considerations for the design of future infrastructure of care.

1. Cool enclosures

Infrastructure is not identical to system or structure, as we currently see them, because infrastructure is defined by the movement or patterning of social form. It is the living mediation of what organizes life: the lifeworld of structure. Roads, bridges, schools, food chains, finance systems, prisons, families, districts, norms [, are] all ... systems that link ongoing proximity to being in a world-sustaining relation. (Berlant, 2016, 393 insert added).

If we take up Lauren Berlant's reframing of infrastructure, not as a technical system or built structure, but a movement or patterning of social form, we can view the history of climate control over the course of the 20th and 21st century as significantly changing the organization of urban life in ways that we are now needing to challenge. The earliest efforts in creating climate controlled environments were, according to Stephen Healy (2008)ⁱⁱⁱ, not in the house but in the context of temperature sensitive manufacturing—from textiles to chocolate manufacture. In the early 20th century there was a lively debate in the domain of public health that pitted approaches emphasizing the circulation of 'fresh air' over the use of climate control technologies that heated or cooled recirculated air. Initially 'fresh air' champions won the public health argument in the context of public buildings, but the advocates of climate control won the day through an appeal to a scientific understanding focused

upon the quantitative study of human comfort (after an earlier focus upon a chemical theory of air had been disavowed). Building upon earlier work, the laboratory published the 'Comfort Chart' that 'graph[ed] . . . the combinations of temperature and humidity at which most people felt comfortable.' (Healy 2008, 314 insert added)

Thermal comfort became an engineered condition, subject to what Shove (2003) calls the 'ratchet effect' whereby imperceptible changes in designed conditions become the norm, constraining the possibility of retraction or backwards movement. A working universal standard for the human body to achieve thermal comfort was set at around 22 degrees Celsius, regardless of the temperature outside (Shove, 2003, 26).

Healy charts the way that the concept of climate control spread from industrial sites, to climate controlled movie theatres and shopping centres—all sites of collective mingling. Eventually climate control spread, in the form of small air-conditioning units, to family homes and then to automobiles.^{iv}

The demand for air-conditioning also became normalised over time, fundamentally informing the design of everyday urban life. Today many urban dwellers' lives, work practices, styles of dress and so on are designed in anticipation of the 22 degrees Celsius working temperature. And many indoor environments, from the home, to the office block, to the shopping (and data) centre, and car, would be uninhabitable or grind to a halt without it.

Air-conditioned comfort is increasingly a feature of the built environment globally. Like the car industry in the last century, thermal comfort delivered via air-conditioning has become a primary signal of urbanisation and rising affluence, and therefore of a modern, functioning economy (Davis & Gertler, 2015). The emerging middle classes in China, India, Indonesia and South America now constitute the largest market for air-conditioning. As reported by the Lawrence Berkeley Lab, the world is set to install 700 million new air-conditioners by 2030, and 1.6 billion by 2050, mostly in developing countries with hot climates.

But while the desire for thermal comfort is understandable in hot cities, the structuring-in of air-conditioning is exacerbating global warming. In addition to energy consumed in use, there are the potent emissions from the HFC refrigerants used in air-conditioners, as well as the impact of peak load, which severely stresses urban energy grids and leaves communities vulnerable to possible breakdown (De la Rue du Can & Shah, 2016). It is also more energy intensive to cool rather than

to heat air, and air-conditioning (and refrigeration) produce and release heat back into the environment, exacerbating the urban heat island effect.

At the level of bodily experience, the ‘thermal monotony’ created by air-conditioning (Healy, 2008) means that humans lose the capacity to acclimatize to temperature variations in the greater environment. The key issue here is “the manner in which technologies fuse prosthetically with humans” (Tonkinwise, 2009, 33). Air-conditioning technologies make a human body that is different, physiologically to one that would exist without it, one that appears to be less capable of responding to thermal variability, one that is engineered into forgetting this capacity. The body produced by the indoor, climate-controlled environment is more sedentary and passive (Sofia [Sofoulis] 2000), as well as more vulnerable to environmental diseases such as asthma. Here we find an ironic confirmation of Annmarie Mol’s (1999, 2002, 2008) assertion of the body’s multiple ontologies; a progressive winnowing of what the *human* body can be by technologies that foreclose on other possibilities. In reality, the commitment to air-conditioning does not ensure ‘steady state’ thermal comfort. SafeWork NSW, the State government workplace health and safety regulator, reports that “problems with air-conditioning are very common” as the experience of its adequacy changes according to dynamics of human movement and people’s different tolerances to temperature.

The delegation of active-control to the built environment also modifies forms of sociality. During hot weather it encloses people in houses, cut off from others. For the body so-acclimatised, the presence or absence of air-conditioning becomes a decisive factor influencing liveability in the city, determining where you go, what you do and who with.

Our conversations in Western Sydney afforded graphic insights into this infrastructure of cool enclosure that has been created by privileging built environment ‘solutions’ to urban heat.

Participants in the *Cooling the Commons* pilot found themselves increasingly restricted to indoor environments. The group of carers described being completely reliant on air-conditioning and were largely confined to their homes during hot days due to the difficulties of getting around comfortably. An enduring image was one described by an elderly carer, who was totally reliant on air-conditioning to transport their adult child between home and the community centre. The carer explained that they routinely experienced being stuck at the traffic lights in their car, and even with the air-conditioning on full bore, still suffered the threat to their charge of potential heat stroke. Another common experience was the need to get back into a car that had been baking in the sun all day, and the problem of finding some shade under which to wait while air-conditioning made the environment in the car more habitable.

In particularly hostile hotspots, many residents did not have access to air-conditioning at all, and were coping with already excessive outside temperatures and internal environments that intensified this heat. These residents were further disempowered as they did not have the capacity to modify their home environments for cooling due to poor design (for example lack of insulation and the use of cheap sliding rather than lockable sash windows, which limit the easy and secure circulation of air), or by the fact they were renting or in social housing.^v

A group of Aboriginal mothers living in poorly designed public housing were one group facing excessive and destabilising indoor heat. The Director of the local neighbourhood centre explained that the upper levels of their homes become uninhabitable in summer, leaving people needing to crowd in downstairs and take up residence in the neighbourhood centre during the day. Some mothers who took part in the *Cooling the Commons* study explained that their main option for managing heat was to remain completely still. Their children in childcare were not allowed to play outdoors after mid-morning due to the lack of shade, and rather than ride their bikes, school-aged children came home straight after school to, in their words, ‘just chill’. These ongoing issues

are exacerbated by the lack of public transport infrastructure to enable people to easily get to cooling refuges such as the local public swimming pool.

Interestingly, the seniors we spoke to were highly critical of the ‘thermal indulgence’ (Strengers & Maller, 2017, 35) of younger generations, arguing that they had learned to rely too heavily for their comfort on air-conditioning. The idea that thermal comfort was something you needed to take responsibility for and manage, was strong in this group. They were very aware of the costs associated with fans and air-conditioning and this energy-aware dwelling was a source of pride.

Said one participant:

I have rules ... it has to be at least 30 degrees (before I turn the air on) —usually my body can tell me. The other day it was 34 degrees before I turned it on... as soon as it starts to cool down, we turn it off (participant, Seniors group).

While this may be seen as evidence of detrimental ‘thermal rationing’ (Nicholls et al., 2017), these comments also point to different generational experiences and a loss of cooling knowhow. They reflect a trajectory of cool enclosure that an infrastructure of built environment climate control has charted.

We use the term ‘enclosure’ purposefully, to connect with the long tradition of concern for enclosure of the commons. The enclosure we refer to here is not the process of legal exclusion and displacement of the English peasantry from the commons pasture, to make room for private property. This instance of enclosure radically reshaped the lifeworld of whole populations, confining their movements, cutting off options for survival and proscribing new exploitative livelihoods within urban hells. The enclosure of urban life in individuated air-conditioned households with expensive energy bills is certainly not of the same order, but it does constitute a remaking of the built environment and reshaping of lifeworlds. Technical infrastructures of enclosed coolth are deeply structured into the ways in which the city is imagined, planned and materialised, and distinctive forms of sociality have emerged in response. It is important to

remember that the continued distribution of individual air-conditioned enclosures is largely considered an exercise of social responsibility, a type of caretaking. People need to be cooled and air-conditioning performs this remedial function. However this way of defining how we occupy our earthly home, is fundamentally blind to the fact that we also contribute to the destruction of that home in the same move. In the next section we turn to the commons to imagine infrastructures of care in a hot city.

2. Commoning coolth

The commons concept is a powerful vehicle for troubling troubled times.
(Berlant, 2016, 395)

Increased urban heat is trouble in our troubling times, and while one response is to shut our doors and close ourselves in a cocoon of thermal comfort, the price we pay is to still our bodies and close ourselves off from one another. We have reviewed how technical cooling infrastructures have produced home as an enclosed and private space with a strong boundary that demarcates cool liveability. We turn now to explore infrastructures that instate home as a space of flow and encounter across porous boundaries (Power, 2009; Crabtree, 2006) and that enact a commons that is continually in the making (Linebaugh, 2008). The commons we refer to include cooling knowledges, practices, shared spaces and built environments that are widely accessible for use in achieving thermal comfort, that also require care in order to be maintained and that produce benefit for a wide community (Gibson-Graham et al., 2013).

We enrol this commoning framework in seeking a different understanding of the built environment, a redefinition of home that allows us to respond to heat in ways that are less energetically intensive, that incorporate and common outdoor environments as part of our shared home-environment, and, following Brault (2017), pursue more social, convivial responses to a warming world. We want to harness the troubling power of the commons to expand our concept of home as a life-organising infrastructure.

(Insert figure 1)



Figure 1, Armstrong, H. (2015). Glenmore Loch, Glenmore Park: an oasis of coolth in one of Sydney's hottest suburbs.

Participants in the *Cooling the Commons* study showed practices of commoned coolth have not completely disappeared. They did what they could to keep cool with the resources they had access to in and around their homes, and where possible migrated to cool refuges such as the pool or river or shopping centre on extremely hot days. However as air-conditioning has become a standard for the delivery of thermal comfort—each of those 180,000 plus new Western Sydney houses is highly likely to have air-conditioning—infrastructures that afford comfortable mobility in the broader public domain, have fallen into decline and disrepair. This was clearly reflected in the experiences of the groups we spoke to. People perceived the removal of street trees, toilets, public drinking water facilities and shaded seating over the years as a withdrawal of care that reinforced a deficit of trust in local government.^{vi} This points to the critical relationship between interpersonal care and care of place. As we found in our study, traditional care-giving was constrained by structural features of the built environment—in homes, cars and childcare centres. For our participants, cared for commons that provide for safe and comfortable mobility and invite participation, existed

primarily as memory or aspiration. Here, we summarise our findings about *residual*, *transgressive* and *aspirational* commons that help to inform our provisional guidelines in section 3 of this paper.

Keeping common knowledge alive

In spite of their restrictive environments, not all participants had lost common knowledge related to cooling. Older residents spoke of shared knowledge of ways to manipulate indoor environments to create coolth without air-conditioning. They demonstrated a high degree of practical knowhow and sensitivity to environmental conditions, having developed a number of ‘work arounds’ for keeping cool in their often thermally poor houses using available materials and skills learned from their parents. They spoke of the importance of openable windows, ventilation, eaves and verandahs, the absence of which they had noticed in new housing developments, as well as an overall lack of interstitial ‘breathing space’. Some had what Strengers and Maller (2017) call ‘practice memories’ of very low tech solutions, like placing the baby under the table with a wet sheet over the top, or freezing water in cake tins and setting up a fan to blow air over it. This group was also adept at DIY modifications, such as installing heat-removing ‘whirlybirds’ on their roofs.

Caring for residual commons

Participants shared many stories about cooling practices that circulated *beyond* the indoor environment, involving the distributed amenity of trees, rivers and swimming pools, and more appropriately ‘furnished’ public environments. People recalled sitting and swimming in the river on hot days and public amenities that both assumed and supported a walkable city. They mentioned with disapproval the lack of nearby shaded green space, which has been associated with an increase in heat-related illness and death (Bradford, et al., 2015). Of course, the perception of ‘nearby’ changes according to how accessible such environments actually are. For parents in our study, the streets were generally seen as too hot to push prams or walk, and paths were not pram-friendly,

broken up by roads. Seniors complained that there were few places to rest comfortably out and about:

The post-office, My Gov and Centrelink – they feel like they are literally hundreds of miles apart (participants, Seniors group)

Participants were supportive of local council plans to reverse some of these trends and nurture the commons for wider participation.^{vii} However it is not a case of ‘build it and they will come’. As Star (2010) argues, infrastructures both shape and are shaped by conventions of practice. Such strategies speak to a civic life that has been undernourished for some time. Normative social practices that have grown up around current conditions, such as children playing indoors for large parts of the day, will be difficult to change, and require multiple actions and interventions in relation to both the built and social environments on an ongoing basis (Hunter et al., 2015).

Tolerating transgressive commons

Indoor shopping centres and fast food restaurants are major sites of recreation in Western Sydney—they are also cool places that can be accessed free of charge. During heat waves people in Western Sydney occupy these air-conditioned spaces for extended periods of time—transgressively commoning ‘privately’ owned space. An important precedent study, *Out and About in Penrith* (Sofoulis et al., 2008), found that children identified play structures associated with the fast food restaurant (located inside the shopping centre), as the ‘park’ (39). Concludes this report, such slippages of meaning are invited by the availability of both amenity (air-conditioning, toilets) and society in those environments, which are often not available in the traditional outdoor park. This delineates a further sociocultural context for the retreat indoors: a ‘conceptual infrastructure’ (Berlant, 2016) of the commons.

Amongst the groups, there was a sense of a right to occupy cool spaces in extreme circumstances. In another example of transgressive commoning, teenagers had resorted to swimming in the decorative water feature of the adjacent new housing development on hot days, as the local shuttle bus had been cancelled.

Imagining future commons

Another ‘emergent’ commons was found in people’s shared aspirations for the cool future city. These aspirations included the recovery of basic amenities that still existed strongly in memories of place. The provision of shade, shelter and water in public environments was seen as a necessary support to a far from basic range of social affordances, including meeting and gathering, resting and waiting, swimming, walking and the everyday exchange of knowledge and ideas. However participants went beyond this, to describe multipurpose environments, such as car parks or roads that could be used for different activities at different times of the day, and called for a more extensive use of the rivers and riverside parks. They also imagined alternative social futures—the seniors were keen to share their cooling expertise with others, and the gardeners across the groups were interested in sharing knowledge about on-site water management and supporting conversations about trees and their social, cultural and environmental significance. Community cooking was also an aspiration in the groups, a way to share knowledge and enjoy social interaction in a local setting. It was noted that this would require access to material infrastructures beyond the currently ubiquitous local park barbeque.

These commoning practices foreshadow a future home-space that goes well beyond the individualised enclosures currently on offer as ‘home’, and the ontologies they produce. The technical infrastructures of coolth that both assume and produce a passive and static body, (whether that body is positioned inside or outside of the air-conditioned cocoon), chip away at the capacity for civic life. Conversely, the infrastructures we seek to promote are both social *and* technical, requiring a multiplicity of resources distributed across and between private and public domains. In the following section our learnings from the *Cooling the Commons* project support the generation of a preliminary set of considerations for designing infrastructures of care.

3. Designing infrastructures of care

... at some crisis times like this one, politics is defined by a collectively held sense that a glitch has appeared in the reproduction of life. A glitch is an interruption within a transition, a troubled transmission. A glitch is also the revelation of an infrastructural failure (Berlant, 2016, 393).

As climate change threatens the reproduction of life, infrastructures of thermal comfort through enclosure are exposed as failing to care for people and the planet. The time is ripe to mount a challenge to these infrastructures and the embodied and public geographies of thermal restriction that they support. Care is a world-making practice (Slater, 2016), as is design (Fry, 1999). The ability of designed artefacts and systems to alter the condition and behaviour of other things in multiple incremental ways, constitutes the ethical force of design. Elaine Scarry (1985) describes this force as an empathetic projection through which the designer says to an other: “in... this small way, be well” (292). In the context of our study, the question becomes what lifeworlds are being cared for, and what diminished or undermined, through design?

We have seen how heat reaches into people’s lives in different ways, depending on their physical, material, socio-economic and even cultural circumstances. In the context of rising heat, city inhabitants need different ways to be at home beyond the skin of an enclosed, private domain. This requires a far more convivial socio-material environment that *precedes* artificial air, rather than assumes it.

In this last section of the paper we explore the possibilities for infrastructures of sociality and circulation, which enable communities to be at home in a places where ‘the body multiple’ can find expression. We enumerate here some key considerations for a care-ful design practice that could support the future home as a care commons and that recognises the significance of design in the patterning of sociomaterial relationships. Important to note is that attempts to design in another way are constrained by the modern city as it largely is, a heat-amplifying hot zone. As Tonkinwise (2009) argues, what is now required is not a more systemic form of designing, but one that

performs “a plurality of more humble, agile propositions that allow for the evolution of less ecologically harmful ways of keeping cool.” (37).

Open and porous infrastructures of the commons

We need designed commons that are accessible and appropriately furnished with amenities and ‘attractors’. A significant challenge here is negotiating the terms of ownership and not necessarily ‘giving in’ to the neo-liberal narrative of exclusivity, where every home has every *thing* and spare capacity is ignored.

There is a need to consider how to support the acclimatisation to more open and porous infrastructures of the commons, including their sensorial dimensions. If you are cooking out in the open for example, along with food you will be sharing smells and sounds with your neighbours. Therefore, in addition to the infrastructures for community cooking, might be the need for new rules to govern how the social space is shared. These would want to be anticipated in advance rather than reactively, as part of a more care-ful design *ethos*.^{viii}

Distributing spare cool capacity

How might spare cool capacity (created in part by the settings of thermal indulgence and monotony in autonomous, air-conditioned environments), be better shared? This is of particular importance as single-occupant dwellings are on the rise in Australia, with one in every four being a lone household, and skewed to older age groups (ABS, 2016). Older people are deemed more at risk of heat-related illnesses than younger people, but are also at risk of social isolation, so this trend is significant in terms of home rethought as a socio-thermal infrastructure of care (Power & Mee, forthcoming).

Sharing cooling centres

In Pittsburgh in the United States, public buildings in areas of high vulnerability have been reconceived as cooling centres, where at-risk residents can seek refuge from extreme heat. The optimal location for cooling centres was identified through the use of a ‘heat vulnerability index’ (Bradford et al., 2015). This research notes that the repurposing of existing buildings may be preferable to purpose-built ‘cooling centres’, as people may not wish to be labelled as ‘vulnerable’ and in need of special facilities. For a rapidly developing but dispersed geospatial context like Western Sydney, a ‘patchwork’ approach to the provision of artificially cooled air would build on social practices that *transgress* existing environments and could facilitate the development of new social networks. This suggests the need for a shift in focus from the design of individually enclosed and autonomous dwellings to shared infrastructures such as libraries, hospitals, schools, childcare centres, swimming pools, community centres and so on, that are open to the circulation of air and people, as well as to multipurpose use. A careful consideration of how these infrastructures might be freely accessed during extreme heat events, implies that contextual sensitivity should be part of their design. Such material infrastructures also require social response plans designed by the communities who will inhabit them, so that for example, vulnerable families or lone residents might be identified and their care anticipated. We argue that this sort of participatory care planning should form part of the induction of people into any new community.

Participating in planning, repairing and maintaining infrastructures of care

We need designed commons that make space for people to make their mark and contribute their own practical knowledge and skills. Thinking of those keen gardeners in the *Cooling the Commons* study, a key example here would be the community garden, which can be understood as an ‘enabling platform’ (Jégou & Manzini, 2008) to reduce radiant heat impacts, support ecological literacies and facilitate learning communities (Mellick Lopes & Shumack, 2012). The garden is a living design that calls for time and attention but gives back in the form of food, habitat and social learning: a knowledge commons.

In response to the impact of the decline of infrastructures that are vital to sustain the comfortable mobility of people in the hot city, we also need designed environments that are repairable and maintainable, and that invite the participation of residents. Design that has internalised the normality of air-conditioning has to relearn the importance of basic ‘passive design’ features such as appropriate orientation, shading, ventilation and weatherisation, but their effective use requires human occupants to become more sensitive, anticipating changes in temperature through the day, and more engaged in actively controlling indoor temperatures.

Stewart Brand (2004) argues that modern designed homes prioritise the ‘show surface’ and do not tend to invite ongoing maintenance and care (and thus the *need* for incremental maintenance and care is forgotten, leading on occasion to catastrophic failure). The technical delegation of care to air-conditioning, further exacerbates the decline of a ‘maintaining eye’ and a skilled hand.

Designed environments that allow for people to manipulate them, but also to practice their care of and investment in them, require commoning infrastructures such as shared tools, spaces and knowledges.

Performing preparation for extreme heat

Finally, we need support to become care commoners; forms of induction and instruction that can help facilitate the performance of unfamiliar social and technical practices. All designs need instruction manuals, the future home as a care commons is no exception. How to manage and maintain commons is a significant design task in itself, and needs to be provided in forms that are both sharable and accessible to diverse capacities and knowledges.

One important form of induction in relation to extreme heat is the community weather preparedness plan. We are familiar with strategies to prepare for flood and fire; we also need plans to prepare for extreme weather. Rather than generic measures and checklists designed to help individual

households fend for themselves, the community preparedness plan would require people to assess where the vulnerable members of their community are, where the spare cool capacity is, and plan to bring them together on hot days. This might involve the design of a purposive social network that is activated on the basis of certain indicators like weather forecasts. An important precedent here is Yoko Akama et al.'s (2014) work on bush fire preparedness—the researchers worked with communities to identify and visualise social bonds, bridges and links to help people think like a community with a common concern during times of emergency. Such an approach makes an important contribution to supporting the adaptive capacity of communities living in extreme conditions (Akama et al., 2014).

Conclusion

The commons is an action concept that acknowledges a broken world and the survival ethics of a transformational infrastructure. (Berlant, 2016, 399)

The sobering reality that we confront is an Australia where 50 degree summer days may become a normal event in Sydney by 2040, sooner in other metropolitan areas, even if the international community abides by the terms of the 2015 Paris Climate accord (Lewis, et al., 2017). Certainly air-conditioned environments will have to be one response to a much warmer world, but in our view the equitable distribution of coolth will have to accompany adaptive responses. As we move toward these futures of designed circulation, there is a need to develop the infrastructures and practices of sociality that can sustain them. The *Cooling the Commons* participants remind us that this is a process of the generational circulation of ideas and practice, where historical and new knowledges and practices must continue to cross-fertilise to imagine new practices of urban habitation.

The *Cooling the Commons* study was an initial exploration of socio-material responses to the complex and dynamic problem of urban heat in a specified geographic location. As a transdisciplinary team of researchers we seek to further expand and test some of the preliminary

design considerations emerging from that study, in a research program that aims to actively ‘improve the situation of inquiry’ (Mitchell et al., 2016). This requires the development of integrated concepts that can translate the memories, improvisational transgressions and aspirations we identified in *Cooling the Commons* into an approach to design apprehensible to policy-makers, planners, and developers. For this we need to do engaged research that is, from the outset change-oriented, one that works with, and cares for commons infrastructure. At the same time we seek to challenge the practices that are constitutive of ever hotter urban futures—while good design may ameliorate the worst effects of the heat without compromising our sociality, bad design—more impermeable heat absorbing surfaces, energy demanding buildings, isolating structures—will serve to make the problem worse.

The multiple design interventions we propose, rather than simply reducing home to house-as-enclosure, instead seek to reimagine the home as a porous and socially connected space tied to other spaces that enhance community preparedness in the face of a much warmer Australia.

Following De Angelis and Harvie (2013), we see the prospects for the cool commons as a break in the historic trajectory of thermal enclosure. Pursuing this alternative makes new demands upon us as researchers, our fellow citizens and decision makers. We hope it is clear that we do not propose that designed recalibrations of the material environment in themselves constitute a cool commons.

As anthropologist Stephen Gudeman (2001) reminded us many years ago, the commons do not exist without a community that both uses and cares for it.

Acknowledgements

The authors would like to acknowledge the contributions of Helen Armstrong and Cameron Tonkinwise in developing our *Cooling the Commons* research agenda. Helen Armstrong was also a key researcher on the *Cooling the Commons* pilot study.

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ⁱThis correlation between distributions of income and tree canopy cover in urban centres is a global issue. See for example Schwarz et. al’s study (2015) looking at the burden of environmental hazard carried by low income and minority populations across seven US cities. The authors point out some interesting disincentives for urban trees including a resistance to the ‘gentrification’ that comes with tree cover because it also brings rising rents.

ⁱⁱ For a detailed, qualitative study of the impact of electricity pricing and messaging on low income households in Australia see Nicholls et al., (2017).

ⁱⁱⁱ We note that this Stephen Healy is a history of science scholar based in Australia who shares a name with one of the authors of this paper.

^{iv} Dolores Hayden (2002) documents a similar trajectory with collectively used appliances such as dishwashing machines and vacuum cleaners used in hotels and rooming houses, migrating to individual households in miniaturised form. As a template, climate control anticipates the “smart home” Sofia [Sofoulis] (2000) presciently described nearly two decades ago, as an environment that caters to (the largely male) fantasy of a command and control home, separated from the outside world, silently and efficiently shaping conventions and practices of comfort (Shove, 2003).

^v The particularly vulnerability of renters to urban heat was also found in Nicholls et. al.’s (2017) study.

^{vi} These findings about features of the built environment constraining people’s movement in a hot city, resonate with and build on those reported in Sofoulis et al.,’s (2008), study *Out & About in Penrith* of nearly a decade earlier.

^{vii} For example Parramatta City has new walkable city and bicycle plans, and in 2015 launched the Our Living River strategy, which is a plan to make at least some of Western Sydney’s degraded rivers swimmable again by 2025.

^{viii} There are numerous examples of a lack of anticipatory care in design decision-making related to transient usage. The intrusive impact of light spill from sports field flood lights on human and nonhuman residents, is but one obvious case in point.