Experiencing the Smart Nation: Materiality, Affect and Everyday Life in Singapore



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Abstract

The overall image of a smart city has often stemmed from a material-technological transition, with less known about the social aspects of this transition. In this thesis, I argue that a smart city is constructed through material engagements residents have with smart infrastructure, producing affective circulations that reveal how smartness is experienced on the ground. This thesis draws on ethnographic fieldwork done in the Punggol neighbourhood in Singapore, which has been planned to be deliberately smart and sustainable. An analysis of the interviews, walk-alongs and participant drawing sessions from respondents living in the smart estates in Punggol yields on-the-ground explanations demonstrating how everyday spaces become interfaces of the smart city. I also draw on Reddit data to show how the affective experiences of smart city residents can provide people with tools to expand political discourse. I use the haze as a case study to show how bodily and sensory encounters with material substances produce affects that reveal the constructedness of data infrastructures that are part of smart assemblages across the city. As the scale of observation shifts from the estate to neighbourly relations and everyday social practices and, finally, to the substance-level sensory engagements of skin and air pollution, this thesis looks at how affect, engagement and encounters produce everyday affective experiences for smart city residents. In observing what eventually becomes sensed, measured, and produced as affect and data, smart cities are revealed as spaces that are not static. Their production and reproduction are determined not only by infrastructure, digital technologies, and smart city policy; the smart city is also produced and reproduced socially and affectively in everyday ways. This work contributes to the growing geographical and sociological scholarship that use affective approaches to study the everyday experiences of smart city residents.

Chapter 1: Introduction

In 2020, an article written by Joanne Leow, a Singaporean academic living overseas, titled "'This is Singapore': On Watching Westworld[1] in the Diaspora", was widely circulated online. This non-fiction piece about how a specific smart, shiny, sleek iteration of Singapore, disseminated through the television show Westworld, claimed that "Singapore's relation to the unreal and artificial is no clearer than its now-ideal status for numerous photoshoots and luxe film sets" (Leow, 2020). Among Westworld's filming locations in Singapore were Marina One and Singapore's National Gallery.



Image 1: Marina One in Singapore, which was one of the filming locations in (Source: Warner Bros Discovery)

[1] Westworld is an American dystopian science fiction television series that first aired on October 2016, on HBO. Westworld. In the show's third season, Singapore was used as a backdrop to provide futuristic settings for the characters.



Image 2: Singapore's National Gallery (pictured above), which was another filming site (Source: Warner Bros Discovery)

These locations were reimagined on screen as a futuristic version of Los Angeles. As presented on screen to international audiences, Singapore existed between fantasy and reality. The city toed the line between fiction and material while imprinting itself upon visual culture in solid and compelling ways that established it as already firmly planted in a perceived smart future. This vision of a smart city was more than something exported through this show. These visions also reached those living in Singapore and Singaporeans overseas. Leow writes about how it felt being away from Singapore and watching her homeland materialise across the screen:

> "The city-state of my birth was rearranged on screen; its locations subtly adjusted to represent something else with a disorienting dream logic. As I watched this alchemy, I knew my vision was doubled. I saw the sleek fiction of a glossy, dystopian world with its flawless android skin and futuristic architecture and vehicles. Simultaneously I was immersed in a synesthetic memory of warm tropical nights in the ever-changing city-state. I struggle to describe it to those who have never visited…all I have are these vistas, mediated through screens, large and small. The sheen of neon lights on

> Thandie Newton's face. The empty bus stops, with their alternate seats crossed out by duct tape. The tropical chic modernist architecture of the new downtown. The shin-deep wildness of the fields next to the orderly rows of flats. The gleaming, climate-controlled airport, with its rows and rows of luggage trolleys, its expanse, completely empty. The public parks patrolled by robot dogs." (Leow, 2020).

Leow describes how watching the way in which Singapore was represented on the screen was to witness a "disorienting dream logic… [where her] vision was doubled". She felt the "memory of warm tropical nights" and described the visceral experiences of the city – the "sheen of neon lights", memories of "empty bus stops" and expansive, "empty" airports. The disorientation that Leow felt was caused by the simultaneous representation of an unfamiliar space and the visceral memory of how it had once been familiar. To Leow, the smart city, as depicted on screen, existed beyond its immediate representation. It was situated within a longer history of personal memory and public discourse. Leow's reflections bring attention to the visceral and affective experiences of the city that become familiar to its residents. The city becomes more than just infrastructure; it is also 'felt'. This is shown through Leow's description of her fractured experience of her homeland through the screen, where 'home' had been reimagined through a vision of techno-utopianism. Singapore is presented as a seductive, smart fantasy, with its allure extending beyond the city-state's territory. There is an element of the ephemeral in the representations of the Singaporean smart city that circulate through these images.

These depictions raise questions about the kinds of images and knowledge that circulate globally about smart cities. Images of smartness circulate in different ways. Some images circulate through personal accounts, the media, and popular fiction. Other images are circulated in policy. Notable smart city models from Seoul (Lee, 2023; Yoo, 2021), London (Song, 2020), Jakarta (Webber et al., 2023) and other cities across the Global North and the Global South offer alternatives to the Singapore model. There is also increasing work on regional specificities in the transition to models of smart urbanity or nationhood. The significance of municipalities in managing local digital transformations has been highlighted in scholarship on the African region (Soderstrom et al., 2021; Arku et al., 2022; Boyle et al., 2024). Work on technocratic regionalism in ASEAN (Kong & Woods, 2021) and the impact of transboundary learning on sustainability initiatives amongst ASEAN smart cities (Tan et al., 2021) highlight regional specificities. These various models suggest diversity in the

visions circulating of the smart city. There are, however, particular visions of the smart city that have become more normative than others. The smart city model that Singapore mobilises, for example, is particularly attractive in aspects like state-led ecological modernization (Semyachkov, 2021; Nielsen, 2014), resource management (Usher, 2024) and the development of smart and sustainable technologies (Miao & Phelps, 2019). Other aspects of the Singapore model, such as the extensive use of surveillance infrastructure, for example, resonate differently (Guest, 2021; Wood and Mackinnon, 2019). The variation in the ways the smart city is constructed suggests that not only are there many different models of 'smart cities', but within these models themselves, they are not singular or unified.

In depictions such as the one in Westworld, the vision of the smart city travels through a particularly techno-utopian vision of smartness. Going back to Leow's experience, how the vision of Singapore as a smart city is circulated does not only consist of how it is received as a fantasy but also how it is experienced on the ground in the face of this simultaneous fantasy. Smartness can be a dynamic and shifting set of attachments to different versions of urban life. Individuals develop attachments to their built environments – one can feel affectionately or nostalgic about steel buildings, skyscrapers, or a city's skyline. These attachments coalesce in complex ways with different situational, cultural and historical contexts. As Leow's experience suggests, the smart city is constructed through tenuous and uneven processes. These images of the smart city are not accessible to all in the same way. In addition to the limits to accessing a universal image of the smart city, the many different images of the smart city in circulation can also be attributed to the various ways the city is being experienced. Singapore's transformation into a Smart Nation can critically affect how smart city residents experience these processes. Leow's experience of the representation of the Singapore smart city can be contextualised within her location in the diaspora and her contributions to discourse in Singapore from afar. Thus, there are multiple ways in which parts of the smart city can be seen, represented, and perceived. All have the potential to influence the everyday experience of the materiality of the smart city on the ground.

The earlier discussion of Westworld foregrounds the question this thesis asks about the affective experiences of a smart city. This thesis asks: What kinds of affective experiences are characteristic of the smart city? To answer this, I examine the practices through which the smart city's affective experiences become evident. I refer to the high-rise public housing

neighbourhoods I studied in Punggol, a town in the northeast of Singapore, as 'estates[2]'. I used these smart estates in Punggol as the key site for understanding how residents engage with smart infrastructure. This thesis focuses on the kinds of everyday engagements HDB residents have with the materiality of their estates. The material-discursive engagements that individuals have with the smart infrastructure of their estates occasionally produce circulations of affect. This results in individual and collective practices of smartness that show how the relationship between engagement and affect is dynamic and complicated. As Singapore develops multiple smart estates across the city as part of the larger Smart Nation project, there is a cumulative effect of the application of smartness in the transition to the Smart Nation. The HDB is a significant site of the Smart Nation project. This can be seen through the spatial production of different smart estates - from Yuhua, which was retrofitted with smart technologies, to Punggol, which consists of a mix of planned and non-planned smart and sustainable estates, to Tengah, which is being built from scratch as an entirely smart and sustainable neighbourhood. This suggests variations in the modes for implementing smartness, even within a single initiative, such as the Smart Nation project.

1. Key Contributions

My analysis offers a place-based study of how the smart city is constituted in smart estates and makes three contributions to scholarship on smart cities. The first contribution is conceptual, as the thesis identifies and discusses how attention to affect can enhance the conceptual frameworks through which the smart city is understood. I show how specific affective experiences are characteristic of the smart city, and in doing so, I add to the insights that have emerged in previous research on affective lives in smart cities (Zhu et al., 2022; Cook & Valdez, 2021; Rose & Willis, 2019). Affect, in these works, reflect an additional conceptual focus for smart city research, in addition to understanding 'smart' as a capitalist or neoliberalist strategy, 'smart' as a discursive tool, and 'smart' as a form of urban governance.

[2] The Housing and Development Board (HDB) is one of Singapore's "most important and effective public institutions since the early post-independence days" (Hamnett and Yuen, 2019: 6). Established in 1960, HDB wields immense power over the acquisition and ownership of land in Singapore and houses approximately 79% of the population (Singstat, 2024). They house the population in HDB towns and estates, which are housing developments. Officially, HDB has developed 24 towns and 3 estates. The neighbourhood of Punggol is considered a town. 'Estates' as a term is used most often to refer to a subsection of the housing development within a larger town. For example, 4 or more blocks of flats, usually organized around the same small commercial centre, can be referred to as an 'estate'. These estates are usually larger than a single high-rise building, and smaller than a neighbourhood town. Estates in Punggol include the Northshore development, and Waterway Terraces I and II.

In expanding on these works that look at the smart city as an affective experience, I draw primarily on Ahmed's work (2004, 2010) on affect to show "intimate connections between affect, interpretation and agency" and reject the bifurcation between affect and emotions that the Spinozian tradition of affect emphasises. Through this, I identify and discuss how residents of smart estates express the "mixed bag" of good and bad (Yeo, 2022) through ambivalences and mixed feelings. In addition to clarifying the different emotions and affects that make up this "mixed bag", I also use the concept of "stickiness" (Ahmed, 2010) to show how paradoxes explain the persistence of the "cruel optimism" (Berlant, 2011) of respondents. I do this by discussing how respondents hold onto dual desires for their estates that cannot be achieved in tandem. The achievement of one of these desires directly threatens the achievement of the other desire. These two aspects of the affective experience of the residents of the smart estates in Punggol seek to provide an account of how the relations between affect and engagement can produce and reproduce the smart city at the scale of the everyday. By investigating if there is anything distinct about the affective experiences that emerge in the smart city, I move past Foucauldian notions of smart subjectivity and conceptualise city residents as 'smart' through their everyday social practices. This centres a conceptualization of smartness that focuses on the everyday experiences of smart city residents that is not limited to their engagements with smart technologies.

Second, this thesis makes an empirical contribution by providing an account of the everyday affective lives of smart city residents in the Punggol area of Singapore, which research has not previously covered. This thesis explores how engagement with smart and sustainable infrastructure in Punggol's smart estates mediates the relationship between the Smart Nation project and its smart subjects – the city's residents. Singapore develops multiple smart estates across the city as part of the larger Smart Nation project - from Yuhua, which was retrofitted with smart technologies, to Punggol, which consists of a mix of planned and non-planned smart and sustainable estates, to Tengah, which is being built from scratch as an entirely smart and sustainable neighbourhood. This suggests variations in the modes for implementing smartness, even within cities. The application of smart urbanism across the city can be observed as varied. Thus, the experiences of smartness are varied, too. Observations in Punggol show how the Smart Nation project might not be experienced similarly across the city, even in Singapore's tightly managed and over-planned neighbourhoods. This insight expands on work done on smart cities that use Foucauldian frameworks and socio-material approaches to understand how the different kinds of applications of smart urbanism can

produce varying experiences of smartness (Ho, 2017; Calder, 2016; Shamsuzsoha et al., 2021; Calvada et al., 2019; Joo, 2023; Woods, 2020; Kong & Woods, 2018; Woods & Kong, 2020). This research also adds to our understanding of how smart cities are experienced specifically in two types of urban forms: high-density, high-rise housing (Pettit et al., 2018; Wynn et al., 2022) and public housing, or social housing (Szczech-Pietkiewicz et al., 2024; Listerborn, 2024; Zhao & Zou, 2025) - Singapore's heavily centralised method of managing HDBs has the potential to produce insight into smart governance and social housing.

Third, this thesis makes a minor methodological contribution by demonstrating how collaborative and participatory methods, such as walk-along and participant drawing sessions, co-produce shared experiences of spaces that allow for observing affects as they develop, circulate and shift. There is "no single, generalizable theory of affect" (Gregg & Seigworth, 2010: 3). Gregg and Seigworth (2010) refer to this as a "methodological and conceptual free fall" (2010: 4). There have been various studies however, that have used a range of qualitative methods to investigate affect (Woods, 2024; Woods, 2023; Edensor, 2012; Edensor, 2016; Anderson, 2017; Gershon, 2013). This thesis adds to the possibilities for researching affective experiences that have been provided by earlier works. In particular, this thesis offers insight on the use of different participant-led methods in the study of affect. The continuous nature of co-production in participant-led methods can cultivate a "more caring, emphatic and attentive [way] of engaging with others" (Duedahl and Stilling Blichfeldt, 2020: 438). Thus, the methods discussed in this thesis would be relevant to those interested in designing qualitative studies that explore affective questions.

This introduction will reflect on the contributions that analysis focused on affect can bring to scholarship on smart cities. I will first situate this thesis within the body of work on smart cities that respond to the call to study smart cities empirically and to move past technological determinism (Luque-Ayala and Marvin, 2015; Marvin, et al., 2015; Kitchin, 2015; Rose, 2020). Then, I will discuss the significance of using affect as a framework to respond to this question. I will also discuss the need to understand the Singapore smart city as it is realised locally. This will introduce the context for which the fieldwork site of Punggol becomes relevant and useful as a smart city case study. Lastly, this introduction will provide a roadmap through the subsequent chapters in this thesis.

2. Smart City Infrastructure

In this thesis, the relations between engagement and affect are seen primarily through material engagements individuals enact in smart estates, where affects are produced. Through this, we can observe how 'smartness' is experienced on the ground. Focusing on smart infrastructure reveals everyday interfaces of the smart city that individuals negotiate. By exploring engagements individuals have within their smart estates, the definitions of 'smart' move from one that reductively centres digitalisation and technology to one that grounds understanding of what visions of the smart city might mean in everyday life (Luque-Ayala & Marvin, 2015; Kitchin, 2014; Rose, 2020). There have been critiques of smart urbanism as it has been applied as a general panacea to urban problems (Luque-Ayala & Marvin, 2015) and as a localised solution to problems cities like Singapore face (Kong & Woods, 2018). This thesis contributes to recent work contextualising smart cities in the specific spatio-temporalities of the everyday. It provides an empirical account of how smart cities are constituted through local and particular visions of the smart city project. Additionally, the use of affect theory as a conceptual orientation reveals the complex experiences of smart city residents by identifying some of the different positive and negative emotions that emerge in these estates and residents' oscillations between the two. This provides a dynamic understanding of these estates' affective and social landscapes.

When attempting to explore this affective landscape, it is helpful to examine how smart urbanism represents a "utopian vision or a false dawn" (Marvin, et al., 2015). Smart city literature includes significant critiques of the smart city and criticisms of the neoliberal ethos that underpins technological solutions to city governance and development (Gupta et al., 2015). These critiques highlight the tensions that often emerge with applying smart urbanism (Kong & Woods, 2018; Eger, 2003; Kitchin, 2014; Luque-Ayala & Marvin, 2015; Verrest & Pfeffer, 2019). They also highlight how there is a "powerful political and economic lobby advocating the development of smart cities" (Kitchin et al., 2015: 17). Arguments for the smart city put forth by this lobby often obfuscate significant concerns around smart urbanism. Kitchin et al. (2015) outline five key critiques of the smart city (2015: 17), which include identifying issues around technocratic governments and the politics of urban data. Inherent in this critique is the sense that while some benefits of the smart city – such as security and energy efficiency – are clear, there are plenty of "unresolved concerns" around the costs they bring (2015: 29). There has also been recent work that discussed how alternative models of smart city formation have resolved some of the tensions between global capital and local

governance. This has resulted in instances where the "public sector becomes the driver of urban innovation, and thus [maximises] the benefits of "civic tech" (Woods et al., 2024a: 735) – with the Singapore case provided as an example.

The vast and growing literature on the development and critique of smart cities has shown how central the transition to smart is to contemporary urban theory. While there is great diversity in the kinds of smart cities being built and the types of smart initiatives being undertaken, this transition heavily influences how cities develop. This is why this thesis explores smart cities as affective experiences. There is burgeoning scholarship on understanding cities as affective (Latham & McCormack, 2017; Duff, 2017; Yeoh, 2015) through affective urbanism (Anderson & Holden, 2008; Paiva & Sánchez-Fuarros, 2021; Ernwein & Matthey, 2019), affective publics (Lunenborg, 2019; Juarez Miro, 2022; Papacharissi, 2016; Hautea et al., 2021) and affective atmospheres (McCormack, 2008; Anderson, 2009; McCormack 2014; Stephens, 2016; Bissell 2010). Recent work on affective infrastructures (Bosworth, 2023; Knox, 2017; Street, 2012; Berlant, 2016; Ramakrishnan & O'Reilly, 2023) has also broadened conceptualisations of the co-constitutive nature of infrastructures and affect. The increasing importance of both smartness and affect theory in understanding urban life can be examined by expanding the current work on smart cities to consider how smartness can be understood as producing affectivities.

Although a social body is not uniformly produced through the bodily practices of smartness in everyday infrastructure engagements, individuals share some generalisable experiences as they move through smart spaces. This thesis reveals the varied everyday experiences of different kinds of people implicated in the smart city. In addition to digital infrastructure, and the engagements smart city residents have with them, these individuals are also by themselves central to understanding the smart estate. Amongst these individuals, there is further stratification, revealing marginalities that problematize the vision of the Smart Nation project as equalising (Green, 2019; Luque-Ayala & Marvin, 2015). Marginalities are created even as collective 'felt' experiences can be observed, revealing some of the exclusionary practices that are applied through smart urbanism. The spatial anchoring of smartness moves beyond normative understandings of what 'active citizenship' looks like in smart cities. Instead of attempting to identify instances where people participate publicly and collectively in political practices, in this thesis, I observe the kinds of emotions and affects that emerge in discussions around the relationship between smart city residents and the state. These

conversations on power may not use overtly political language. However, these feelings, emotions and affects shape, and are shaped by, society's relationship with the state. This relationship creates the capacity for individuals to exercise agency over their surroundings in ways that impact their everyday lives. Through actively seeking ways to understand and, thus, adapt or control their environments, individuals are empowered to critically engage with what is being produced by smart systems – data, for example. To participate in the production of the smart city then involves not just levels of technological adoption or data literacy as per the aims of 'digital readiness', which is one of the pillars of the Smart Nation project (Smart Nation Singapore, n.d.). Smart subject formation can be conceptualised as spatial, material, and affective, encompassing a much larger sense of what the interface between urban spaces and smart urbanism can be constituted of. Additionally, by emphasising the collective and lived nature of smartness, this thesis considers how meaning is made through practice rather than identity.

3. The Normative Smart City

Due to the lack of definitional precision, what constitutes a smart city is not "universally agreed upon" (Kitchin et al., 2015: 16). Thus, smart city definitions might not just be descriptive. They can also be evaluative. The smart city is a "normative framing of what the urban should be, underscoring the potentialities for digital technologies in urban processes" (Burns et al., 2021: 463). According to Kong and Woods (2021), "smartness is not an absolute category of classification; rather, it is a relational construct that is used to classify one city in relation to another, or in relation to a predefined, "normative" standard" (2021: 2). The authors identify two main problems with this – firstly, that the standards used have been mainly Eurocentric. Secondly, "to label a city as "smart" is to establish a series of technocentric, homogenous, and often unrealistic expectations as to how it should operate" (Kong & Woods, 2021: 2). Smartness needs to be understood in socially and spatially situated ways – as a kind of "guiding logic of all urban processes – not just those that are technology dependent" (Kong & Woods, 2021: 2). For example, for developing cities, smartness can be seen as a driver of change and specific visions of development and modernity.

According to Luque-Ayala and Marvin (2015), the smart city is based on the normative idea that technology is the driver of change. Smart cities promise transformation across multiple

aspects of urban life. In Singapore, this transformation is outlined in the state's Smart Nation project, which anticipates improvements across the government, the economy, and society (Smart Nation Singapore, n.d.). The 'Digital Readiness Blueprint' outlines the city-state's main sites of smart solution applications. There are four efforts in this framework that direct resident-technology interactions:

- That every Singaporean has the means to transact digitally
- That every Singaporean has the skills, confidence, and motivation to use technology
- That every Singaporean makes use of technology to achieve a better quality of life
- That every digital product or service is designed for easy and intuitive use by all Singaporeans

What is reflected in the Digital Readiness Blueprint is the idea that the smart city is not just composed of hardware. The aim of these technologies should address the needs of the citizens and improve their quality of life (Ponting and Zhou, 2016). Information on how the Singapore state aims to do this is publicly available online on the Smart Nation website. A range of state-produced material is available across the different state agencies and platforms, detailing the digital and social transformations the Smart Nation project hopes to achieve. Broken down into specific projects, much of the official material available online outlines what smart city residents can expect from the state of Singapore. In the Punggol Digital District (PDD), for example, the state aims to bring together industry, academia and society through digital transformation to "foster a vibrant, strong digital community" where "a thriving community of people will…be calling [the] neighbourhood home" (Smart Nation Singapore, 2024). These vague objectives are sometimes accompanied by commitments communicated to the public through the websites of state agencies. For example, on the Smart Nation website, the PDD is "expected to bring approximately 28,000 exciting jobs to Punggol and the north-east region" (Smart Nation Singapore, 2024). The Smart Nation project consists of extensive digitally mediated state-society relations, enabled by the city-state's 'whole-of-government' approach, which centralises coordination between agencies efficiently and consolidates innovative capacities within the government (Lee, 2020; Hoe, 2016; Ng, 2018).

This is unlike some other cities[3], where private sector involvement in developing smart cities has been criticised as growing too powerful and autonomous, moving beyond the purview of the state (Hollands, 2015). In the example of Singapore's Smart Nation project, consolidating innovative and entrepreneurial capacities within the government has allowed the state to manage access to private companies and the country's resources, including capital, expertise, and people. Singapore's state-led insourcing of innovation through tech talent and capabilities has allowed the city to pursue smartness through strong centralised power (Woods et al., 2024a). The role of the state in Singapore in realising smartness is significant. Singapore presents a case study that "speaks to a layer of governance – the national – that has often been overlooked" (Woods et al., 2024a: 742). Woods et al. (2024a) discuss the significance of the national in offering alternative or "new insight into pathways of smart city formation" (2024a: 742), where the Singapore smart city is conceptualised as a "nationalizing" construct (Woods et al., 2024a: 743). Discussions of the 'national' are essential in understanding the construction of the vision of 'smartness' in Singapore[4]. Both the state and smart city residents here are significant stakeholders in the "nationalizing" smart city of Singapore.

In this thesis, I acknowledge that the scale of the 'city' and the 'national' are often conflated. Additionally, for analysing the Smart Nation project as an initiative organised and carried out by the state, the scale of the 'state' and the 'national' are often conflated as well in this thesis. However, the field site of Punggol offers insight on the everyday lives of smart citizens, which may or may not align with the "nationalizing" construct of the Singapore smart city. Thus, the scale of the 'city' and the 'national' can be differentiated to an extent, by observing everyday smartness that can be enacted in ways that move beyond the state-society interactions outlined in the Smart Nation project. State-developed material on the Smart Nation significantly contributes to the discourse around smart cities in Singapore. Information on the strategic focuses, projects and vision of the Smart Nation is publicly accessible online. The state is not, however, the only driver of this transition. In the Singapore case, questions around the co-optation of marginal groups into 'smartness' remain "ambiguous" (Woods et al., 2024a: 751), "as does the place and viability of alternative modalities of "smartness" that might exist outside of or even contradict, and perhaps

[3] A notable example is the Sidewalk Toronto project to redevelop the city's eastern waterfront was halted by protests against the Google-backed company, Sidewalk Labs (Cecco, 2020)
[4] Woods et al. (2024a) discuss in detail how the smart city project can be conceptualised as 'nationalizing', bringing the 'national' level into conversations on Singapore city's transition to smartness.

undermine, the state's vision of the Smart Nation" (Woods et al., 2024a: 751). The range of affectivities – feelings, emotions, affects - observed in interactions with individuals who experience the Smart Nation every day suggest that there are relations of smartness that exist beyond the official discourse around the Smart Nation. One of the visions of the Smart Nation project is the push "for a digital-first Singapore…[where] a Digital Government, Digital Economy and Digital Society harness technology to effect transformation in health, transport, urban living, government services and business" (Smart Nation Singapore, n.d.). This vision, however, is not the only driver of this transition. Kong and Woods (2021) show how the mobility of the 'smart city' concept can be "scaled up" through technocratic regionalism (Kong & Woods, 2021: 2). At the city level, the authors discuss how actors beyond the state are involved in the building of digital infrastructures. They also distinguish between the regional, city and local scales, emphasising the importance of all stakeholders, including smart city residents, in the transition to smart.

Various authors have discussed the role of smart city residents in the transition (Cardullo & Kitchin, 2019; Shelton & Lodato, 2019; Calzada, 2018; Datta, 2018; Ho, 2017; Lee et al., 2020; Woods et al., 2024a; Woods, 2020; Woods & Kong, 2020), arguing that cities are not merely passive to smart urbanism. The distribution of agency across smart cities results in unevenness in the implementation of smart technologies, and thus, reiterates the importance of looking at the realisation of the smart city at the "local level" (Kong & Woods, 2021: 7). This "local level" can be observed and analysed through the experiential and 'felt' sense of the everyday in smart estates. The range of affective experiences observed during fieldwork in Punggol suggests that the experience of the smart city goes beyond relations to the state. By exploring the everyday experiences of residents in a smart estate in Singapore, this thesis asks if there is something distinct about the affective experiences that emerge in the smart city, exploring the kinds of subjectivity that emerge through the body rather than those governed by rationality (Vanolo, 2014; Ho, 2017). Although the smart city can be explored at this "local level" through groundedness in the affective geographies of smart estates in this thesis, discussions of the ways in which the smart city consists of multiple and interrelated scales lies beyond the scope of this thesis.

Smartness in Singapore "is about subjecting the individual player…to a bigger and more integrative vision of the future" (Woods et al., 2023: 8). The "logic of citizen-nation-state interoperability that is so evident and dominant in Singapore" (Woods et al., 2023: 7)

emphasises the centrality of the "citizen" in the Smart Nation project – it is "citizen-centered", rather than being "citizen-led" (Woods et al., 2023: 7). To understand how subjectivity has been discussed in Singapore, both recently, through the 'smart citizen' and historically, it is helpful to contextualise the shifts in subject formation within Singapore's longer modernisation process. The Singapore state has regularly used technocratic interventions to achieve urban planning goals. The Smart Nation project can be understood as a culmination of Singapore's government's long-term efforts at using technological solutions to solve the city's problems. Singapore has historically used technological solutions and specifically designed policies and services to direct citizen behaviour towards effecting long-term desired outcomes. Two examples are the state-digitalized Central Provident Fund (CPF) or pension fund contributions. The state also introduced ethnic quotas in public housing through the Ethnic Integration Policy (EIP), artificially managing the racial mix of estates and neighbourhoods to avoid ethnic enclaves. Road congestion pricing, or ERP, has been successful at disincentivising car usage. These initiatives show how Singapore has had a history of using innovative technologies to change citizen behaviour.

This history of technocratic rule suggests that the Smart Nation project represents a continuation of Singapore's technology-centered policies (Ponting & Zhou, 2016: 3). There have been earlier efforts at digitalising the government or creating an "e-government" (Tan et al., 2005; Sriramesh & Rivera-Sanchez, 2006; Chan et al., 2008). The roots of the current Digital Government Blueprint can be traced back to the 1980s with the National Computerisation Programme and the "Civil Service Computerisation Program". This was followed by the IT2000 and e-Government Action Plans of the early 2000s. In Appendix 1, I have included a timeline that shows how the Singapore state has used technology as a driver for governance and development throughout Singapore's growth.

In addition to smartness, being 'green' has been central to Singapore's urban planning. The growth of the city and the greening of the urban environment as part of carefully controlled state efforts have been studied by various scholars (Hamnett & Yuen, 2019; Jalais, 2021; Goh, 2001; Han, 2017). The state initially used the Garden City project as a marketing tool for foreign investors and tourists, but then grew it into a larger vision of an "urbanized utopia" (Goh, 2001: 12). The Urban Redevelopment Authority's (URA) "City in a Garden" plan, launched in 2012, was conceptualised by the state as an evolution of the earlier Garden City project, with key areas identified in continuing efforts to 'green' the city. The state used

specific discursive tools – ideologies of "land scarcity", "smallness", "urban", "survival" and "necessity" (Goh, 2001: 13) – to justify the consolidation of land within the city-state. The realisation of the Smart Nation can thus be understood within Singapore's history of technocratization, the greening of the urban environment, and "state intrapreneuralism" (Miao and Phelps, 2019).

4. Feeling the Smart City

Smart cities, as spaces where the transition to smartness is taking place, are not static entities – these spaces are defined as much by the structured urban planning agendas that organise their development as they are by the indeterminacy of the everyday. They are also contested sites, even as they adhere to high levels of uniformity and standardisation from a material point of view. Affect theory provides a framework for contemplating how smartness is being pursued as it looks at how it is experienced on the ground. Affective dimensions of this experience can reveal alternative ways of looking at smart infrastructures and their material entanglements with smart city residents. Infrastructures "are implicated in the human experience of the city…[alluding] to particular habits such as improvisation or opportunism and to particular affects such as endurance or anger" (Amin, 2014: 319). Infrastructures reveal the human experience as they constitute emotional practices.

In this thesis, affect theory informs the research's theoretical framework and methodology. For this reason, the thesis draws more closely on the phenomenological strand of affect theory, informed by Ahmed's work. Morrison argues that the "widespread tendency to interpret affect as unconscious, physiological, prelinguistic, primitive, autonomic, and non-intentional" (Morrison, 2020: 147) can be contrasted against the more phenomenological approach in Sara Ahmed and Judith Butler's work. The feminist, queer and more cultural trajectory of affect theorises affect in and besides existing social and cultural phenomena. Affect is defined in a more flexible way, to include affect, emotion and feelings that get historically constructed in a range of ways. Ahmed's definition of affect traces emotions through phenomenological orientation. We are affected by what we encounter. The forces of affect are co-created in dynamic ways with social worlds. In the Spinozian origin of affect theory, affect is also the outcome of an interaction – an active result of affecting and being affected (Deleuze, 1988; Keating, 2019). However, affect as it is theorised here attends to the other-than-conscious forces. Scholars that draw on this Spinozian strand of affect theorise

these forces as an "impersonal force[s]" (Keating, 2019: 245), as "form[s] of encounter" (Keating, 2019: 246) and as "autonomous from cognition" (Uhlmann, 2020:159). Ahall (2018), drawing on Ahmed's work, discusses how affect as a methodology is interested in the "affective-discursive in-between as shared meanings" (2018: 50) rather than figuring out what the 'real' affective impressions are between body to body. She argues that there are "feelings of structures everywhere" (2018: 50), and feminist knowledge of affect offers a way to rethink the politics of emotions by emphasising that feelings and emotions are parts of affect.

This phenomenological strand of affect theory questions the distinction between emotion and affect I draw on Ahmed's definition of affect for two main reasons. Firstly, her phenomenological focus rejects the mind-body dichotomy by understanding affect and emotion as mutually constitutive (Guschke, 2023). Secondly, her focus on how emotions and affects circulate socially links emotions and affects to normativity. This makes it possible to investigate affects in relation to larger norms and power relations. Due to these reasons, it is then possible to observe "the intimate connections between affect, interpretation, and agency" (Morrison, 2020: 147). The relations between engagement and affect are complicated. An affective framework also allows us to understand the experience of smart city residents without being limited to smart discourse. Individuals engage affectively with smart infrastructures, and what eventually becomes sensed, measured, and produced as data reveals how smart cities are both infrastructural and affective spaces.

5. Chapter Outlines

This thesis asks: what kinds of affective experiences are characteristic of the smart city? It investigates the kinds of affective experiences characteristic of the smart city, as observed at the scale of the smart estates in Punggol as a particular localization of the smart city in the context of Singapore.

In Chapter 2, I draw upon the rich literature on smart cities, infrastructure and affect, to show how an affective framework offers new perspectives to understand everyday human-material engagements in smart cities. The different sections of the literature review emphasise how much of the literature around smart cities, infrastructure, and affect challenges conceptual binaries, critiques data-driven urbanism, and contributes to knowledge on the smart transition

across both the Global North and Global South. I echo previous problematisations of the top-down/bottom-up approach of looking at the distribution of power and agency in smart cities (Kong & Woods, 2018; Kitchin, 2014; Luque-Ayala & Marvin, 2015). Through this, I suggest looking at how the smart city is enacted beyond the lens of state-society relations in Singapore. Although the state's role is significant, the smart city is enacted in ways that go beyond actions that show support for or are oppositional to the government. The literature discussed in this chapter provides contextualisation for exploring the everyday life of smart city residents through their affective experiences so that smartness can be understood as enacted beyond the Smart Nation project (Kong & Woods, 2021; Yeo, 2023).

Chapter 3 details my methodology, field methods, and field sites. I also critically examine my positionality, discussing opportunities and challenges I faced as a 'native' researcher. I discuss the practice-oriented methodologies I used to understand affectivities. I discuss in detail my field methods, which include the interviews, walk-alongs, and participant drawing sessions I conducted. I outline their contributions to the generation of data used in this project. I explain my choice of field sites and the data analysis processes I used. I also provide details on the multiple data collection periods, including the most recent one in June 2024, which involved gathering data from the online platform Reddit. In addition to my positionality, I also explain the ethical choices I made during this research and the limitations of my methodological choices.

In Chapter 4, I discuss the affective experiences of smart estate residents that were produced through engagements with the materialities of their estates. I explore these engagements in two main ways. First, I analysed the kinds of engagements residents had with the smart and sustainable features of their estates that I expected to be significant in their lives but did not organically emerge as such in conversations. Here, I discuss solar panels, the pilot testing of smart home technologies and specific smart technologies that were unpopular among respondents, such as environmentally-friendly bathroom taps and laundry machines. Affectivities around frustration and incredulity surrounded aspects of the smart estates that residents found unhelpful and poorly planned. The disconnect between the top-down implementation of smart urbanism and its ground-up experience created friction that respondents often described in ambivalent ways. This ambivalence was something that I analysed more thoroughly through the engagements respondents had with the smart and sustainable features of their estates that they expressed as being significant in their everyday

lives. The tension between their desire for green spaces and the further development of their estate caused their affects to oscillate between positive and negative emotions. On one hand, there were positive emotions related to hopefulness, pleasure, enjoyment, comfort and optimism. On the other hand, there were negative emotions such as insecurity and uncertainty. The tensions and co-occurrences of emotions about the different aspects of smart city life led to the persistence of ambivalence. Conflicting emotions, then, characterised the emotional landscape of these smart estates. This chapter brings more precision to what the "mixed bag" (Yeo, 2023) of good and bad of smart cities might look like in the everyday life of smart city residents. The application of smart urbanism is not always even, and the fleeting, often conflicting mixed feelings that characterise the affective landscape of these estates show how the experience of the smart city can be dynamic and complex.

In Chapter 5, I discuss how these affective experiences produce socialities in these smart estates. I focus on the affectivities related to social practices around neighbourliness. I expand the normative conceptualisation of a smart city resident as a "smart citizen". This expansion includes recognising everyday social practices that are significant to the lives of respondents but do not necessarily engage with the state or smart technologies. In particular, I looked at how respondents negotiated issues around proximity to maintain their privacy. The tensions that emerged from their paradoxical desires for privacy and connection add to the complexity of the emotional landscapes of their everyday. These landscapes can contain negative feelings like loneliness, frustration, isolation and distrust. These landscapes are also shifting and uneven. Respondents often experience conflicting and fleeting affects that oscillate between different emotional states. This complexity echoes how ambivalences operate in Chapter 4. This chapter, however, focuses more directly on the push of connection and pull of disconnection in developing social practices. Positive affects like hope and affection characterise the emotional landscapes of respondents' social lives as much as the negative emotions. Additionally, through investigating the minority/Muslim experience, I discuss how the affective experiences of these smart estates are uneven in ways that maintain the separateness of minority communities. This exacerbated how much vulnerability and disconnection these minority/Muslim respondents experienced, adding a layer of disconnection to their social lives that non-minority/Muslim residents did not experience. Through studying the social practices of neighbourliness that emerged through residents' interactions, this chapter challenges the assumption that smartness can be collapsed into only what can be observed or expressed through one's engagement with technology.

The scale of observation moves from the smart estate in Chapter 4, to the more micro-relations between neighbours in Chapter 5, to the scale of the body's interactions with substances in a smart city in Chapter 6. Chapter 6 is different from the previous chapters as it is observes affective experiences that are not limited to the smart estate. Additionally, data that is used in this chapter was not collected from the same respondents as those discussed in Chapters 4 and 5. Instead, an analysis of responses on the online social media platform, Reddit, was done. Chapter 6 is still related, however, to the previous chapters as it also describes affective experiences that are characteristic of the smart city. The affective experiences that are characteristic of the smart city extend beyond that of the smart estate through the exploration of the affective experiences of Singaporean Reddit users online. Their experiences are, similarly to the smart estate residents, mediated materially. They are also implicated in the larger entanglements of the smart city that smart estate residents are part of. In Chapter 6 however, the smart infrastructures I focus on are data infrastructures, not the infrastructures within smart estates. I use the case study of the haze in Singapore to understand how affects are produced in everyday sensorial encounters. The affects related to the haze include suspicion, confusion, frustration and distrust around the kind of haze data being officially communicated by the National Environment Agency (NEA). Through the contestation of official haze data online, the efficiency of data-driven urbanism is problematised as data is seen as a non-neutral tool of smart governance. This chapter looks closely at how discussions of sensorial engagements and the affective experience of haze developed into an alternative form of haze data and a minor way to counter official PSI figures by the NEA. Reddit users enacted 'smartness' through the generation of 'counterdata' (Olojo, 2024). By proving data to be changeable and dynamic, these users problematise data as an objective tool for effective governance.

In the next chapter, I discuss my theoretical orientations and arguments through the literature of three main bodies of work on smart cities, infrastructural studies, and affect theory.

Chapter 2: Literature Review

1. Introduction

To respond to my research question on the affective experiences that are characteristic of the smart city, this chapter reviews three main bodies of literature around smart cities, infrastructural studies, and affect theory. Within these bodies of literature, I also discuss how assemblage thinking can contribute to investigations on everyday life in smart cities and the alternative perspectives on subject formation that a focus on affect can bring.

This literature review is informed by the increasingly large body of work around smart cities, including critical literature overviews by scholars exploring "actually existing smart cities" (Rose, 2020; Luque-Ayala & Marvin, 2015). This thesis contributes to earlier work that investigate smart cities using affective approaches (Rose & Willis, 2019; Cook & Valdez, 2021). This work also expands on Yeo's 2023 study of smart city residents in the Yuhua estate in Singapore and Ho's 2017 work on the biopolitics of smart citizenship. Ho's work on the biopolitics of smart citizenship shows apparent changes in people's behaviours when they engage with smart technologies, resulting in a unique kind of smart subject – smart government relationship. His work acknowledges the uneven power relations that manifest through the Smart Nation initiative. There has been unevenness in how smart city residents are implicated in the technological infrastructure being built in smart cities (Luque-Ayala & Marvin, 2015; Karvonen et al., 2018; Shwayri, 2013; Kitchin, 2014; Kong & Woods, 2018; Lee et al., 2020). The "assumptions of smart technology are often undermined by the ways in which they are received, applied and (mis/un)used across society and space" (Kong & Woods, 2018: 2). These assumptions, often drawn from promises within the smart urbanism discourse, "are often based on abstraction, which in turn are liable to being undermined by what they can actually deliver" (Kong & Woods, 2018: 2). Kong and Woods (2018) argue that the paradoxes of smart technologies need to be reconciled with how they have been applied on-the-ground (2018: 2).

Empirical studies on smart cities have recently focused on the dual processes of both the 'worlding' and 'provincializing' of smart cities, which reveal the tensions between the complementary processes of being implicated in global flows of capital and "the theoretical

shift towards understanding the variegated nature of social processes" (Burns et al., 2021: 464). Recent work on the ASEAN Cities network shows how these processes are not limited to the Global South and that there can be both "deprovincialization" and "reprovincialization" (Kong & Woods, 2021). The variegated circumstances in which smart urbanism has been applied across cities, and the different results and everyday experiences of smart city residents demonstrate how existing political, economic, and socio-cultural conditions are implicated in the realisation of smart cities. Cities, then, are not just "passive backdrops" but "variously complicate, enable, disrupt, resist and translate SU [smart urbanism]" (Luque-Ayala & Marvin, 2015: 2108).

In the first section, I situate my thesis within the now extensive scholarship on smart cities (key works include Hollands, 2008; Hollands, 2015; Greenfield, 2013; Sadowski & Pasquale, 2015; Halpern et al., 2013; Kitchin, 2014; Luque-Ayala & Marvin, 2015; Green, 2019; Rose, 2020; Townsend, 2013). I take the term 'smart' in smart cities to refer to the simultaneous application of information and communication technologies (ICT), big data, the Internet of Things (IoT), artificial intelligence (AI), machine learning and robotics to the improvement of urban governance. I discuss the main arguments around 'smartness' as an organisational power and examine the social aspects of the smart city. I review how the social experience of smart cities has been discussed, focusing on the idea of 'socialities' to investigate smart subjectivity. In the second section, I situate this thesis within current scholarship on infrastructure, especially within the social sciences. I show how infrastructure has been used to understand city-making and the consolidation of state power through discursive and material means. In this literature review's third and final section, I focus on affect theory and explore how it adds to existing perspectives that have been used to understand the smart city experience.

The different sections of the literature review emphasise how much of the literature around smart cities, infrastructure, and affect challenge conceptual binaries. I problematise the top-down/bottom-up approach of looking at "smart cities", echoing earlier calls to look at how the smart city is enacted beyond binary conceptualizations of state-society relations that see smart city residents as either showing support of being oppositional to the state (Kong & Woods, 2021). In observing the everyday life of smart city residents through their affective experiences, the smart estate is understood as both a component of the Smart Nation project and, in that way, an extension of the state as an organising power that enacts smartness

through residents, and something that is felt in dynamic, shifting ways. The problematising of binaries—top-down/bottom-up, visibility/invisibility, smart/dumb—lends itself to the larger task of the thesis, where I explore the complex relations between engagement, affect, and encounter by analysing the affective experiences characteristic of the smart city.

2. Smart Cities

"The smart city will be the city of our dreams" (Green, 2019: 3)

Few ideas in recent years have captivated political, professional, and public imaginations as much as the idea of the smart city. ICT and the internet's role in society and social relations have been studied over the last few decades. Within the social sciences, much of the earlier work on smart cities drew on what Castells (1996) called the "network society". This sense that technology can reconfigure society by altering the relations within it has been expanded to understanding the specific material effects of ICT (Foth, 2008; Graham, 2001). These material effects have been studied closely by scholars, considering how cities change with the implementation of smart infrastructure and become "digitally-mediated cities" (Thrift & French, 2002).

The smart city movement began with calls to define what 'smartness' could mean in the context of cities in a post-recession world (Hollands, 2008). It gained momentum in critical discourse circles with various frameworks (including the European Commission H2020 Framework Program) and paradigms proposed for understanding various approaches to the term across multiple disciplines (Albino et al., 2015; Batty et al., 2014; Calzada & Cobo, 2015; Glasmeier & Christopherson, 2015). Some conceptualisations emphasise aspects like politics and governance (Calzada, 2017; Kitchin et al., 2015; Noveck, 2018; Shwayri, 2013; Vanolo, 2014; Farias & Blok, 2016; Wiig & Wyly, 2016), smart subjects and subjectivity (Gabrys, 2014; Ho, 2017; Cardullo & Kitchin, 2019; Rose, 2020) and experimentation, test-bedding and the idea of 'living laboratories' (Karvonen, et al.,, 2018; Calvillo et al., 2015; McLean et al., 2016). Some approaches attempt to understand the specific relationship between 'sustainable' and 'smart' as a feature of cities (Shwaryi, 2013; Viitanen & Kingston, 2014; Agyeman & McLaren, 2017; Woods, 2020; Martin et al., 2018), while others contextualise smart cities specifically within developmental and post-colonial discourse (Datta, 2018; Datta, 2015; Datta, 2019; Datta, 2020; Boyle et al., 2024; Odendaal, 2016).

Singapore, although post-colonial, more closely shares economic growth rates and levels of urbanisation and modernisation with the three Asian Tigers – Hong Kong, South Korea and Taiwan. However, as a developmental state, the strongly interventionist state and model of entrepreneurialism Singapore pursues "resonate[s] with many other Asian cities in which the state plays an outsized role in shaping developmental policies and outcomes" (Woods et al., 2024a: 743). This centralisation of innovation capacity offers an alternative model for the transition to smartness[5] (Woods et al., 2024a).

Key characteristics of smart cities have changed over time across different locales to account for varying priorities of smart agendas as they have been applied in cities. What remains consistent Is the embedding of digital technologies into urban life and the exponential growth in the volume of data produced about cities and their citizens (Kitchin, 2014). A smart city is distinctive due to the effective use of digital infrastructure. Ignoring this distinction "risks over-generalizing the concept" (Ponting & Zhou, 2016). The kinds of technologies in a smart city include sensors, high-speed broadband, smart lighting and meters, remote monitoring systems, and increasingly sophisticated surveillance infrastructure. While this remains a generic definition and one that underlies a lot of the literature on smart cities, numerous other definitions provide contextualisation for the lack of clarity of the term. A review by Albino et al. (2015) concluded that no small group of terms or definitions is employed to describe 'smart' in the literature, with little consensus over how smart cities should be defined. De Jong et al. (2015) show how 'smart' is used as a qualifier, alongside many other related terms such as sustainable and resilient cities. In addition to the range of terms used to describe smart cities, there has also been a range of focus within smart city scholarship. Within the smart city literature, there are generally three main focus areas for smart city research (Burns et al., 2021: 463): the first, critiques of smart as a capitalist or neoliberal strategy (Hollands, 2015; Sadowski & Pasquale 2015; White, 2016; Cardullo & Kitchin, 2019; Grossi & Pianezzi, 2017), the second, the unpacking of smart as a discourse (Soderstrom et al., 2014; White, 2016; Wiig, 2015; Luque-Ayala & Marvin, 2015), and thirdly, the use of smart cities to achieve various modes and goals of governance – mainly through the processes of surveillance and co-creation (Jameson et al., 2019; Sassen & Kourtit, 2021; Kitchin, 2020; Pereira et al., 2017; Miao & Phelps, 2019).

[5] Woods, et al. (2024a) discuss some of the particularities of the Singapore case that suggest the implementation of its solutions or policies in other contexts might not achieve the same type of outcomes (2024a: 743)

The ‘smart city’ concept has been “put forward as a strategy to address urban growth and social and environmental sustainability” (Verrest and Pfeffer, 2018: 3). According to a study on urban buzzwords in the last 30 years by De Jong et al. (2015), the term ‘smart city’ emerged in the mid-1990s in newspapers and the media. In 1997, there was a World Forum on Smart Cities that “suggested that around 50,000 cities and towns around the world would develop smart initiatives over the next decade” (Hollands, 2008: 304), and early studies on ‘smart cities’ included discussion of IT and its role in transforming urban spaces (Graham, 2001; Katsara, 2008). Its prominence post-recession is matched only by the term ‘sustainable cities’ (De Jong et al., 2015). Woods highlights the need to rethink what ‘smartness’ and ‘sustainable’ might mean in different cities (Woods, 2020).

The ambiguity of what ‘smart’ means (Hollands, 2008) and how it should be measured or assessed has led to uncertainty around the smart city’s ability to deliver on its promises. This ambiguity has also meant that there is a discursive space where the definition of smart is being actively constructed, providing ample opportunity for cities to define what it can mean in their specific contexts. The term's ambiguity is thus a double-edged sword, both threatening to turn the term into something meaningless while simultaneously opening the space for a wide range of definitions to emerge. Woods (2020) argues that “the intersection of smart and sustainable cities is problematic because it represents the tension that exists between two distinct forms of urban imagination and praxis” (2020: 2). These tensions are not addressed through the embedding of smart technologies into cities to achieve sustainable goals. Woods highlights the “emergence of parallel regimes of (social) sustainability”, where “reconciliation is needed to…integrate smart and social infrastructures in ways that consolidate and strengthen the realisation of more sustainable cities” (Woods, 2020: 7). One of the limitations of technological determinism is in how it defines and identifies urban problems. Green discusses a perspective he terms “tech goggles” (2019: 4), grounded in the belief that the solution to every issue is to become smart. Green argues that by applying this perspective to all urban problems, we risk getting stuck in a dangerous “tech goggles cycle” where we reinforce the perspective of “tech goggles” by reproducing technologies as solutions, whether or not these solutions help solve the problem.

In Hollands’ 2008 discussion of the characteristics of smart cities, he highlights particular tensions that result from these characteristics, such as the tension between “serving global,

mobile capital and stationary ordinary citizens; attracting and retaining an elite creative class and serving other classes; and top-down, corporatised, centralised development and bottom-up, grassroots, decentralised and diffuse approaches" (Kitchin, 2014: 2). The problem then, for smart cities, is one of overcoming several tensions, or contradictions, in the ideal-type of corporatised governance (Kong & Woods, 2018). Understandings of power within smart cities include significant discussion of the "neoliberal ethos that prioritises market-led and technological solutions to city governance and development" (Kitchin 2014: 2). The smart city is a neoliberal form of governance, where stakeholders such as multinational corporations (e.g. IBM[6], CISCO, Microsoft) exercise large amounts of clout and power over city, state, and national governments. They are often the strongest advocates for innovative city development and adopting new technologies and services that enable highly efficient and frequently deregulated forms of capital accumulation across borders.

Critics of the smart city have focused on the use of technology to advance political, neoliberal agendas that curtail the privacy and autonomy of ordinary citizens. Kitchin argues that smart cities are, or have been built to be, neoliberal technocracies (2014). The tensions he details have been largely reproduced and discussed in later works, not just on smart city discourses but also on smart urbanism discourses, which emerged later "at the intersection of visions for the future of urban places, new technologies and infrastructures" (Luque-Ayala & Marvin 2015: 2105). This vision, however, can be problematic. The smart city is "illusory" (Green 2020: 3) – "their deception stems from their very definition, which overemphasises the power and importance of technology" (2020: 3). Townsend talks about the "have-nots" and the impact of technology on them (Townsend, 2013). His example of the failure of telecentres in Costa Rica due to ineffectual design focuses on the failure of tech elites to consider indigenous symbolism, and the example of the proliferation of mobile phones argues for considering certain new technologies as economic tools for the world's poorest. Townsend argues that we cannot use the simple rubric of the "digital divide" to describe the kind of inequality that is happening; "the problem isn't just access to technology; it is the lack of capacity to exploit it for good" (Townsend, 2013: 189). He presents the problems of the smart

[6] In Rio de Janeiro, Brazil, IBM and the Centro De Operacoes Prefeitura Do Rio, the city government, formed a partnership to create a city-wide system that draws together data streams from 30 agencies (including the agencies that deal with public transportation, public utilities, weather, emergency services, etc.) into a single data analytics centre that is accompanies by a virtual operations platform, allowing city officials to access real-time information (Kitchin, 2014)

city as “digital dilemmas” (2013: 189) that must be considered to overcome the haves/have-nots binary.

Smart urbanism refers to the discourses around the development and planning of these smart cities, occasionally referring to a specific and burgeoning academic field that examines how smart policies and smart urbanism operate in cities (Verrest & Pfeffer, 2018; Kong & Woods, 2018; Townsend, 2013; Calder, 2016; Marvin et al., 2016; Green, 2020; Kitchin, 2022; Kitchin et al., 2017; Woods, 2020). In its more theoretical sense, smart urbanism refers to conceptualisations of ‘smart cities’ and the study of how ideas around smart and urban planning intersect. Applied, smart urbanism is “simply an urban response to the explosive growth in the production (and potential) of data brought about by the permeation of digital technologies around the world.” (Kong & Woods, 2018). Criticism of smart cities have moved beyond those that make normative judgments about whether a smart city is ‘good’ and ‘bad’ (Yeo & Lin, 2020; Yeo, 2023). Recent calls to engage more critically with smart urbanism (Rose, 2020; Luque-Ayala & Marvin, 2015; Marvin, et al. 2015; Kong & Woods, 2018; Woods, 2020; Verrest & Pfeffer, 2018) have resulted in increasing efforts to look at the hegemonic ways in which smart technologies are used.

Smart urbanism has been criticised for lacking validation in the real world (Hollands, 2008; Duarte & Firmino, 2017; Vuolteenaho et al., 2015; McFarlane, 2016; Shelton et al., 2015) and is primarily “based on abstraction” (Kong & Woods, 2018: 680). Significantly, the literature around ‘smart urbanism’ includes the deconstruction of the discourse of smart itself, “[unpacking] the different logics and rationales behind smart urbanism discourses and proposals, and in this way understand the ways by which imaginaries of urban futures are currently being constructed, along with their socio-technical and political implications for future research priorities” (Luque-Ayala & Marvin, 2015: 2105). Smart urbanism discursively positions smart technologies as having the potential to solve urban problems like pollution and inadequate housing (Kong & Woods, 2018). However, smart urbanism has often represented a technocratic type of urban development, with critics pointing to its inability to address inequalities, often playing a role in deepening existing disparities within and between cities (Green, 2013; Luque-Ayala & Martin, 2015; Datta & Odendaal, 2019; Woods, 2020; Woods & Kong, 2020; Kong & Woods, 2018; Lee et al., 2020). Recent work on Singapore have drawn on such theoretical concerns and contextualized them to specific instances of unevenness within the city-state (Ho, 2017; Woods, 2020; Kong & Woods, 2018;

Lee et al., 2020; Woods & Kong, 2020). Datta and Odendaal (2019) discuss the smart city as a power that normalizes structural and social violence within and between cities.

Smart cities can also be applied across different geographical scales (Keshavarzi et al., 2021; Kong & Woods, 2021). Recent studies have shown the efficacy of city-wide scaling-up pilot projects (Bundgaard & Borras, 2021; Franke et al., 2015; Sebrechts et al., 2021). Some smart cities can be understood as part of national agendas spanning entire countries. Singapore's Smart Nation project is one example. Woods et al. (2024a) discuss how the Singapore smart city is conceptualised as a "nationalizing" construct. In addition to the national level, there is also a regional significance to smart cities. This regional significance of smart cities has been referred to as "technocratic regionalism" (Kong & Woods, 2021). In this thesis, I focus on three sites where smartness is enacted: the infrastructure of the smart estates, neighbourly relations, and the "local level" (Kong & Woods, 2023). This 'smartness' moves through global urban planning and governance through smart solutions and policy exchanges (Woods & Kong, 2017). These flows are constituted not just by urbanisation and development processes that push an agenda anchored in smart urbanism. They are also formed by policy mobilities that circulate smart and sustainable urban solutions (SSUS), establishing global hierarchies of 'smart cities' and granting 'model' cities legitimacy. Miao and Phelps (2019) discuss in depth the development and exporting of SSUS by Singapore. They argue that there is much a city can gain from positioning itself as a model city, and exporting SSUS has legitimised Singapore's governance on a global stage.

Work on smart cities has also focused on decentralised power while acknowledging the significance of corporations and the state. "Governmentality" (Foucault, 1991) describes the shift from governments exercising coercive power to the mobilisation of disciplining technologies of the self through the population. Power is conceptualised here not so much as a matter of imposition but that of which works 'through' people. This makes it "power without a centre, or rather with multiple centres" (Miller and Rose, 2008: 9). "Biopolitics" (Foucault, 2007) has been an essential way of exploring the idea of governmentality as it examines the mechanisms that manage human life under regimes of authority that result in some subjectification. Biopower refers explicitly to "the set of mechanisms through which the basic biological features of the human species [become] the object of a political strategy, of a general strategy of power" (Foucault, 2007: 1). This can be seen in the organising power

of IT-mediated infrastructure, for example, which often follow a Foucauldian governing logic through tools like code (Klauser & Soderstrom, 2016; Kitchin & Dodge, 2014).

Although Foucault's idea of governmentality teases out the concept of 'multiple centres' of power, there remains the firm idea of 'government' or 'governance' as emanating from one source. Ash Amin and Liza Rose Cirolia (2018) extend the framing of governance beyond the relationships between state and non-state actors and account for the distributed agency and power of the material as part of a socio-technical assemblage, as a "critical technology of government and/in place" (Amin & Cirolia, 2018: 274). Ash Amin and Nigel Thrift argue in "Seeing Like a City" (2017) that "the infrastructure of the modern city can become the main focus of political action" (Amin & Thrift, 2017: 6). They conceive of agency as operating in a "force field of relational interactions" (2017: 17), where cities are imagined as a "combinatorial force field" (2017: 16). This allows us to explore cities as assemblages "governed by the force of many authority structures" (2017: 16).

Other theorists have similarly acknowledged the multiplicity of power in smart cities (Powells et al., 2015; Bulkeley & Castan-Broto, 2013; Datta & Odendaal, 2019; Deitz et al., 2021). Smart cities are seen as constructing a conducive platform for biopolitical management (Guest, 2021; Jameson et al., 2019; Sassen & Kourtit, 2021; Klauser et al., 2014). Biometrics is seen as a way of "intensifying commodification" (Sadowski & Pasquale, 2015) of the physical bodies of smart city residents. The infrastructure of smart cities opens the door for surveillance to become incredibly pervasive and invisible despite causing much harm to society (Guest, 2021; Sassen & Kourtit, 2021). The internal logic of software-mediated systems, used to regulate the behaviour of smart city residents, is seen as a kind of 'governing' of everyday life – "governing through code" (Klauser et al., 2014) is one example. Moving beyond the Foucauldian conceptualisation of biopolitical control, this thesis draws on work that explore understanding power through relationality and assemblages. These assemblages across the smart city observe and analyse practices that see everyday "affective activity [as] a form of social practice" (Wetherell, 2012; 2013). These everyday practices become a central aspect of governing. What is observed is then now just the "moments of deviation where we are flooded by a sentiment" (Gregg & Seigworth, 2010: 16) but also the affects that constitute the everyday.

The literature on the Singaporean smart city Is growing rapidly. Earlier works focused on the computational and ICT capacity of Singapore (Mahizhnan, 1999; Neville, 1999). Recent works explore how the Smart Nation project realises the smart city of Singapore (Calder, 2016; Ho, 2017; Kong & Woods, 2018; Cavada et al., 2019; Gonzaga, 2019; Leon & Rosen, 2021; Joo & Tan, 2020; Woods & Kong, 2020; Lee et al., 2020; Woods, 2020). Work has also explored Singapore's dominance in developing urban solutions (Bulkeley & Castan-Broto, 2013; Miao & Phelps, 2019) and the specific top-down ways in which Singapore has achieved smartness (Woods et al., 2024a; Woods et al., 2024b; Woods et al., 2023). Recent work on the Smart Nation has also shown how Singapore's state-led innovation through insourcing tech talent and capabilities has allowed the city to pursue smartness without ceding state power to large technology companies (Woods et al., 2024a).

There are many stakeholders in the smart city that have been identified in the literature on the Singapore smart city. Both the state and private industry have been implicated. Smart city residents have also been studied (Ho, 2017; Yeo, 2023; Woods & Kong, 2020). By focusing on the smart HDB estates in Punggol as the main sites of observation, this thesis expands on earlier work on the everyday experiences of HDB residents (Cao et al., 2022; Cao et al., 2023; Chong & Cho, 2018; Bhuyan & Yuen, 2021). Much of the recent work has focused on the experience of the elderly (Cao et al., 2022; Cho et al., 2018; Bhuyan & Yuen, 2021; Bhuyan et al., 2020; Woods & Kong, 2020). HDBs have also been studied as experiential environments. Trivic's 2021 study on older adults' multi-sensory perceptions of living in HDBs is one such study. HDBs have been conceptualised as distinct affective spaces (Chee, 2017). In her 2017 paper, Chee discussed how the void deck and common corridors in HDB estates conflated the boundaries between the categories of housing and domesticity and called for the study of the affective nature of these spaces. Chee used the keeping of cats and hoarding as critical spatial devices to understand this affectivity. There has been recent work studying the Singapore smart city experience from an everyday perspective (Yeo, 2023; Azzali et al., 2022; Woods & Kong, 2020; Kong & Woods, 2018) and an embodied one (Zhuang & Goggin, 2024; Willems & Graham, 2019; Gonzaga, 2019). However, the significance of the shift to smart estates as particular kinds of shared spaces has not been widely studied using an affective framework. Such observations can help fill the gap in understanding how residents of smart estates experience their surroundings.

The range of affects observed in interactions with individuals who engage with the everyday materialities of the smart city suggest that there are relations of smartness that exist beyond the official discourse around the Smart Nation. State-developed material on the Smart Nation significantly contributes to the discourse around smart cities in Singapore. Information on the strategic focuses, projects and vision of the Smart Nation is publicly accessible online. The state is not, however, the only driver of this transition. In the Singapore case, questions around the co-opting of marginal groups into 'smartness' remain "ambiguous" (Woods et al., 2024a: 751), "as does the place and viability of alternative modalities of "smartness" that might exist outside of or even contradict, and perhaps undermine, the state's vision of the Smart Nation" (Woods et al., 2024a: 751). Here, the authors argue that smartness in Singapore is not limited to the Smart Nation project. In his article on the Singaporean Smart Nation, Ho (2017) problematised the limitations of smart interventions through a neoliberal-developmental lens. He clarified that the benefits of smart interventions are not equally distributed, even if their objective is relatively singular, that of authoritarian consolidation. There is a large body of work on power and inequality in smart cities that suggests there is unevenness in the application of smart urbanism (Halpern et al., 2013; Luque-Ayala & Marvin, 2015; Kitchin, 2015; Shelton et al., 2015; Vanolo, 2014). There are some areas of focus, including the smart city's expansion of surveillance (Akbari, 2022), smart urban governance (Meijer & Bolivar, 2016) and rising citizen discontent (van Twist et al., 2023). Singapore is not exempt from such critiques (Ho, 2016; Guest, 2021).

2.1 Smart Subjects

A smart city requires 'smart citizens', and the governance of citizens as particular kinds of 'smart' subjects becomes a central part of how the 'Smart Nation' is mobilised within Singapore's smart urbanism agenda. In this section, I discuss how this thesis expands the conceptualisation of the smart citizen to focus on the social groupings, practices and behaviours of their everyday lives. Through understanding the smart city as a relational, lived experience, this thesis will use affect theory to understand the kinds of affective experiences smart city residents have, which add to the current 'smart citizen' and 'smart sociality' discourse. I focus on the collective subjectivities that are being developed in smart estates through socialities, when individuals engage with and are impacted by technology (Rose, 2020; Ho, 2017; Shelton & Lodato, 2018).

Smartness in Singapore "is about subjecting the individual player…to a bigger and more integrative vision of the future" (Woods et al., 2023: 8). Despite smartness being an "integrationist vision", distinctions are made between "the state, the nation, the citizen, the consumer" (Woods et al., 2023: 8) and different permutations of private-public partnerships. The "logic of citizen-nation-state interoperability that is so evident and dominant in Singapore" (Woods et al., 2023: 7), however, emphasises the centrality of the "citizen" in the Smart Nation project. The project is "citizen-centred" rather than being "citizen-led" (Woods et al., 2023: 7). This problematises other theorisations of the smart citizen, where co-creation and active citizenship is emphasised (Joss et al., 2017; Shelton & Lodato, 2018; DeWaal & Dignum, 2017).

In theorisations of the smart citizen, scholars argue that there are many ways in which social activity is being reconfigured in smart cities (Shelton & Lodato, 2018; Cardullo, 2020; Ho, 2017; Rose, 2020). In conceptualising the smart subject, social aspects of the smart city can be understood as emanating from residents' everyday practices that engage and do not engage with smart technologies and infrastructure. Ozaki and Shaw's recent work on technology use and social practices (2014) studies "the interrelations between practices and both sustainable and mundane technologies" (Ozaki & Shaw, 2014: 593). The authors argue that people might not use sustainable technologies in ways intended by their producers, "hence not [generating] the sustainable outcomes anticipated by environmental policy" (Ozaki et al., 2013, in Ozaki & Shaw, 2014: 593). This broader observation of the combination of people and technologies in establishing everyday life practice problematises the "normative notions of 'correct' use promoted by policy" (Ozaki & Shaw, 2014: 594). Ozaki and Shaw argue that the assumptions around technological practices that policy-based interventions rely on often do not correspond with actual, everyday practices.

In this thesis, I draw on a definition of sociality that emphasises the local, multiple, sensory, and emotional characteristics of these "emplaced" (Pink, 2008: 185) everyday practices. Pink refers to socialities as "different sets of concrete…social relationships that develop around actual activities" (2008: 172). Socialities are norms of "social interrelatedness" (2008: 172) that can be distinguished by "forms of contact, varying intensities and durations…material and sensorial elements" (2008: 172). I use this definition for two reasons. The first reason for using Pink's definition of sociality is that it accounts for the 'brought together' nature of everyday social relatedness that puts the micro-relations of the community at the forefront

rather than the top-down application of social practices. Pink's definition did not develop out research on a 'smart' site. This definition is not limited by smartness, but by practice. The second reason for using Pink's definition of sociality is that it emphasises the roles of sociality's sensory and emotional aspects, placing the observation of the production of sociality out in the world as experienced and relational. To summarise, the definition of sociality I use in this thesis has two main aspects: (1) It refers to social relations and practices that are dynamic, emergent, and multiple, and (2) It is 'emplaced' in social and material ways that include affective and sensory elements. These two parts of the definition of sociality speak to the relevance of practice theory in considering affectivities.

Rose's theorisation of "cybernetic socialities" (Rose, 2020) suggests that a specific kind of sociality is being developed as a result of the large amount of data organising the administration of smart city residents. Her work on smart socialities emphasises the need for a sociological, especially 'cybernetic', understanding of the sociality that develops in smart cities – not just as human-technological engagements but as transfers of data and information as learning. The definition of "cybernetic sociality" describes top-down social determinants that stem from big data's prevalence in smart cities. Rose (2020) argues that digital systems mediate and augment a distinct form of social interaction and connectedness. Social groupings are not seen as innate or fixed but as something configured by the constant circulation of data. The social becomes emergent through data as there is a lack of social structure, and subjects are articulated through computational technologies. Thus, in Rose's conceptualisation of smart sociality, data plays a central role. The lives of smart city residents are continuously influenced by the feedback loops created by the large volume of collected data. This impacts their social behaviours and engagement with their environment. They enact specific social practices because of who they are and how they are 'known' through data. Rose also discusses sociological forms of sociality that focus on underlying institutional and political structures that shape social groups and their relations (2020). She argues that a diversity of smart socialities developing in smart cities must be studied empirically to be understood. This thesis aims to contribute to this body of work on socialities within smart cities. It does this by examining the everyday lives of smart estate residents and their engagement with smart and non-smart aspects of their neighbourhood while emphasising the affective dimension of these socialities.

Before Rose's conceptualisation, other theorists discussed how different technologies in entangled assemblages of smart cities might impact social behaviours and groupings. In her seminal essay, "The Cyborg Manifesto" (1985), Haraway suggests a techno-political logic of cyborg cities as potentially emancipatory, where we can see ourselves as simultaneously whole and part of wholes in a cyborg city. The 'body politic' takes on a new, mediated meaning. Sadowski and Pasquale (2015), who focus on technologies of control and their role in developing societies of control, discuss how these connections "amplify the ability of those in power to coordinate and channel apparatuses of control…the city dweller is better understood as an urban cyborg: one who doesn't live in the city, but who lives as part of the city" (Sadowski & Pasquale, 2015). Gandy discusses how the cyborg is a "material interface between the body and the city…most strikingly manifested in the physical infrastructure that links the human body to vast technological networks" (Gandy, 2005: 28). These technological-material-human entanglements that are also affective can manifest on multiple scales, from the individual to the city and beyond.

Smart citizenship, similarly, has been discussed as engagement with policy and urban infrastructures at various levels (Cardullo & Kitchin, 2018; Datta, 2018; March & Ribera-Fumaz, 2016). Ehrkamp and Leitner (2003) have argued for a more relational view of citizenship, where it is "conceived of as a social practice that individuals engage in beyond the state" (2003: 131). This conceptualisation of citizenship is not limited to the national scale but includes the neighbourhood's local scale. Smart citizenship has also been explored as "a civic engagement via technology whereby cities can be co-designed and co-created in a civic, inclusive and transparent manner" (Lee et al., 2020: 2). The idea of 'active participation' and 'co-creation' is central to many smart city narratives (Angelidou, 2014; Leclerq & Rijshouwer, 2022; Cao & Kang, 2024; Leino & Puumala, 2021; Grossi & Pianezzi, 2017; Kourtit et al., 2017; Wiig, 2016; Cardullo & Kitchin, 2019). Despite various attempts at placing the citizen at the centre of the smart city, scholars argue that "smart urbanism remains rooted in rational, functional and paternalistic discourses instead of social rights, political citizenship and the common good" (Lee et al., 2020: 2). Smart citizenship then represents a type of "neoliberal citizenship" (Cardullo & Kitchin, 2018) instead, where there are few avenues for meaningful participation.

Recent studies on the 'Smart Nation' of Singapore have expanded on Foucault's approach to power to study the dynamics behind contemporary smart city developments, including a

technology-mediated conceptualisation of "soft biopolitics" (Cheney-Lippold, 2011; Ho, 2017). This conceptualisation describes the kind of statecraft that undergirds neoliberal developmental logic and explores how citizens are governed through "the constitution of new categories of urban life through which to define and manage [them]" (Ho, 2017: 3103). The move from biopolitics to "soft biopolitics" follows the accompanying state developmental logics that have shifted from being rigorously disciplinarian–- a 'disciplinary modernisation' (Wee, 2001: 990) that has been heralded for Singapore's early, rapid economic development. Work on smart citizenship in Singapore and the 'inclusive' smart city (Lee et al., 2020) outlines how smart citizenship can sometimes be implicated in urban inequalities. This is not unique to Singapore, as other Asian cities have pursued smartness as a developmental strategy and a way to reform governance through technical strategies (Chang & Das, 2020; Joo & Tan, 2020). Smart citizenship has been conceptualised as "neoliberal citizenship" (Cardullo & Kitchin, 2018), with few avenues for meaningful participation. Recent work on smart citizenship in Singapore and the 'inclusive' smart city (Lee et al., 2020) outlines how smart citizenship can sometimes be implicated in urban inequalities, arguing for a more nuanced definition of 'inclusiveness'. This call for nuance has been reflected in the varied ways political rationalities accompanying the transition to smart have been discussed in different Asian countries (Datta, 2015; Kong & Woods, 2018; Chang & Das, 2020; Shwayri, 2013). They differ from the larger body of literature on smart cities that focus on cities in the West – a point addressed by Kong and Woods (2021) in their discussion on (de)provincialising the smart city.

The conceptualisation of the smart city resident as 'active' and participatory has become more popular as the 'smart urbanism' field has grown. With this, the push for inclusivity has grown stronger. Through citizen participation and co-creation, the misalignment of the aims between smart governance and smart citizenship can be reconciled (Kong & Woods, 2018). The Digital Readiness Blueprint, developed by the Smart Nation Office, conceptualises the smart citizen as being able to fulfil their responsibilities of developing the capacity to engage with smartness. Here, the idea of inclusion is defined largely as digital inclusion. The responsibility for being digitally included falls on the smart city resident. A similar sentiment that the individual is responsible for engaging and participating in the smart city to benefit from it is echoed in the literature. Other studies explore what "actually existing smart citizens" (Shelton & Lodato, 2018) are in various empirical examples (Calzada, 2018; Cardullo & Kitchin, 2018; Ho, 2017; Joss et al., 2017). Cardullo and Kitchin's (2017)

scaffold of smart citizen participation exemplifies the hierarchy in smart city literature that values active, visible, bottom-up participation rather than the more passive, top-down and paternalistic modes of engagement. This hierarchy posits that urban life thrives under the conditions of freedom, engagement, and political involvement (Cardullo & Kitchin, 2018; Kitchin, 2014; Shelton & Lodato, 2018; Ho, 2017). "Citizen power", which the authors describe as the most desirable type of participation, requires citizens to engage in the co-creation of the smart city actively, in ways that are visible in public spaces. The authors describe citizen involvement that follows a top-down and paternalistic modality as a lower-level kind of involvement. The highest forms require conscious, collective and active participation. This scaffold exemplifies how the literature broadly defines political participation as active, visible and collective (Cardullo & Kitchin, 2017; Hollands, 2015). This is echoed in the larger literature on smart cities, where co-creation, which refers to the active participation of smart citizens, is considered crucial to the success of smart cities (Joss et al., 2017; Shelton & Lodato, 2018; DeWaal & Dignum, 2017).

Foucauldian conceptualisations of the subject have been used variously in the literature on smart cities. Vanolo suggests that smart cities produce active and goal-oriented subjectification, a Foucauldian "smartmentality" (Vanolo, 2014: 887). Gabrys, on the other hand, specifies how the prominence of techno-science governmentality in smart cities results in a kind of enacted "environmentality" (2014). She argues for conceptualisations of the subject that reject the totality of governmentality when looking at "specific spatial-material distributions and relationality of power through environments, technologies and ways of life" (2014: 30). She considers how citizenship transforms into citizen sensing "embodied through practices undertaken in response to (and in communication with) computational environments and technologies" (2014: 34). Gabrys is interested not in how these sensing technologies are used as tools of power but in how they change ideas of citizenship and re-distribute power through urban spaces. Gabrys emphasises how "Foucault's interest in environmentality can be advanced in the context of smart cities to consider how distributions of power within and through environments and environmental technologies are performative of the operations of citizenship – rather than of the individual subjectness of citizenship" (2014: 45). Agrawal's post-structuralist Foucauldian definition of environmental citizenship and subjecthood similarly rejects the totality of governmentality. Agrawal considers how citizenship might look in non-Western societies that do not observe 'participatory democracy' in coordinated, public ways (Agrawal, 2005). His study on the construction of environmental subjects in the

northern Indian state of Kumaoan explores changes in environmental practices and beliefs. He rejects the notion of 'totality' and instead extends an understanding of governmentality to accommodate variations in self-formation, accounting for these variations in terms of social practice. People are different kinds of environmental 'subjects' not because of who they are, due to factors like caste and gender, but because of what they do.

These subjectivities are contingent on practice. Both Agrawal and Gabrys attend to the 'everyday' enactments of environmentalism in constructing selves. It is in the 'doing', whether be it through resource management in Agrawal's account or citizen sensing in Gabrys' study, that the subject is constructed. Their conceptualisations of subjectivity emphasise how the "actually existing smart citizen" (Shelton & Lodato, 2019), deriving from the original concept of the "actually existing smart city" (Kitchin, 2014), is a "much messier and more ambivalent role in practice – both as this figure gets deployed discursively in the everyday practices of smart city-making, as well as in the actually existing practices of citizens participating (or not participating) in such efforts" (Shelton & Lodato, 2019: 36). In moving past these Foucauldian conceptualisations of power and agency, there has been recent work done in affect theory that discuss the mediation of power differently. Recent studies discuss "affective inequality" to conceptualise mediations of power (Juvonen & Kolehmainen, 2018; Lynch et al., 2016). Kolehmainen and Juvonen (2018) argue that conventional analysis can miss these affective mediations of power, whose workings may go unnoticed. Affective inequality is defined as "a specific form of those subtle mechanisms of inequality that are generated and registered through affect" (Kolehmainen et al., 2023: 5). Theorists use "affective inequality" to observe inequalities in intimate spaces, produced and shaped through everyday affective encounters. The concept advances a relational understanding of affect and suggest that there are subtle, fleeting and open-ended relations of power that produce inequality.

3. The Smart City as Imagined and Infrastructural

This section discusses the smart city discursively, as it is imagined, and materially as infrastructure. There are a few reasons for doing this. Firstly, discourse and discursive regimes around smartness have become significant (Kitchin & Dodge, 2014). A smart city can constitute what Foucault calls a 'discursive regime'—where smart ideology organises power within the city. Secondly, conceptualising the smart city as an infrastructural project

allows for a focus on the materialisation of smart urbanism through the smart estates in Punggol. Drawing on assemblages thinking, this project is anchored within a materialist ontological stance that looks at smart infrastructure as being shaped by and as having a hand in shaping the range of actants across the larger assemblages of smart that extend across the city. In this section, I will situate this thesis's exploration of the everyday life of residents in the smart estates of Punggol within the larger bodies of work around ideology and infrastructural studies.

3.1 The Smart City as Imagined

Authors have argued that strong, centralised governance is a modality of governance that is "keenly felt in Singapore, where the "national" is conflated with the "city", creating a uniquely singular governance structure through which policies can be implemented" (Woods et al., 2024a: 742). The integrated governance structure in Singapore conflates the 'national' with the 'city' through a "whole-of-government" approach. The state, which comprises the government and public sector, along with public sector agents, is conceptualised as constituting this singular governance structure that conflates the 'national' with the 'city'. Particularly in exploring how the smart city is imagined, the state's role in Singapore in realising smartness through ideology is significant in ways that make it difficult to untether from the city. The Singapore smart city is argued to be a "nationalizing" construct (Woods et al., 2024a: 743). Discussions of the 'national' and its interrelations with various other scales reveal insight into the construction of the vision of 'smartness' in Singapore[7]. It is not just the technical and bureaucratic whole-of-government approach that is totalising; the authors also highlight the "ideological dimension in creating alignment amongst the population" (Woods et al., 2024a: 743). There is a range of work (Barr, 2016; Rodan, 2008; Thompson, 2006; Menon, 2016; Yea & Chok, 2018) that has criticized this level of state consolidation of power, necessarily engaging with critique of Singapore's exceptionalism and demonstrating the necessity of challenging the narrative. While the broader scale of the 'city' and the 'national' is differentiated through observing everyday smartness that can be enacted in ways that move beyond the state-society interactions outlined in the Digital Readiness Blueprint, the 'state' and the 'nation' are often conflated in this thesis.

[7] Woods et al. (2024a) discuss how the smart city project can be conceptualised as 'nationalizing', bringing the 'national' level into conversations on Singapore city's transition to smartness.

McNeill (2015) argues that large technology firms like IBM have become smart cities' primary arbiters of the 'single version of truth'. These firms do this through controlling methods of perceiving the city; for example, McNeill discusses how new visual technologies determine the modes of perception available, becoming central to the visual formation of cities. However, this control is not absolute or total. Smart cities can be seen as breaking away from the genealogy of cities and representing a new digital era when they are perceived in new ways both ontologically and practically. Differences in how information is perceived can inform ideological worldviews (Zmigrod et al., 2021; Jenkins-Smith & Smith, 2019). In the specific instance of understanding how narratives and the 'truth' of the experience of living in smart cities operate, it is helpful to understand the socio-spatiality of the smart city. This link between infrastructure, ideology and the state is not new. Multiple scholarly works have linked infrastructure and ideology (Humphrey, 2005; Schwenkel, 2015; Larkin, 2008; Guldi, 2012; Shamir, 2013; Amir, 2012; Von Schnitzler, 2013). There has been recent focus on the development of essential infrastructure and ideology in Southeast Asia and other developing regions, highlighting the relationship between nation-building and infrastructure. Schwenkel (2015) explores the links between ideology, affect and nation-building in Vietnam. Guldi (2012) writes about the 'invention' of the British infrastructural state through negotiations and narratives of power. Amir (2012) writes of the socio-technical state of Indonesia, focusing on the making and re-making of the state and state power through energy politics (Amir, 2012).

Many studies of Singapore have emphasised the ruling party's institutional controls as central to constructing the city's development (Mutalib, 2002; Rodan, 1998; Slater, 2010; Abdullah, 2018). Studies have focused on Singapore's ruling party's (People's Action Party, PAP[8]) use of 'soft power' and the role of ideology in its continued political dominance – "the importance of history and narrative-making in the perpetuation of ideas can be crucial in promoting [a]…regime's durability; without ideological hegemony, institutional dominance may not guarantee such success" (Abdullah, 2018: 482). This hegemony is linked to various "ideological state apparatuses", as opposed to the ideologies themselves, whose shapes change over time (Koh, 2002; Tan, 2012). How the state has been described has run the

[8] The PAP government have been in power continuously since the nation's independence in 1965, winning "super majorities in Parliament in each of the twelve General Elections since" (Abdullah, 2018: 473).

gamut: it has been described as a "Disneyland with the death penalty" (Gibson, 1993), as being both multi-cultural but also Confucian, and as an "Asian tiger"[9]. Singapore's internal "national project of constructing a national identity continues to be reinvented and reframed across and in other ideological sites" (Koh, 2002: 76). As these ideological sites shift in importance, consensus-building moves from the more "vulnerable and vagaried" sites of the economy (Koh, 2002: 76) to the complex sites of ethnicity, language and culture. The Singapore smart city is thus ideological, constructed, and complex.

Overall, the state's role in constructing the narratives around the smart city is essential to consider. For example, Sadowski and Pasquale's 'society of control' (2015) is just one of many smart city ideologies – the authors emphasise the impact of technologies on eroding personal liberties, agency, and privacy. The ideologies that support the Smart Nation project are ideologies around "smart" that have hegemonic support behind them for them to be formalised and propagated. This is not to say that there is no popular support for the Smart Nation project or critics, but that "smart" and the Smart Nation as an ideology has been significantly perpetuated by state narratives – much like other narratives utilised by the state as part of its techniques of governance, such as the idea of "survival" in the Singapore context (Abdullah, 2018; Usher, 2019). The discursive elements of the material-discursive smart city cannot be neatly separated from the infrastructure it constructs, and that it is constructed by. In the next section, I discuss the significance of understanding the smart city as infrastructural.

3.2 The Smart City as Infrastructural

The infrastructural turn (Dalakoglou, 2016) has led the study of infrastructure out of the exclusive domain of engineering and into the social sciences and humanities, resulting in a burgeoning field of academic research whose aim is to explore the socio-political, ecological, spatial, and materialist aspects of systems. Traditionally, infrastructures have been a central conceptual tool for thinking about modernity (Morgan, 1877; Engels, [1884] 2010; Rostow, 1960). More recently, its analysis has been expanded to include explorations of social life. Infrastructures often offer tangible evidence of analytical claims, making them a popular

[9] Singapore is one of the "Four Asian Tigers". The other "Asian Tigers" are South Korea, Taiwan & Hong Kong. They are referred to as "Asian Tigers" because between the 1960s-1990s, these countries underwent rapid industrialization and achieved exceptionally high growth rates of more than 7% a year

metaphor for use. From urban research that focuses mainly on public utility provision to more critical work on post-colonial states and infrastructures as symbols of modernity and identity-making, the study of infrastructures currently is extensive. The body of work does remain, however, as Larkin states, "conceptually unruly" (Larkin, 2013: 329).

Infrastructures are defined as "built networks that facilitate the flow of goods, people, or ideas and allow for their exchange over space…they comprise the architecture for circulation, literally providing the undergirding of modern societies" (Larkin, 2013: 328). They are commonly studied in their physical forms – "matter that enable the movement of other matter…they are things and also the relation between things" (329). Materialist understandings of 'things' first extended to objects or specific technologies as the focus of research, such as roads (Harvey, 2012; Masquelier, 1992) or dams (Campregher, 2010; Ghosh, 2006) rather than seeing these objects as part of a larger system or network – that is, part of a larger materialist infrastructure (Anand et al., 2018). In Larkin's generative and broad-ranging review of the body of work around infrastructures, he discusses how ethnographic approaches have allowed for dynamic approaches to emerge in the study of infrastructures, especially through the concept of techno-politics (Anand et al., 2018; Anand, 2011; Anand, 2017; Collier, 2011; Collier & Lakoff, 2008; Dalakoglou & Harvey, 2012; Sneath, 2009). This lends itself to understanding infrastructures as "architectures of circulation" (Barua, 2021: 1468) that facilitate the movement of matter. Infrastructure thus has been increasingly conceptualised within distinctly political contexts as a "sociotechnical assemblage, and urban social life as never reducible to the purely human alone" (Amin, 2014: 138). They are seen as a materialisation of the relationship between people and abstract entities such as the state and interstitial organisations (Graham, 2010; Humphrey, 2005; Larkin, 2013).

Infrastructures are not just the site of material provisions – there are also dimensions of social infrastructure that can compound or limit inequalities within a space (Latham & Layton, 2019). There is a burgeoning amount of literature on the social inequalities of infrastructure and the increasingly politicised ways it reconstitutes urban politics (McFarlane & Silver, 2017; Datta & Ahmed, 2020; Ash & Cirolia, 2018). Infrastructure is not just a proxy of the state, a networked system that carries out urban provisioning. It is also a site of agency (Latham & Layton, 2019; McFarlane & Silver, 2016) as people engage with the state through infrastructure. Infrastructure can become the "main focus of political action" (Amin & Thrift,

2017: 6). Agency can then be conceptualised as located within a "force field of relational interactions" (Amin & Thrift, 2017: 17). Drawing on the recent 'relational' turn in urban studies, where cities are imagined as a "combinatorial force field" (2017: 16), cities can also be explored as assemblages "governed by the force of many authority structures" (2017: 16). Understanding "collective urban agency" (2017: 17) then involves exploring how agency is distributed and often constructed into hybrid forms through "intersecting infrastructures" (2017: 17), with these interactions "thought of as the machine, habitat and atmosphere of the city, one that holds things in place, enables process, and endows the entities and their associations with purposeful capacity" (2017: 17). McFarlane (2011) has made the convincing argument that assemblage thinking is generally used to "connote indeterminacy, emergence, becoming, processuality, turbulence…[and] is interested in emergence and process, and in multiple temporalities and possibilities" (2011: 206), thus "allowing for no single history of assemblage to be told" (2011: 207). It is unclear, however, if this develops a framework that can narrativise unequal relations in a more extensive understanding of politics, as opposed to just relationalities of composition.

Infrastructures are considered systems or networks in addition to objects of study. Exploring infrastructures through assemblages is an emerging method that recognises the multiple contested roles of disparate objects within the socio-technical and material systems that comprise infrastructures. Here, relationality and materiality can be considered in a way that connotes "indeterminacy, emergence, becoming, processuality, turbulence" (McFarlane, 2011: 206). This understanding of infrastructure as part of larger systems and networks allows for the exploration of the everyday experiences of infrastructure. This also considers the indeterminacy of the everyday. Everyday experiences of infrastructure are dynamic and complex (Appel, 2012; Anand, 2011; Collier, 2011). The everyday can be conceptualised as both the site of the performance of infrastructure, and where this performance can fail.

Gupta argued that the "biopolitical project embodied in infrastructure fails when infrastructure breaks down" (Anand et al., 2018: 66). Gupta argued that "there is no such thing as politically neutral infrastructure" (2018: 66), partly because so much about how infrastructure works links to things beyond it that help bring about a future that privileges one group over another. Larkin (2013) echoed this sentiment when he discussed how the infrastructural turn can be seen mainly within the burgeoning field of 'technopolitics'. Larkin argued that this field draws on "science and technology studies to trace out the material

operation of these technologies and the ways in which this materiality has consequences for political processes" (2013: 328), revealing particular forms of governmentality at work. Mrazek (2002) analyses the process in which infrastructures create a sense of modernity by "focusing on how the materials of infrastructure…produces sensorial and political experiences" (Larkin, 2013: 337). That infrastructures operate on a sensorial plane is crucial to Mrazek's analysis and draws attention to how the entanglements of things within assemblages can have affective dimensions enacted by being 'felt'. These affective dimensions are further explored in recent work on affective infrastructures that analyse affects related to social formations (Bosworth, 2023; Berlant, 2016). Larkin discusses this aspect of visibility, arguing how infrastructures are "anything but invisible" (Larkin, 2013: 336) and "the point is not to assert one or another status as an inherent condition of infrastructures but to examine how (in)visibility is mobilised and why" (2013: 336).

Questions around (in)visibility have implications for understanding how the "affective, social and political orientations [of space] is governed by the policies and actions of ruling elites and institutions" (Amin, 2014: 155) and how power is implicated in the exercising of agency across these infrastructural socio-technical assemblages. Precisely because power within these assemblages is conceived of as distributed, the infrastructures that individuals interact with on an everyday basis become significant as "mundane, everyday practices are part of the macroscale societal picture, precisely because power is diffuse, signifying that everyday practices produce, reproduce, and elaborate social norms" (Ettlinger, 2011: 548). In responding to earlier critiques of the contradictions or paradoxes that exist within 'smart cities' (such as those discussed in Kong and Woods, 2018), the idea of the "doubling of infrastructure" is useful – it refers to "how systems and practices operate in variance with their purported objective" (Larkin, 2013: 334), and has been used in much of Africanist anthropology to describe formal technologies of the state that have little effect on reality (Mbembe, 2001; Hull, 2012). These infrastructures are "poetic" in that sense, as they become both symbolic objects as well as techniques of governance, and at these moments, the state is "simultaneously both present and absent" (Larkin, 2013: 335). Though the technical efficiency of infrastructures may thus be limited, what they accomplish instead is training subjects in a particular relationship to state power. Infrastructures are, in this way, 'visible' not just during breakdowns.

This has been discussed in much literature around the (in)visibility of infrastructures (see Star, 1999; Collier, 2011; Elyachar, 2010; Graham & Marvin, 2002; Larkin, 2008). They become visible in everyday, ordinary life, as "visibility was necessary to continually renew its political effect" (Larkin, 2013: 336). Increasingly, work has been linking infrastructure to their "poetics" (Larkin, 2013; Coleman, 2014; Kaika & Swyngedouw, 2000; Larkin, 2008). Ash Amin's work focuses on infrastructural absence or failure to reimagine "the urban social" (Amin, 2014: 138). There has been much work, in addition to Amin's, that highlights how infrastructures, in their failure or absence, have been implicated in the making and maintenance of poor neighbourhoods and slum areas in urban spaces (Roy, 2011; Caldeira, 2000). Although this project draws on assemblage thinking precisely because of its perspective on relationality, it is also helpful to consider power beyond relational terms. By taking on a more fragmentary and spontaneous view of power while not abandoning the notion that these fragments can be contextualised, power can exist beyond that of Foucauldian top-down state power or that which is purely exercised through bodies. Here, the "poetics of infrastructure" (Larkin, 2013) is a helpful conceptual orientation to understand the way power might work in a simultaneously relational and fragmentary, present and absent way:

> "In the case of infrastructures, the poetic mode means that form is loosened from technical function. Infrastructures are how the state proffers these representations to its citizens and asks them to take those representations as social facts. It creates a politics of "as if"" (Larkin, 2013: 335)

The politics of infrastructure show how the transformations cities undergo in becoming more smart do not just represent a neutral improvement from one type of city to another (Sadowski & Pasquale, 2015). Recent studies on the politics of material geographies discuss infrastructural explorations of power (Schouten & Bachmann, 2022). This includes Gandy's 2014 study of water systems in urban settings, Bennet's 2005 discussion of the "distributive agency" within the "agentic assemblage" of an electrical power grid in the 2003 North American blackout, and Swyngedouw's 2013 study of desalination as a socio-natural fix within Spain's eco-modernization project. Assemblage thinking was used in these studies to conceptualise resource geographies within modernisation projects. Various human and non-human 'actants', such as cables or salt, were conceptualised as one node amongst many in a networked system. These plural assemblages are more than anthropocentric in their outlook,

echoing Star's earlier assertion that infrastructures are both human and non-human (Star, 1999). Barua's 2021 work, for example, studies this plurality by focusing on how non-human forms of agency manage and govern human life (2021: 1479). Assemblages consider the fragmentary and spontaneous nature of power that sometimes emerges in networks. Some entities within assemblages rarely present as "reified, unified, totalities" (Anderson, 2017: 507), and the way this power emerges is therefore difficult to predict or anticipate as it "surfaces in fragmentary, momentary ways as 'structures of living' are made and remade" (2017: 507).

This perspective on the plurality of infrastructures is expanded upon in Datta and Ahmed's (2020) post-colonial work on the implications of the body in larger assemblages of the city. Their conceptualisation of "intimate infrastructures" (Datta & Ahmed, 2020) emphasises the body as a site upon which power is exercised. Datta and Ahmed proposed the idea that the scalar metric should be understood as a kind of continuum of assemblages that reconfigure both the intimate and public, forming various types of "internalized, externalized, public, private, structural, affective and intimate" (Datta and Ahmed, 2020: 75) ways to understand everyday life. Similarly, smart infrastructures can be examined through the entanglements between structural and intimate forms of power across various geographical scales. This demonstrates that infrastructural projects can have far-reaching implications in the intimate sphere. Instead of looking at invisible infrastructure as kind of "forgotten, [in] the background…frozen in place" (Star, 1999: 379), infrastructures negotiate dynamics of (in)visibility that can be significant even when it is not visible.

In observing everyday life, it is useful to think of the infrastructures of sustainability and 'smart' as not just intersecting but also 'ordinary' in that these infrastructures become "ordinary spaces of negotiation" (Anjaria & McFarlane, 2011: 58). The authors argue how this perspective views "the state [as] experienced less as an extension of disciplinary power than as a locus for the negotiation and legitimation of spatial claims…[that] significantly shape the practices of citizenship and politics in the city" (2011: 58). The disjuncture between institutional claims like those made within the 'City in a Garden' vision and what is happening on the ground reveals a fragmented state "effect" (Mitchell, 1991) that brings statecraft into the intimate 'ordinary' infrastructures of the everyday life of residents. It reflects the assertion of recent scholarship on smart urbanism that calls for reconciling paradoxes such as that between 'theory and praxis' (Kong & Woods, 2018).

Infrastructures are no longer seen as static and classically materialist. They can now be conceptualised as open sites of social and political contestations. Conceptually, this assertion is echoed in work that discusses public life through 'social infrastructure' to observe the public dimensions of sociality. Dalakoglou's (2016) work on infrastructures includes a discussion of the changing notions of the 'public' (2016: 825) and a "transformation of social relationships and the mechanisms of social reproduction within current material conditions…[where] social subjects are learning to act and think of their individual and collective selves, their relationships with those around them, as well as with the state and its infrastructures in novel ways" (2016: 826). Sociologist Eric Klinenberg (2018) makes the case that infrastructure is essential to the emergence and maintenance of social bonds. Public places like libraries and parks are significant to developing sociality within cities – they nurture public life. The scholarship on social infrastructure continues to grow (Latham & Layton, 2019; Berney, 2017; Yarker, 2021; Simone, 2010). Geographers have explored the social dimensions of physical and institutional infrastructures (Graham & Marvin, 2001; Gandy, 2005; Gandy, 2014; Graham & McFarlane, 2014; Amin, 2014). Studying spaces as facilitating social connection and activity considers the significance of social infrastructure to the public dimensions of urban life, "not least in how it orientates us to how the sociality which is entwined with publicness takes place in certain places and facilities" (Latham and Layton, 2019: 4). There are also theorisations of people themselves being understood as infrastructure (Simone, 2004; Simone, 2014). In all these works, there is a shared acknowledgement of the importance of infrastructures to the social fabric of urban spaces.

There have been radical changes in conceptions of the 'social' in this social fabric. Theorists have viewed culture from the perspective of the everyday, with many attending to this perspective by using ethnography as a central way to understand the intimate details of the mundane to conceptualise larger ideas (Das, 2010; Lefebvre, 1974; Smith, 1987; Ong, 1987; Carlson, 2019; Burke, 2001; Highmore, 2004; McFarlane & Silver, 2017). In Carlson's (2019) work on the renewable energy transition in a German village, she spoke to female residents in their homes to understand where everyday sensibilities around eco-capitalism were being developed. Through her study of the everyday lives of a group of women, Carlson uncovered how the seemingly indifferent villagers made sense of the political institutions and processes they were a part of by exercising their civic duty in creating infrastructures that gave them affective and social registers. In McFarlane and Silver's (2017) work on "everyday

urbanism", the authors showed how studying the making of everyday life in Uganda allows for an understanding of the infrastructural conditions of urban poverty – both through the failure of infrastructural systems that include public provisioning, and the emergence of social infrastructures that compose everyday urban life.

As physical forms, infrastructures also generate affects. Larkin's (2013) encompassing overview of the literature on infrastructures includes a helpful discussion of the affective nature of infrastructures. Bosworth's discussion of affective infrastructures (Bosworth, 2023) addresses the emotions produced by infrastructure and how affect impacts political organisation. Mainly, he writes about the constrained conditions where politics can arise from rupture – repair and brokenness in infrastructural systems being understood through affective registers – rather than smoothness. Berlant sees these affective infrastructures as accommodating multiplicity and difference while retaining a sense of the common that goes beyond relations of sovereignty. The 'commons' then provide a way to view what is broken in sociality, redefining the concept of structure in constant transition. Ethnographic studies have shown how infrastructures constitute emotional practices and systems that "operate on the level of fantasy and desire" (2023: 333). Understanding infrastructures as emotional and ambient entities requires conceptualising them as spaces that form cultural 'matrices' that produce particular affects through configurations of material, social-technical, political and historical conditions. Starosielski (2015), in her study of deep-sea cable networks, follows the material infrastructures of these cables through a method she terms "network archaeology" (2015: 15) that traces the large-scale cultural forces that have affected cable networks in different eras. Amin's study of land occupations and informal settlements in Brazil notes that communal spaces can significantly shape sociality, sometimes holding considerable symbolic power (Amin, 2014: 147).

This thesis situates itself within this literature and expands into the politics of materiality, smart city discourse and affect theory to understand how smart infrastructures are symbolic structures where the state is "simultaneously both present and absent" (Larkin, 2013: 336). In expanding on the ideas around citizenship and subjectivity and offering an alternative approach to studying infrastructure in Singapore, the next section of this literature review will discuss the significance of affect theory.

4. Affect Theory

In the introduction to the Affect Theory Reader (Gregg & Seigworth, 2010), the authors pose the question: "How [do we] begin when, after all, there is no pure or somehow original state for affect?" (2010: 1). The authors respond to this question by acknowledging that while there is "no single, generalisable theory of affect" (2010: 3), there are "infinitely multiple iterations of affect….as diverse and singularly delineated as their own highly particular encounter with bodies, affects, worlds" (2010: 4). Scholars have identified two main strands of thought within affect theory. Morrison explains how "in its more theoretical articulations, affect theory typically draws on the philosophies of Gilles Deleuze and Felix Guattari" (Morrison, 2020: 145-146). These theorists emerge from the Spinozian tradition, which "locates affect in the midst of things and relations (in immanence) and then, in the complex assemblages that come to compose bodies and worlds simultaneously" (Gregg & Seigworth, 2010: 6). Scholars like Brian Massumi draw on this Spinozian strand of affect, theorising it as an "impersonal force" (Keating, 2019: 245), a "form of encounter" (Keating, 2019: 246) and "autonomous from cognition" (Uhlmann, 2020: 159). This conceptualisation of affect aims "to develop a kind of anti-foundationalist ontology …[where] there is an analytical bifurcation between…the biological level of affect, registered in the bod…and the conscious lived experience of emotions" (Morrison 2020: 146). The mode of inquiry that has accompanied this strand of affect theory includes forms of descriptive or speculative empiricism (Stewart, 2020; Massumi, 2015; Anderson, 2021). One of the differences between this strand of affect theory and the next, more phenomenological one, is that these theorists "understand emotions or feelings to be more or less conscious and articulate…[while] affect is held to operate below the level of what can be analysed in these terms" (Morrison, 2020: 146). Affect here is "unconscious, physiological, prelinguistic, primitive, autonomic, and non-intentional" (Morrison, 2020: 146).

In contrast, the second and more phenomenological approach is heavily influenced by cultural theory and feminist thought. Sara Ahmed's work criticises the strong separation between affect and discursive meaning. Her writing "shows the intimate connections between affect, interpretation, and agency" (Morrison, 2020: 147). Scholars that draw on this more phenomenological approach are tasked with paying "careful attention to the forms of lived experience, and, in particular, to the constitutive intertwining of passivity and sense-making activity in embodied experience" (Morrison, 2020: 147). Below, Ahmed explains why her approach to affect differs from that of theorists who follow the Spinozian tradition.

> "I do not assume there is something called affect that stands apart or has autonomy…Instead, I would begin with the messiness of the experiential, the unfolding of bodies into worlds, and the drama of contingency, how we are touched by what we are near." (Ahmed, 2010: 30).

Affect is "rooted in the intelligibility of lived experience itself" (Morrison, 2020: 147). Ahmed discusses how bodies have intentionality, and can "turn toward things evaluatively, enacting implicit judgements of objects or situations" (Morrison, 2020: 149). This turning is made explicit by Ahmed in her phenomenological concept of "orientation" (Ahmed, 2006). In this work, she "worked with the phenomenological model of emotions as intentional: as being "directed" toward objects" (Ahmed, 2006: 2). Ahmed's definition of affect traces emotions through their phenomenological orientation. She argues that affect is bound with human meaning-making processes as it "resides in the relation between objects and subjects since emotions construct those objects and subjects in ways which make the emotional reaction possible and inevitable" (Wetherell, 2015: 158). Emotions are deliberate in that they involve a direction or orientation towards an object and are, therefore, 'about' something (Parkinson, 1996). The 'aboutness' of emotions means they involve a stance on the world, or a way of apprehending the world." (Ahmed, 2004: 7). This phenomenological strand of affect theory problematises the distinction between emotion and affect – emotions are not just interior states of mind, and "are tied to social and cultural practices" (Morrison, 2020: 152). On the other hand, Spinoza's concept of affect sharpened the distinction between affect and what is more commonly known as emotions. In a study on how workplaces ought to be happy spaces, Hunter and Kivinen (2022) draw on Ahmed's work to conceptualise how emotions can consist of "affect, or the ability to move us; intentionality, or where to direct our feelings; and judgement, or expectations on how we should or ought to feel" (Hunter & Kivinen, 2022: 130). Their work analysed power "within the circulation of emotions, seen in different intensities of affect" (2022: 130). This shows how some recent work has overcome the bifurcation between affect and emotions to observe how affects flow in empirical contexts. Ahmed's perspective on the bifurcation of affect and emotions also informs the thesis's treatment of emotions as affective. Ahmed argues that what should matter for political studies or analysis is what emotions do politically (2004). The insistence on affect as something beyond emotion, as pre-personal and nonconscious is that the social is excluded (Hemmings, 2005). Brennan (2004) argues how "affective atmospheres" include emotions that do not

necessarily belong to us, but that "the moods of others can have a physical and psychological impact on others without their consent" (Ahall, 2018: 40). Ahmed emphasizes that "affect is already partial and contextualized" (Ahall, 2018: 40) as we bring our experiences to situations. The affective process then, is already social.

Geographers have elaborated on approaches to affect that emphasise its relationship to socio-spatiality. There have been various conceptualisations of "affective atmospheres" (Anderson, 2009; Steinback & Munar, 2024; Kalemba et al., 2024; Zuev & Simpson, 2024; Tschakert et al., 2024) that pay attention to the phenomenological aspect of the singular experiences of these atmospheres. Anderson and Holden's (2008) conceptualisation of "affective urbanism" puts forth "an urbanism animated by a conceptual vocabulary specific to affectivity" (Anderson & Holden, 2008: 142). This understanding of affectivity is "attentive to how various modalities of the more than/less than rational, including affects, emotions and feelings, compose urban life" (Anderson & Holden, 2008: 144). McFarlane discussed how assemblage, "whether as an idea, an analytic, a descriptive lens or an orientation…is increasingly used…generally to connote indeterminacy, emergence, becoming, processuality, turbulence and the sociomateriality of phenomena". (McFarlane, 2011: 206). This attends to the agency of individual elements and the "interactive whole" (2011: 208), and accounts for an agency that can change over time and through interactions" (2011: 208).

Assemblages are relational, and agency is an "emergent process" (McFarlane, 2011: 215). Bennett's work (2010) theorises that materiality within assemblages is not stable or isolated objects. These theorisations of assemblages allow for the body to have agency in its engagements with materiality and other bodies in specific enactments of the smart city. Thus, the 'affective present' is made up of "multiple, co-existing structures of feeling that enter into loose relation, rather than tight homology" (Anderson, 2016: 746) – the "process of dispersion/intensification" (2016: 747) results in much more than the formation of subjects. It produces affective conditions that attach, temporarily, to objects and subjects in various contexts, creating "dispersed but shared 'affective present' felt across diverse phenomena" (2016: 747). This offers an alternative perspective on power, especially in analysis of power within smart cities that has tended to focus on the biopolitical (Ho, 2017; Vanolo, 2014).

Anderson and Holden argue that their theorisation of affects as part of assemblages comes into tension with Ahmed's theory of emotion, where there are 'affective economies' as assemblage is a topological concept that is capable of producing difference between the actual and virtual (Anderson & Holden, 2008: 146). In their discussion of the geographies of hope of the event of the city of Liverpool receiving the Capital of Culture status, they show how "the event as multiple is also constituted through specific mechanisms that individuate hope…[including] induction, disposal, and contagion" (Anderson & Holden, 2008: 156). The incompatibility between affect and emotion, as seen through assemblages thinking, is challenged by Edensor. Edensor argues that "there are no purely affective atmospheres, for all atmospheres entangle affect, emotion and sensation" (Edensor, 2012: 1114). In his work on the yearly Blackpool Illuminations event, Edensor draws on Ahmed's assertion that "emotions are also about attachments…what connects us to this or that place" (Ahmed, 2004: 27). In Blackpool, Edensor identifies "affective and emotional dispositions through which subjectivities are grounded in place and time and mobilised around customs of shared practice" (Edensor, 2012: 1116). Similarly, Ahall, drawing on Ahmed's work, discusses how affect as methodology is interested in the "affective-discursive in-between as shared meanings" (Ahall, 2018: 50). Ahmed's approach explores this instead of working out or identifying what the 'real' affective impressions are between bodies. Ahall argues that there are "feelings of structures everywhere" (2018: 50). Feminist work on affect offers a way to rethink the politics of emotions by emphasising that feelings and emotions are parts of affect. Affect is not just enacted in the world (Massumi, 2002); it is also enmeshed in this world through engagements with its physical and material nature. Urban forms, then, are entangled in affective circulations in the city. The relational affects within these urban forms are in flux. This material reality, composed of the assemblages of affects and urban forms, is constantly in the process of becoming.

5. Conclusion

In this chapter, I outlined three main bodies of literature that I draw on to make my arguments in the succeeding chapters. I begin this chapter with a review of the current literature on smart cities and alternative perspectives on how smart subjects should be conceptualized. There is a large body of work that study smart cities critically. However, the empirical case studies used to support some of these critiques have generally used political-economic frameworks to analyse its negative impacts. There are a few studies that examine the

affective experiences of the smart city (Zhu et al,, 2022; Cook & Valdez, 2021; Rose & Willis, 2019), and this thesis aims to contribute to this limited body of work. In the second section, I focused on the idea of the nation as ideological and infrastructural, discussing the two large bodies of work that accompany ideology and hegemony and infrastructural studies within the social sciences. Here, there is an opportunity to expand on current work conceptualising smart power in Foucauldian ways. This thesis moving beyond this to consider what a focus on affect might reveal about power relations. I also identified the need to look at mundane aspects of smart infrastructure and observe human-material engagements as they emerge in the field rather than identifying only the significant engagements that smart city literature mostly focuses on.

By expanding the horizons of "biopolitics" and "governmentality" to include considerations of the body in the emergent expressions of agency and power, I propose studying the everyday engagements in order to analyse how smart city residents engage with geographies of smart infrastructure in novel, communal ways. I draw on the more phenomenological strand of affect in order to look at affect beyond its Spinozian conceptualizations as pre-cognitive. This understanding of affect allows for observations of not just affective states, but also emotions and feelings within social "domains of practice" (Slaby, 2016: 2). This offers new ways of observing what 'active citizenship' can look like in smart cities, emphasising the significance of how people feel, as opposed to what digital technologies can do. In observing how smart citizens feel, I study the interactions they have with the engagement of all kinds of materiality in smart neighbourhoods, not just strictly 'smart' ones. This challenges the assumption that smartness should only be collapsed into what can be observed or expressed in people's engagement with so-called 'smart' technology.

This thesis also aims to contribute to the expanding body of work that uses affect to understand everyday life in Singapore (Woods, 2024; Woods, 2021; Lee et al., 2022; Gao et al., 2024). Here, there is an opportunity to add to previous explorations and theorisations of the "actually existing smart city" (Kitchin, 2014) and the "actually existing smart citizen" (Shelton & Lodato, 2019). Using affect as an approach also opens up the project's methodology to a more extensive range of ethnographic methods that allow for observations and analysis of embodiment and atmosphere, including "walk-along" and participant drawing sessions. In the next chapter, I present these methodological strategies that have allowed me

to generate and analyse data in order to understand the complex relations of affect, and engagement that emerge in the smart estates studied.

Chapter 3: Methodology

1. Introduction

In this chapter, I discuss the methodological approaches employed to answer the research question raised in the first chapter of this thesis. I begin by outlining the research methodologies I used to inform my work. Then, I discuss my choice of field methods and how these methods were applied to the field sites, including physical and digital locations. I collected data through four methods: face-to-face interviews, walk-alongs, participant drawing sessions, and passive data collection on Reddit. After discussing how the data was collected, I detail the data analysis processes used. Finally, I critically evaluate the significance of my positionality, some ethical considerations, and the project's methodological limitations. This chapter aims to detail my methodological decisions during the research process to contextualise my findings within the specific spatio-temporality of my fieldwork.

2. Research Methodologies

Ontologically, the smart city can be understood as a relational experience (Kitchin, 2018) that encompasses everyday subjective and collective engagements with smartness (Odendaal, 2021; Mouton, 2021; Soderstrom et al., 2021; Rose, 2020; Shelton & Lodato, 2019; Ho, 2017; Woods, 2020; Woods & Kong, 2020; Kong & Woods, 2018). The research question concerns the affective experiences of everyday life in smart estates in Punggol. I have deliberately limited the observation site to Punggol (I explain the reasons for this in Section 3.1 of this chapter). In doing my research in Singapore, I did not aim to develop an account of the affective experiences of all "Singaporean people", or a national culture around smartness. The methods used aimed to capture processes and relationships as they unfolded through dynamic relationships in the specific field sites. As a relational process, the smart city can be studied through methods that capture relationships between individuals, within collectives, and between humans and their environments through material engagements with their surroundings. As a lived experience, the smart city can be studied through methods that capture everyday practices. For this reason, a mix of different qualitative research methods will be discussed below. I will discuss how affect theory, as a theoretical framework, has

informed my methodological choices. I will also discuss how thinking of the smart city as a relational and everyday experience informed my methodological choices – first by describing the field as an 'assemblage' and then by discussing how affectivities can be observed and studied.

2.1 The Smart City as Relational: Assemblages

While the selection of Punggol as the main field site was informed by the pre-defined boundaries of the smart and sustainable town, the actual geographies explored with respondents were led by them, as interlocutors to their own neighbourhood. To understand these geographies, assemblages thinking as an approach was helpful. McFarlane argues that assemblage thinking allows us to approach the concept of urbanism by orienting "attention towards agentic distributions" – "it is not that assemblage necessarily decenters the human, but that it necessarily draws attention to the constitutive human-nonhuman multiplicity of relations" (McFarlane, 2011: 651). The site itself, where people move in and out of in their daily lives, situate the assembling. As a kind of "dwelling…[it] offers assemblage a focus on its verb – i.e., on assembling – rather than the noun, the assemblage" (2011: 651). Thus, assemblages thinking lends an orientation to qualitative methods that can reveal the multiplicity of processes of becoming, emphasising the dynamic nature of everyday life and relations within it. This approach informed the project's methodological orientation in two main ways.

Firstly, by understanding assemblages as a kind of symbiosis – a co-functioning of human and non-human actors (Lambert, 2016) – assemblages can be studied as relationally constituted. These actors are defined relationally by their interactions within assemblages rather than as absolute entities. This understanding of spatial relationality informed the decision to include 'walk-along' and participant drawing sessions into fieldwork to gather more data about respondents' interactions with the material elements of their estates. Even though this approach centred on the human actor, as the respondents ultimately decided the routes on these walk-alongs and called on their memories and perceptions during the drawing sessions, it reduced the emphasis on the human by allowing other non-human actors to come to the forefront. Non-human elements within these estates that produced sensorial experiences like heat, smell and taste, and elemental actors like the sun and wind all come to

the forefront in their interactions with the respondents. These aspects of the estates became visible and meaningful through respondents' engagements with them.

Secondly, by understanding assemblages not just as wide networks that include many different actors but as deep ones too, assemblages are relations seen as constructed and constantly in flux and in the transformation process. McFarlane writes how "assemblage thinking emphasizes the depth and potentiality of sites and actors in terms of their histories, the labour required to produce them, and their inevitable capacity to exceed the sum of their connections" (McFarlane 2011: 654). Urban histories, imaginations and possibilities all speak to relations between the past, present and future where "at different moments in time, relations within and between sites and actors may require different kinds of labour and are more or less vulnerable to collapse, or to reassembling in different forms" (2011: 655). Conceptually and methodologically, this is an essential consideration for this project. The role of Singapore's urban planning and policy over the nation's history and its imaginations of smart futures is significant. However, the intention in using multiple types of qualitative research methods that included linear and non-linear storytelling, as well as verbal and non-verbal engagements, was to observe the smart city experience from the ground-up and not to collapse these experiences into smart discourse.

Research is a process fraught with power and politics, and there were many complexities involved in 'looking' (Berry, 2015; Ingold, 1993). My method of 'looking' speaks to my specific cultural imaginary rather than a neutral inquiry into others' points of view (Feldman, 1999). These power relations can impact the researcher, subject, and how the data generated by the subject gets interpreted. In observing and exploring everyday practices through an affective lens, it is crucial to note that affects are relational. Therefore, the researcher is also implicated in generating and circulating affects. My assumptions about the Smart Nation project and what I would observe in these smart estates informed the questions I asked respondents, and the emphasis placed on smart and sustainable features that I was interested in. For example, the solar panels emerged as significant in this thesis largely due to my own interest in them. In critiquing the smart city, it was challenging to resist recording only my reactions or overlaying responses from respondents with my critical gaze. The impact of my personal bias on the selection of features or aspects of the estates is discussed more thoroughly in Chapter 4. I also reflect on them in Chapter 7.

There has been a strong impetus to be more critical of the smart city (Luque-Ayala & Marvin, 2015; Kitchin, 2014; Kong & Woods, 2018; Rose, 2020), especially as two camps emerge. One is highly supportive of the smart city as a kind of techno-utopia equipped to solve urban problems efficiently. The other is generally against it due to the threats of utopianism, such as the development of a "society of control" (Sadowski and Pasquale, 2015). For instance, these perspectives on aspects of the smart city are not static. In a post-pandemic Singapore, conversations around surveillance infrastructure (Guest, 2021; Lee & Lee, 2020; Das & Zhang, 2021) and the limitations around privacy and data security (Sassen & Kourtit, 2021) have emerged[10]. These conversations shaped, and were shaped by, discourses around the smart city, which have also impacted my assumptions and approach to the smart city,

2.2 The Smart City as Lived: Affectivities

There has been an 'affective turn' in the social sciences (Clough, 2008; Anderson, 2006; Massumi, 2002; Ahmed, 2004; Leys, 2011; Gregg & Seigworth, 2010; Slaby, 2016), which has conceptualised affect as a method for asking research questions, formulating research agendas that relate to feelings and emotions, and collecting and producing embodied data (Knudsen & Stage, 2015). Recently, there has been increasing scholarly engagement with the phenomenological approach to affect, some drawing specifically on Ahmed's work (Ahall, 2018; Antonakaki et al., 2018; Viernes, 2017; Schiermer, 2021). Phenomenology refers to methods that examine human experiences through the descriptions that are provided by the people. As an approach, it is argued that phenomenology "must be seen as a turning away from any form of thinking about a particular phenomenon that takes its point of departure in crystallised beliefs and theoretical constructs, which in turn risk perpetuating preconceptions" (Raza, 2024: 185). There is a "sensibility towards lived experience" (Raza, 2024: 187). Wetherell argues that the definition of affect from the Spinozian tradition, which sees affect as a "pre-personal, extra discursive force hitting and shaping bodies prior to sense-making" (Wetherell & Beer, 2014: para 3) is unsustainable. She argues that this category of autonomous affect is unhelpful when doing certain kinds of social research. Instead, considering affect and emotion as something observable and a part of practice allows for the "social regularities and patterns around affect…[to] clearly conform to a practice account"

[10] There have been studies around securitization and the surveillance of marginal populations, specifically Bangladeshi migrant workers, in Singapore, prior to the pandemic. For an example of this, see Shona Loong's 2018 study on this.

(Wetherell & Beer, 2014: para 8). A practice approach "positions affect as a dynamic process, emergent from a polyphony of intersections and feedbacks, working across bodily states, registrations and categorizations, entangled with cultural meaning-making, and integrated with material and natural processes, social situations and social relationships" (Wetherell, 2015: 139) Wetherell argues for the use of "affective practices" in order to focus the relationality of affects and avoid its depersonalisation.

While there are no precise ethnographic methods prescribed by affect theory, there have been creative re-workings of methods to concentrate on the actual experiencing of the individual's environment and surroundings. Methods used include interviews, which are themselves "situated affective encounters" (Ayata et al., 2019). There have also been attempts to develop other qualitative methodologies stemming from affect theory, as can be seen in the growing body of work that engages with methods to observe affective experiences (Anderson & Holden, 2008; Ernwein & Matthey, 2019; Kraftl & Adey, 2008; Bille & Simonsen, 2021; Adey, 2008; Edensor, 2012; Edensor, 2015). In this thesis, I draw on work that conceptualize affect as embodied, fragmentary, and observable (Beyt, 2023; Back and Puwar, 2012; Ringrose & Coleman, 2013; Woods, 2019; Woods, 2024; Garde-Hansen & Gorton, 2013). I also draw from methods used by geographers and sociologists whose work did not center affect theory but discussed significant questions around cities and movement. The use of "visual narratives" (Datta, 2012) and the walk-along method popularized by those who study the relationship between sense-making, sensory experiences and walking (Degen & Rose, 2012; Rose et al., 2010; Wylie, 2005; Imai, 2008) informed the decision to broaden my methods beyond interviews.

In my initial interviews with respondents who lived in the smart estates in Punggol, some direct questions yielded little data. These silences that I experienced in conversations with residents suggested that there may be important political, social, cultural, and historical reasons for silence around certain everyday practices. These silences might have represented narratives in and of themselves, which may have be expressed through mundane responses that I found difficult to contextualise, especially in short-term ethnographic work. The silences I encountered during the interviews with respondents from the estates I studied encouraged me to include other methods, like the walk-alongs and drawing sessions, in my engagements with respondents. The Reddit data that I collected also complemented these methods data on online communications. Specific methods, such as walk-along and

participant drawing sessions, helped build a co-constitutive experience of the estates that would encourage conversation. This builds on recent work that has used walk-along interviews to study everyday life in Singapore (Loong, 2018; Cao et al., 2019).

3. Field Sites

3.1 Physical Locations

Ethnographic studies stress the importance of material surroundings and their influence on people – from the relationship between material culture and technology (Vannini & Vannini, 2008) to meaning-making in sustainability practices (Isenhour & Reno, 2019), the materiality of sociality (Ho & Hatfield, 2011), design (Pink & Mackley, 2015) and representation (Gale & Wyatt, 2013) in the everyday. Drawing on these insights, I used smart and sustainable HDB estates in Punggol as the key site for understanding how smart city residents engaged with smart infrastructure.

The HDB is one of Singapore's "most important and effective public institutions since the early post-independence days" (Hamnett and Yuen, 2019: 6). Established in 1960, HDB wields immense power over the acquisition and ownership of land in Singapore and houses approximately 79% of the population (Singstat, 2024). The HDB is one of Singapore's "most important and effective public institutions since the early post-independence days" (Hamnett and Yuen, 2019: 6). Housing, especially public housing, and home ownership, has become an "integral element of inclusive national development" (Hamnett and Yuen, 2019: 14). Housing is also an important site implicated in Singapore’s transition to becoming a smart city. The Smart Nation project is a nationwide initiative, enabled by a unique approach to government described as a ‘whole-of-government’, or increasingly, a ‘whole-of-nation’ effort (Woo, 2018). This means that the state follows a networked governance structure. The Smart Nation and Digital Government Group (SNDGG), sometimes referred to as the Smart Nation Office, works closely with other government institutions, such as the HDB, URA, and the Ministry of Environment, to achieve goals related to sustainability and the smart city. The structure of the SNDGG can be seen below:

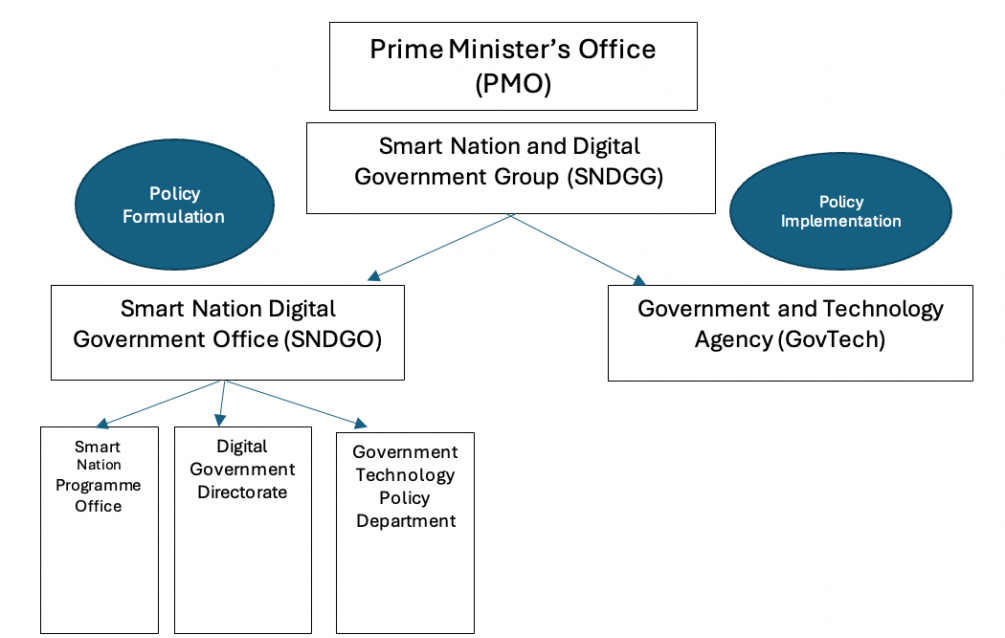


Figure 1: Governance structure of the Smart Nation initiative[11]

Under the Smart Nation initiative, the HDB released a Smart HDB Town Framework in 2014. This framework maps out how smart initiatives will be rolled out across five areas: Smart Planning, Smart Environment, Smart Estate, Smart Living, and Smart Community.

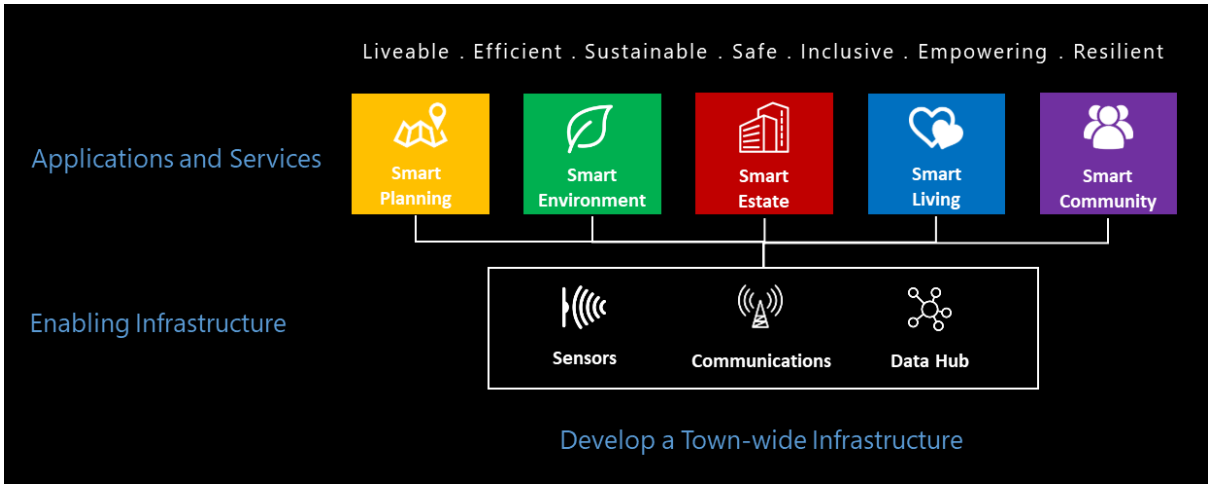


Figure 2: Smart HDB Framework from the Housing & Development Board's website

Official documentation includes claims such as, "In residential homes, innovative design and technology such as the smart features at the Punggol Northshore district provide ways for

[11] Adapted from work by Ponting and Zhou (2016) in their paper published for the Centre for Liveable Cities

people to save energy and water and keep the environment clean" (National Climate Change Secretariat, 2015). Various estates within Punggol and much of the Punggol Northshore development have been planned to include solar panels, outdoor community gardens, high-tech energy-optimizing features such as sensor-based lighting and pneumatic waste disposal systems that can track waste and recycling volumes.



Image 3: Aerial shot of Punggol neighbourhood from the URA's Draft Master Plan for Punggol

Presently, there are HDB estates in Punggol that have been conceptualised as 'sites' of the Smart Nation or where the application of the Smart Nation can be seen. As the Smart Nation emphasises the role of Singapore as a 'living lab' for developing urban solutions, the city-state has become particularly attractive to local and foreign companies building solutions[12]. This living lab is being materialised across the city-state in various ways. One of the ways in which it is being materialised is through Smart Nation initiatives such as the PDD.

[12] There are various examples of these types of collaboration already happening, with government agencies and multinational corporations coming together to create, test and scale solutions – examples include the 'Research Collaboratory' between technology firm IBM and the Land Transport Authority, and leading international energy and public utilities companies such as EDF and Veolia establishing research centres in Singapore to work with the local Housing Development Board (HDB). Government agencies have been involved in test-bedding solutions extensively, with the Public Utilities Board having run about 150 pilots to test various water treatment technologies.

I conducted interviews, walk-alongs, and participant drawing sessions in multiple smart estates in Punggol. To protect the identity of the respondents, I do not disclose which estates I studied. Initially, interactions with respondents were limited to the public areas of their estates. However, a few respondents invited me into their homes for interviews or drawing sessions during the hazy periods to avoid the polluted air. In these instances, our interactions took place in their homes. I met other stakeholders, such as industry practitioners, state actors, and academics that I interviewed, at their place of work or a café of their choice. These interviews were mainly seated, one to one interviews. I provide more detail on these forms of engagement in Section 4 and 5 below.

3.2 Digital Locations

I observed resident activity on Facebook groups for individual estates. These groups were moderated closely, and while some were public, most would only include residents from the estates or only allow verified residents to post and comment. This prompted me to learn more about them through public posts and resident interviews. I began to include questions on Facebook groups in my interviews with respondents, and then later, after it was brought up by several respondents, I also discussed WhatsApp groups in conversations.

Although I had done most of my fieldwork prior to 2020, I collected additional data from Reddit's online platform, specifically the subreddit /r/Singapore, in 2024. The gap between the fieldwork done before 2020 and the data collected in 2024 was due to the need for additional data collection after two rounds of submitting and defending my thesis. The fieldwork done before 2020 mainly focused on the physical field sites of the smart estates in Punggol, while the data collected in 2024 was from online sources. The data collected in 2024 consisted of depersonalized Reddit data, newspaper articles found on The Straits Times Online, and haze health advisories obtained from the National Environment Agency website. I collected this data in response to feedback from examiners in 2023 that encouraged the collection of new data from online sources in a systematic and rigorous way. More details on this will be discussed in Section 5.3 below.

3.3 Government Reports

I reviewed policy documents on the Smart Nation project. These documents "frame desirable futures…[showing the] inscription and reproduction of dominant sociotechnical imaginaries" (Jasanoff, 2015: 26) in practice. Specifically, I reviewed five reports: the Sustainable Singapore Blueprint (National Climate Change Secretariat, 2015), the Digital Readiness Blueprint (Ministry of Communication and Information, 2018), the Smart Nation Strategy (Smart Nation and Digital Government Office, 2018), the Smart Nation Report 2.0 (Ministry of Digital Development and Information, 2024) and DesignSingapore's Loveability Report (DesignSingapore Council, 2021). I analysed these reports using content analysis, focusing on information that would provide a discursive context of everyday life of smart city residents in Singapore.

While the information gathered from these sources allowed me to understand the state's communicated position on issues related to the smart city, they also reify a vision of smartness that the state aimed to promote. This could lead to critique that over-generalises the material effects of the smart city, missing the effects everyday engagements of smart infrastructure have on smart city residents (Shelton et al., 2015). Thus, these documents were reviewed in addition to data collected from other sources, such as fieldwork in the smart estates of Punggol.

4. Field Methods

I undertook three periods of fieldwork in Singapore in August to October 2018, June to July 2019, and August to September 2019. I received ethics approvals for these periods of fieldwork. The empirical material was produced through respondents' engagements with their built environment and infrastructures. This was either recounted via the interviews or generated through direct engagements observed during the walk-along.

In addition to analysing the data collected during the 2018-2019 fieldwork periods, I also gathered data in June-July 2024 from the subreddit /r/Singapore, newspaper articles, and official health advisories found on the NEA website. I did this to address a methodological weakness in my thesis, where insufficient and problematic data from social media platforms had to be removed and replaced with new data. I discuss this in depth in Section 5.3 below.

In the next part of this section, I will discuss the field methods I have used.

4.1 Interviews

The interviews, walk-alongs and participant drawing sessions were organised during my fieldwork period in 2018-2019. Sampling methods for the interviews encompassed several overlaps between three nonprobability sampling techniques, convenience, snowball and purposive sampling.

Convenience sampling afforded the relative ease and accessibility of conducting interviews as the sample can be drawn from conveniently accessible sources. However, they may not represent the larger population or have external validity (Andrade, 2020). Due to my acquaintance with a few residents of the Punggol neighbourhood, convenience sampling was a viable sampling technique. These personal connections proved to be a crucial way of establishing trust and gaining access to interviewees, as I was often referred to residents of smart estates in Punggol by people within my social network. Snowball sampling was occasionally used as a recruitment method, as referrals from interviewees effectively identified willing and appropriate participants for the study. I also used personal contacts to recruit other stakeholders, such as industry practitioners, state actors, and academics, for interviews.

Another method of recruiting respondents through purposive sampling involved contacting various stakeholders, such as industry practitioners, state actors and academics, whose work I knew actively engaged with the Smart Nation project. To recruit these respondents, I followed a systematic approach. Firstly, I identified relevant individuals on the websites of state agencies related to the Smart Nation initiative and academics whose research areas were relevant. Once these individuals had been identified, I reached out to them via email. My initial message of contact was crafted to introduce myself, explain the purpose of my research, and inquire about their interest in participating. This approach aimed to demonstrate the academic nature of my inquiry and reassure potential respondents about the confidentiality and voluntary nature of their participation. This strategy allowed me to identify individuals beyond the constraints of my personal contacts. However, this method had only limited success as despite several state actors and academics responding to my emails, only two agreed to be interviewed.

Below, I include details on the respondents from the smart estates in Punggol and the different engagement methods. I will provide details on the other stakeholders, such as industry practitioners, state actors, and academics that I interviewed in a later section.

	Pseudonym	Age	Gender	Ethnicity	Marital Status	No. of years in Punggol	Interview	Home visit	Walk-alongs	Drawing sessions	No. of meetings
1	Fathin	21-35	F	Malay	Married	<5years	Y	N	Y	N	1
2	Nathan	>35	M	Chinese	Married	5-10 years	Y	N	Y	N	1
3	Felicity	21-35	F	Chinese	Married	>10years	Y	N	N	N	1
4	Humairah	21-35	F	Malay	Not Married	>10years	Y	N	Y	N	1
5	Sharifah	21-35	F	Malay	Married	<5years	Y	Y	N	Y	1
6	Calvin	21-35	M	Chinese	Not Married	<5years	Y	N	Y	Y	1
7	Haikal	21-35	M	Malay	Not Married	>10years	Y	N	Y	Y	1
8	Hasan	21-35	M	Malay	Married	5-10 years	Y	N	Y	N	1
9	Zareen	21-35	F	Malay	Married	<5years	Y	Y	N	Y	1
10	Irfan	21-35	M	Malay	Married	<5years	Y	Y	N	Y	1
11	Sharon	21-35	F	Eurasian	Married	<5years	Y	Y	N	Y	2
12	Victor	>35	M	Chinese	Married	5-10 years	Y	N	Y	N	1
13	Ben	>35	M	Eurasian	Married	5-10 years	Y	N	N	N	1
14	Lily	21-35	F	Malay	Married	<5years	Y	Y	N	Y	2
15	Aminah	21-35	F	Indian	Married	5-10years	Y	N	Y	N	1
16	Asiya	21-35	F	Indian	Married	<5years	Y	N	Y	N	1
17	Nora	21-35	F	Malay	Married	5-10 years	Y	N	Y	N	1
18	Sarah	21-35	F	Malay	Married	>10years	Y	N	Y	Y	1
19	Tina	21-35	F	Malay	Not Married	<5 years	Y	N	Y	Y	1

Table 1: Participant details for respondents living in Punggol

I conducted 19 semi-structured interviews with individuals living in Punggol, often in their estates. Each interview lasted between 60 and 120 minutes. These were face-to-face interviews, and although most were individual interviews, there were instances when respondents would bring friends, their spouses, or, most commonly, their children. Out of 19 interviewees, there were 12 women and seven men. There was variation in terms of ethnicity - four of the respondents were Chinese, 11 were Malay, two were Indian, and another two were Eurasian. 15 respondents were married, while four were not. Due to the use of both convenience and snowball sampling, my sample was mainly skewed towards young women who were Indian or Malay, identified as Muslim, and were mothers.

There are a few impacts of this skew. The sampling bias consists of the over-representation of minority/Muslim women below the age of 35. Thus, the research findings and insights reflect the experience of a small subset of residents. This bias emerged as a result of the sampling methods. These methods drew on my social networks, which included an over-representation of individuals similar to myself – young, minority/Muslim women. The connection of the

sampling method to the location of the smart estates also contributed to the sampling bias. Most of the residents living in the smart estates I studied in Punggol had bought their flats as part of the Build-To-Order (BTO) estates[13], scheme, which is largely accessible to married couples. Thus, most residents were below 35 years old, and part of a young family. Due to these issues, the insights solicited and generated would be limited[14].

The interviews benefited from being more resident-led, with generative conversations sparked by questions allowing anecdotal stories to emerge. One particularly generative question was: "Tell me about your favourite time of day", or "Tell me about your favourite part of this estate". Other generative questions would involve some element of conflict, like "Tell me about a time you fought with your neighbours". Through stories, respondents discussed events and issues that mattered to them, leading to generative conversations about their way of life. The terms "smart" and "sustainable" were not referred to by respondents regularly in conversations, unless prompted. These words were not ascribed or prescribed identifying terms in their everyday lives. Allowing respondents to tell me their stories was critical in building rapport and trust as they often discussed a lack of communication between them and the state[15], or them and their neighbours. Respondents could tell me their stories by expanding the conversations to include topics that were not explicitly smart. Although non-digital forms are not commonly understood as making up smart infrastructure within the literature on smart cities, empirically, they have a part to play in producing and reproducing smart spaces. These non-smart, often mundane technologies, were what respondents engaged with in their everyday lives. Thus, through conversations with respondents, I realised that when thinking about a smart estate, it was also helpful to investigate what kinds of forms and technologies, outside the digital, could construct, negotiate, and distribute agency across these everyday spaces.

4.2 Walking as a Method

In addition to the interviews, I joined 12 respondents on separate walk-alongs. These respondents had previously agreed to do the walk-along after their interviews, so they were

[13] Build-To-Order (BTO) estates are part of the larger HDB BTO system, and typically house families as they enjoy higher priority when balloting for a unit
[14] I further discuss the limitations of the methods used at the end of this chapter.
[15] The lack of a feedback loop between residents and the state, especially during the periods where respondents were involved in smart city interventions or experiments, is discussed in Chapter 4 of this thesis.

from the same interview sample. These walk-alongs were resident-led and usually lasted around 30 minutes. I would audio record parts of the walk-along when respondents and I would have a conversation and make notes throughout. The audio recordings were transcribed and included in the transcripts generated from earlier face-to-face interviews with the same respondents.

Various scholars have discussed walking as a research method. Walking as an urban observation method has been used as a self-conscious and reflexive way to obtain participant data (Kockova, 2016; Holgersson, 2016; Degen & Rose, 2012; Ingold, 2010). Walk-alongs have been studied as an ethnographic tool to explore "environmental perception, spatial practices, biographies, social architecture and social realms" (Kusenbach, 2003: 455). One of the primary purposes of using methodological practices that involve bodily practices was to move beyond the dichotomies found in traditional theory. There are many different walking methodologies that have emerged from various iterations of the walk-along method[16] (Pink et al., 2010; Lee & Ingold, 2010; Kusenbach, 2003; Evans & Jones, 2011; Porter et al., 2010). There is no one way walking as a method has been theorised, although attempts at categorising some of its major themes have been made. Springgay and Truman (2018) proposed one categorisation, which includes place, sensory inquiry, embodiment, and rhythm. Springgay and Truman also argued for consideration of other themes, such as geology, affect, and movement, when thinking about the environment where the walking occurs. Affect theory, in particular, has been used in walking research as a way to break from more human-centric approaches, particularly by highlighting the unevenness of mobility within specific spaces.

Scholars have argued that walking, or movement, can activate modes of participation that are relational (Springgay & Truman, 2018: 19). Experiencing the city on foot is a popular way of studying the city– from photography to popular literature and movies, walking through a city has featured prominently in the way we imagine moving through urban space. In recent years, walking has become recognised as a formalised ethnographic method (Degen & Rose, 2012). 'Walk-alongs', as they are often called, can "produce richly evocative sensory impressions"

[16] Minkkinen has a brief summary of the history of collecting fieldwork data on foot, or walking as a method (Minkkinen, 2022).

(2012: 3281), where conversation between researcher and participant becomes more "a dialogue than an inquiry" (Holgersson, 2016: 223). Through walking routes, researchers can experience the city along with participants. This allows for the ethnographic exploration of the material, embodied, and sensorial aspects of urban living. 'Walk-alongs' are now occasionally referred to as 'go-alongs' instead in order to accommodate the multiple ways in which people move through cities. These techniques have allowed researchers to access some of the more transcendent and reflexive aspects of participants' lived experiences in their natural domain (Kusenbach, 2003).

During walk-alongs, respondents brought me to places in their estates that they frequented. By going through these movements across their neighbourhood with them, I witnessed the everyday aspects of their lives in these spaces: the sight of school gates, the view of an abandoned clubhouse, the memory of seeing a sunset behind the train station. These images and experiences prompted respondents to tell stories and share memories. These walk-alongs involved co-navigating and co-learning. They reorient the researcher and participant towards the collaborative and participatory aspects of walking and talking. I found that respondents felt more comfortable talking to me if we were both also walking. The most interesting stories often emerged during these walk-alongs.

4.3 Participant Drawing Sessions

Towards the end of the fieldwork period in 2019, I added drawing sessions to my engagements with respondents who lived in the smart estates in Punggol. After the interviews and walk-alongs, respondents would be asked if they wanted to participate in the drawing sessions, which usually lasted 15 minutes. I collected 9 participant drawings from these sessions. These sessions were critical during the hazy season when respondents expressed concern about participating in the walk-alongs, which took place outdoors. Instead of outdoor interviews and walk-alongs, I held fully indoor interviews and drawing sessions with respondents who were concerned about being exposed to the haze.

Following the reflexive and postmodern turns in methodology and research in the 1980s and into the 1990s, visual methods and visual representation have become more accepted as ways of working (Pink, 2012: 8). The intersecting histories of visual sociology, visual anthropology and visual culture has been outlined in Pink's work (Pink, 2006; 2007), where

she discusses the historical contexts and debates that frame visual methods. A growing body of work also addresses the relationship between visual methods, social interventions, and participatory research (Mitchell & De Lange, 2011; Pink, 2007). In particular, the 'practice turn' (Schatzki, 2001) has brought renewed prominence to visual methods, which are particularly adept at studying practices. Pink argues that multi-sensory approaches have emphasised the relationality of the visual to the other senses, and how this comes "into play in the ways that we create routes to knowledge in our research processes" (Pink, 2012: 11). The visual has also been implicated in numerous kinds of multi-sensory methods (Pink, 2009), situating the visual amidst the other senses.

To explore infrastructural (in)visibilities, I wanted to include more visual aspects in my data collection. Amin and Thrift (2017) discuss the variation in in the intensity of luminosity and colour of the infrastructures of digitally-mediated cities, bringing attention to their affective qualities. The participant drawing sessions aimed to produce drawings that would make elements of these variations of intensity observable. Interesting observations of the colouring in of parks, for example, and the colourless nature of the actual estates, could be made. Participant drawings could also be seen as a way for the researcher and participant to slow down. Drawing a place (like one's neighbourhood, for example) is an attempt to explore the place rather than to accurately represent it (Kashanipour et al., 2016; Kashanipour, 2021). Increasingly, drawing is being used as an "ethnographic understanding and as a means of disrupting conventional ways of knowing the world" (Kashanipour, 2021: 83). The art of slowing down, brought about by the "gradual gaze" (Kashanipour, 2021), allows researchers to slow down and consider how knowledge about the participants is being produced. These sessions aimed to pull participants away from language and the rarely-used, and often technical terms of the smart and sustainable city.

These participant drawing sessions were not recorded. Instead, I would note anything that seemed significant during the session. I took note of what participants drew first, if they used markers or pencils, and how much of the non-human and human featured in their drawings. I took note of variations in the scale of the drawings. The sun emerged as a significant part of the drawings of these smart estates. Out of 9 drawings, 8 included the sun. In an analysis of the visual elements of the participant drawings, some features and patterns emerged:

Visual elements	Rate of occurrence	Significance
The sun – including sun rises and sunsets	High	This shows the centrality of the rhythms of the day, especially the sunrise and sunset
Green spaces and park connectors	High	This shows the importance of nature and green spaces
The outdoors	High	
HDB blocks	Medium	Some drawings did not feature the actual HDB blocks, and chose to focus either on their own unit, or the parks
Animals and pets	Low	Animals and people tended to feature less in drawings when compared to nature and green spaces
Other people	Low	

Table 2: Visual elements found in drawings

I observed how certain aspects of the estates were common across drawings, and the order in which things were drawn during these sessions. The sun was usually the first thing or one of the first things participants drew after being prompted to begin. Below are examples of participant drawings that feature the sun.

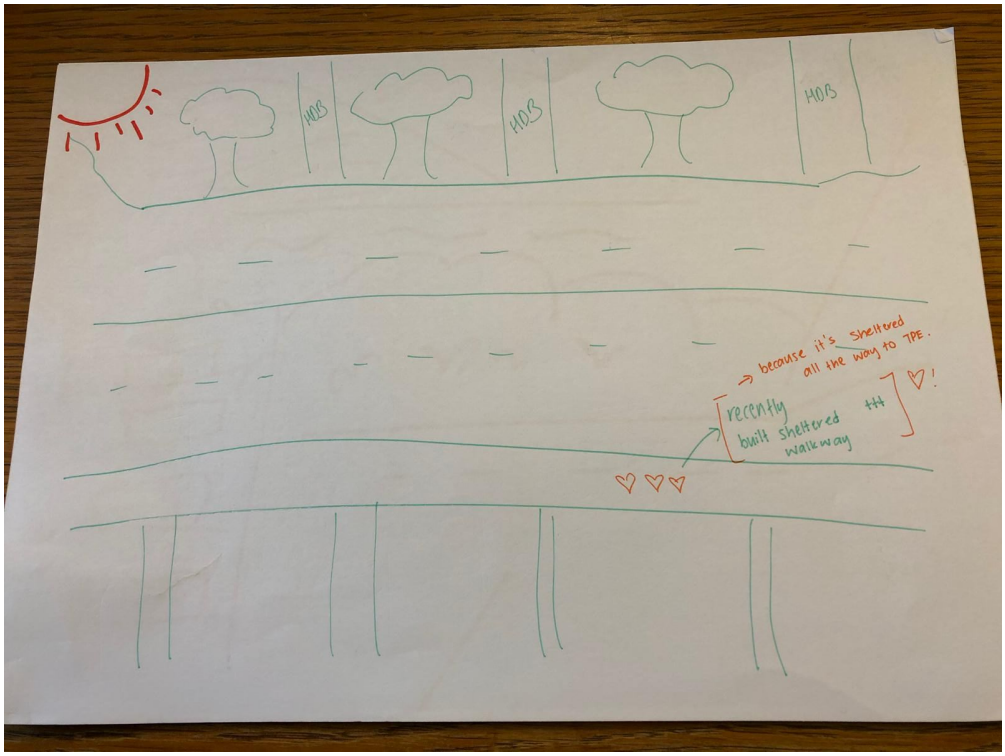


Image 4: Participant drawing – depiction of a highway in Punggol and bordering green spaces and HDB estates



Image 5: Participant drawing – depiction of the view from the estate



Image 6: Participant drawing – depiction of view of the route to work

Through these drawings, the respondents' experience of their surroundings emerged. The sun was salient to respondents in two situations: first, when they were on walk-alongs and had to manage the hot weather and humidity, and second, when they drew their estates. The weather became an object of inquiry later, when post-fieldwork, the topic of the haze emerged as possibly meaningful. These insights suggest that the felt sense of the estate, through the weather, was a significant part of the respondents' experience of their estates. This informed the decision to include the haze as a case study in Chapter 6, as it served as a relevant kind of experience and area of inquiry for understanding the experience of smart city residents.

5. Data Analysis

At the end of my engagement with respondents who were residents of Punggol, I had done 19 interviews, 12 walk-alongs, and 9 participant drawing sessions. I transcribed the interviews verbatim and coded them manually, using a method of developing and applying codes that consisted of heuristically assigning codes to key phrases based on initial observations. I coded the transcripts first through open coding. While analysing them, I focused on the repetition of discursive expressions that respondents would use to express their thoughts, feelings, and experiences in their estates. These codes helped construct more prominent themes that allowed cross-analysis of culturally or historically determined expressions or

narratives that respondents used to describe their experiences in a smart city. I did not use a qualitative data analysis software to analyse the interview transcripts. I found it helpful to review the transcripts and code manually, as I could observe conversations more closely. Slaby, when describing where we might be able to observe relational affects, wrote that one could study these "dense relational encounters by again taking the individual participants as focal reference points." (Slaby, 2016: 24).

5.1 Interviews with Respondents from Punggol

In total, I did 19 interviews with residents of the smart estates in Punggol, and 14 interviews with various other stakeholders, consisting of state actors, industry practitioners, and academics who worked in areas related to the Smart Nation project. Due to the different nature of the interviews, I have distinguished between the interviews with respondents from Punggol, which I occasionally refer to as 'resident interviews', and those with industry practitioners, state actors, and academics, which I occasionally refer to as 'expert interviews'. This distinction was made for two reasons. Firstly, this distinction differentiated the kinds of data gathered as respondents from the Punggol estates were engaged in a much more extensive ways than the industry practitioners, state actors, and academics I interviewed. The data gathered from respondents living in Punggol was often accompanied by data from walk-alongs and participant drawing sessions. Industry practitioners, state actors, and academics, on the other hand, were not engaged in these two activities. Secondly, these different types of engagement also meant that I assumed the respondents from the smart estates in Punggol related to the smart city in different, more personal ways, than the other stakeholders I interviewed. This assumption could exacerbate biases that already exist about smart city residents in comparison to those I have categorized as 'experts' of the smart city. To limit the bias of this distinction, I have coded the data gathered from these two sets of interviews separately. This was done to allow the narratives and stories from the respondents that live in the smart estates in Punggol to emerge without being collapsed into the responses of other stakeholders or smart discourse.

I drew on thematic codes from previous research on public views of the smart city. I refined these codes over time, going back to the smart city scholarship to see how similar themes have been engaged with. In Rijshouwer et al.'s recent 2022 paper, which studied smart city resident responses, a range of codes were developed. The authors termed these codes

'interpretative repertoires'. These codes linked to collective action frames, all of which helped to provide a comparison to my codes developed during the open coding process. I examined the themes that emerged through the open coding process for their articulation in more significant, broader mainframes (e.g. agency, nationhood, sustainability), as shown in the table below.

Main frames	Themes	This frame/theme is characterized by references to:
Agency	Choice and control, apathy, "bo-pian" (ambivalence), participation, inevitability	Feelings of powerlessness
Social relations	Loneliness, friction, "dead" neighbourhood, foreigners and migration, use of Facebook and WhatsApp groups	Experiences and scenarios with neighbours
Nationhood	Singaporean Smart Nation project, the "Singapore Story"	References to identity and feelings of patriotism
Marginality or Injustice	Ethnicity/race, income inequality, rental estates, social class	References to a sense of belonging, social groupings, social practices and behaviours
State or Governance	Self-censorship, lack of engagement with the state, community centres (CCs), weekly meet-the-MP sessions	References to disengagement and disillusionment
Sustainability	Nature, weather, "eco-town", recycling, green spaces, parks, climate change, the elemental (e.g. the sun, heat, rhythms of day and night)	Engagement with the outdoor, green spaces in the estates and open areas
The past	"Kampung spirit", "old" Punggol, modernization and modernity	Feelings of nostalgia

The future	Ageing, "upgrading" of current housing, emigration	Feelings of uncertainty and anxiety
Safety and Crime	Security, security cameras and surveillance, presence of undesirable "others", crimes against animals	References to the use of common spaces, use of common spaces as contested
Cost of living	Housing prices, Singapore being expensive, cost-savings	Feelings of anxiety and frustration

Table 3: Codes from interviews with respondents living in Punggol

There has been research that has shown how certain demographic factors have a significant influence on how people behave or perceive the smart city. Rijshouwer et al. (2022) concluded from the outcome of their gamified survey that age and education impact people's privacy behaviours in smart cities. Thus, the respondents' demographic can be crucial in contextualising some of the data gathered. There were a few limitations of my sample, which I will discuss briefly here (and in more detail under the 'Limitations' section). Most significantly, my sample was limited by a lack of representation of different age groups and the exclusion of non-citizens. Furthermore, as these interviews were held with HDB homeowners, they excluded engaging with rental flat residents and those who resided in private housing. Additionally, ethnically Indian and Malay women below the age of 35 who were mothers were over-represented in my sample – they made up 8 out of 19 of the total respondents I interviewed who lived in Punggol. This over-representation was not intentional and was an effect of using convenience sampling to recruit respondents. Considering this over-representation, I aimed to achieve what Rijshouwer et al. 2022 call "discursive representativity" rather than demographical, where "the repertoires that [are being] reconstructed need to be representative rather than the people" (2022: 4). Thus, the data gathered is not representative of all smart city residents in Singapore.

5.2 Interviews with Industry Practitioners, State Actors and Academics

I conducted 14 one to one interviews with various individuals across the public and private sectors. I include details on them below.

	Pseudonym	Gender	Institution Type	No. of meetings
1	Carmen	F	Government – Statutory Board	2
2	Paul	M	Government – Statutory Board	1
3	Leo	M	Academia	1
4	Karen	F	Government - Ministry	1
5	Nusrat	F	Government – Statutory Board	1
6	Andy	M	Government – Statutory Board	1
7	Imran	M	Industry	2
8	Jasper	M	Academia	1
9	Victoria	F	Academia	1
10	Natalia	F	Government – Statutory Board	1
11	Omar	M	Government – Statutory Board	1
12	Beatrice	F	Government - Ministry	1
13	Kevin	M	Industry	1
14	Walter	M	International Financial Institution	1

Table 4: Participant details for respondents who are industry practitioners, state actors, and academics

Out of 14 respondents, two individuals agreed to be directly quoted, and three others agreed to be indirectly quoted. These five individuals, Carmen, Paul, Karen, Nusrat and Imran, have been quoted in this thesis. I will describe the method of inductive coding for expert interview transcripts here. As shown in the table below, I examined the themes that emerged through the open coding process for their articulation in more significant, broader mainframes (e.g., agency, nationhood, sustainability). The content in the right column provides context and detail to the main frames. After these interviews were coded, I reviewed them alongside the main frames and themes generated in the transcripts from interviews of respondents who lived in the smart estates in Punggol. This was done to look some patterns that might emerge in the conversations across the multiple stakeholders in the Singapore smart city.

Main frames	Themes
State-society interactions	Trust and suspicion, state control, top-down approach, disengagement, lack of awareness

Sustainability	"eco-town", green spaces, sustainability blueprint, greening, misuse or abuse of common spaces
Time and temporality	Rate of development, ageing society, conservation and heritage, urban development, 'kampung spirit'
The elemental	Urban heating and cooling, solar energy, and sunshine
Competition	Threat from other countries, the threat of falling behind
Smart City	Smart Nation, pilot testing, experimental, living labs, inclusivity, surveillance, smart citizens
Individualization of responsibility	Rationality, the rational citizen, meritocracy, rights and responsibilities, digital readiness
Singapore's exceptionalism or unique position as model city	Model city, smart and sustainable solutions, urban solutions, holistic urban planning, Singapore's 'survival' story
Bureaucracy	Whole-of-government approach, single layer of governance, collaboration, cooperation

Table 5: Codes from interviews with respondents who are industry practitioners, state actors and academics

5.3 Additional Data: Reddit, Newspaper and Official Advisory Data

In Chapter 6, I collected and analyzed three different kinds of data between June and August 2024[17]. In addition to analysing the data collected during the 2018-2019 fieldwork periods, I also gathered data from the subreddit /r/Singapore, newspaper articles, and official health advisories found on the NEA website. I did this to address a methodological weakness in my thesis, where insufficient and problematic data from social media platforms had to be removed and replaced with new data.

During my fieldwork periods from 2018 to 2019, I returned to Singapore to interview respondents who lived in smart estates in Punggol, as well as other stakeholders such as

[17] I explain the reason for this gap earlier in this chapter, in Section 3.2

industry practitioners, state actors and academics who had knowledge of the Smart Nation. In my conversations with respondents who lived in smart estates in Punggol, the original aim was to study how smart city residents engaged with their estates' smart and sustainable features. These conversations focused on how smart city residents engaged with aspects of their built environment in their everyday lives and did not include the haze as a topic. Upon my return from fieldwork, while listening through audio recordings and looking through my fieldwork notes, I realised that I had experienced two bouts of haze at the end of both fieldwork periods in 2018 and 2019. In the last two weeks of my fieldwork in 2019 particularly, I noted various cancellations and rescheduling by respondents due to the haze. Five respondents offered to do the interview indoors, in their homes. One of them explicitly called to ask me to come over to her home for the interview as she was uncomfortable with bringing her infant child out and exposing him to the polluted air. Despite not intending to do interviews at participants' homes previously, I went to the homes of respondents who asked to move the interview location during this period. When visiting respondents in their homes, I found that they all had air purification devices that they kept switched on. This, combined with the increase in posters regarding haze, the sale of face masks in pharmacies, and the increase in the number and use of apps addressing air quality, brought the issue of haze to the forefront of my experience with respondents at the time. This prompted me to investigate how smart city residents engaged with environmental issues like the haze.

As the data collection had to happen after the fieldwork ended, I gathered material from newspaper articles, official health advisories, and social media platforms. As the data collection method, data analysis, and data collection period are all different from the ones used in the 2018-2019 fieldwork period described previously, I will discuss these methods separately. In June 2024, I conducted qualitative content analysis on data gathered from Reddit[18]. Reddit is a platform where the volume of conversations around the haze correlated to the intensity of the discussed phenomena. During the worst years of the haze, 2015 and 2019, there were significantly more posts about the haze on Reddit than in 2013, 2014, 2017

[18] I previously collected data from Instagram and X (then referred to as Twitter) in 2022, but do not include this data in this thesis due to feedback on the quality and representativeness of that data. As the data has not been included in any way in this thesis, I have not included a discussion on its collection or analysis

and 2018[19]. As I intended to conduct content analysis, the large number of posts and comments made on the topic on this platform made it a suitable place to gather data.

The posts were all found on the subreddit /r/Singapore. This subreddit had 1.2 million members as of June 2024. I first did an open search on the subreddit using two terms, 'haze' and 'psi'. I chose to 'show all results', which generated 111 Reddit threads[20] from 2010-2024. I used purposive sampling. I had an element of choice over the sampling process and omitted threads based on three criteria: (1) If they fell out of the period of 2013 to 2019[21], (2) if they were a general thread that summarised the day/month/year (e.g. if they were daily summary threads part of the larger group of threads under '/r/singapore random discussion and small questions thread'), and (3) if the threads fell outside of the topic of the haze in Singapore. In total, 49 threads were excluded from the analysis. 36 threads were published online outside of 2013 to 2019, 6 threads were summaries of the day, month or year and not a specific haze or PSI-related post, and seven threads were outside of the topic of the haze in Singapore. After removing bot comments from the threads, I analysed 62 threads with a total of 1,649 posts and comments. These threads were retrieved on 10 June 2024. I used a purposive sampling method to gather this data on Reddit. Here, I had an element of choice over the sampling process, where certain threads were excluded from analysis due to the reasons stated above.

[19] This can be seen when an open search for haze-related threads on the subreddit /r/Singapore is done, and the results are organized by year. The results, when limited to threads around the haze and PSI specifically, are shown in Figure 3.
[20] Reddit threads contain both the original post and comments
[21] 2013 marked the worst levels of haze (according to the PSI) since 1997 (Velasco and Rastan, 2015). The haze returned every year between 2013 to 2019. In 2020, there were low levels of risk of severe haze due to the La Lina climate phenomenon, which brought wetter weather to the region.

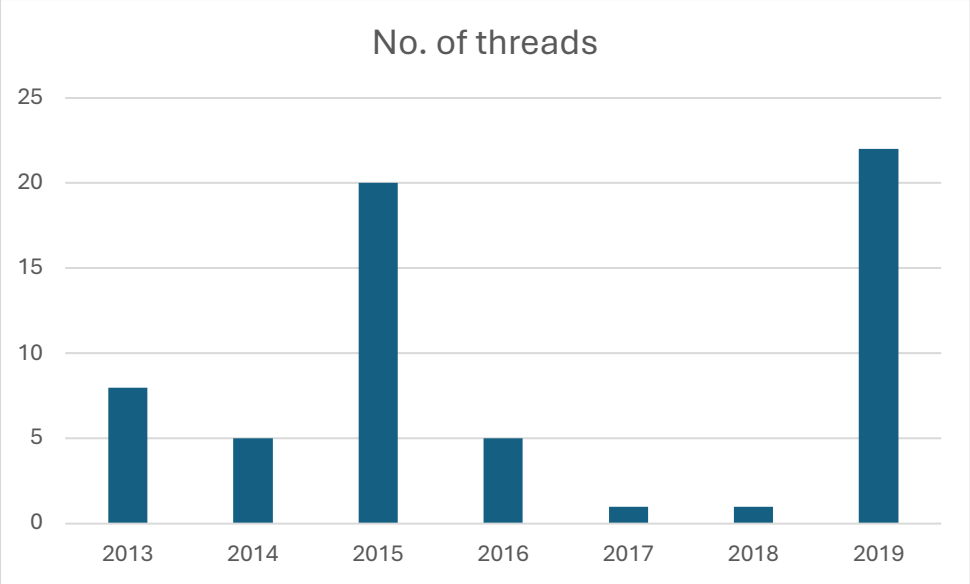


Fig. 3: Total number of Reddit threads related to the haze and PSI (2013-2019)

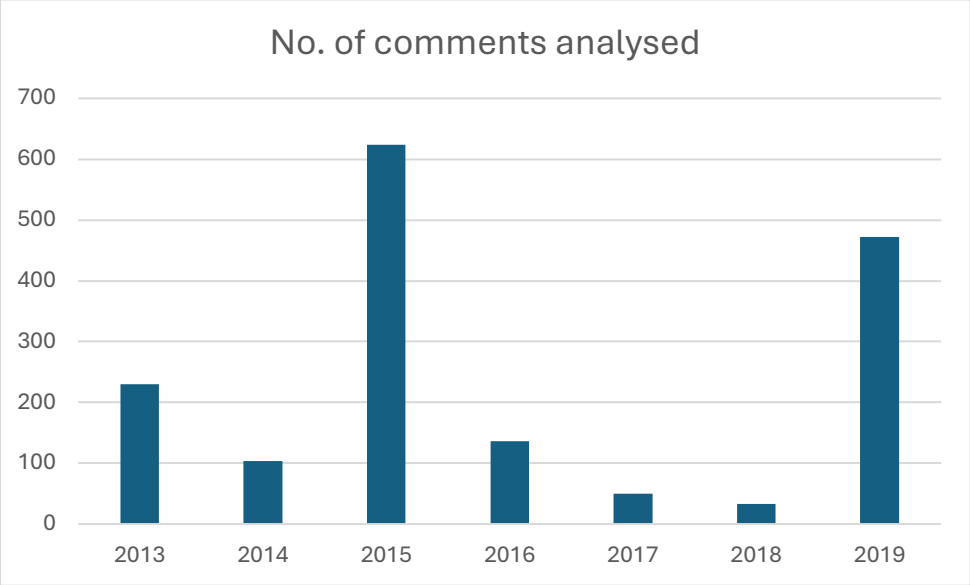


Fig. 4: Total number of Reddit comments analysed (2013-2019)

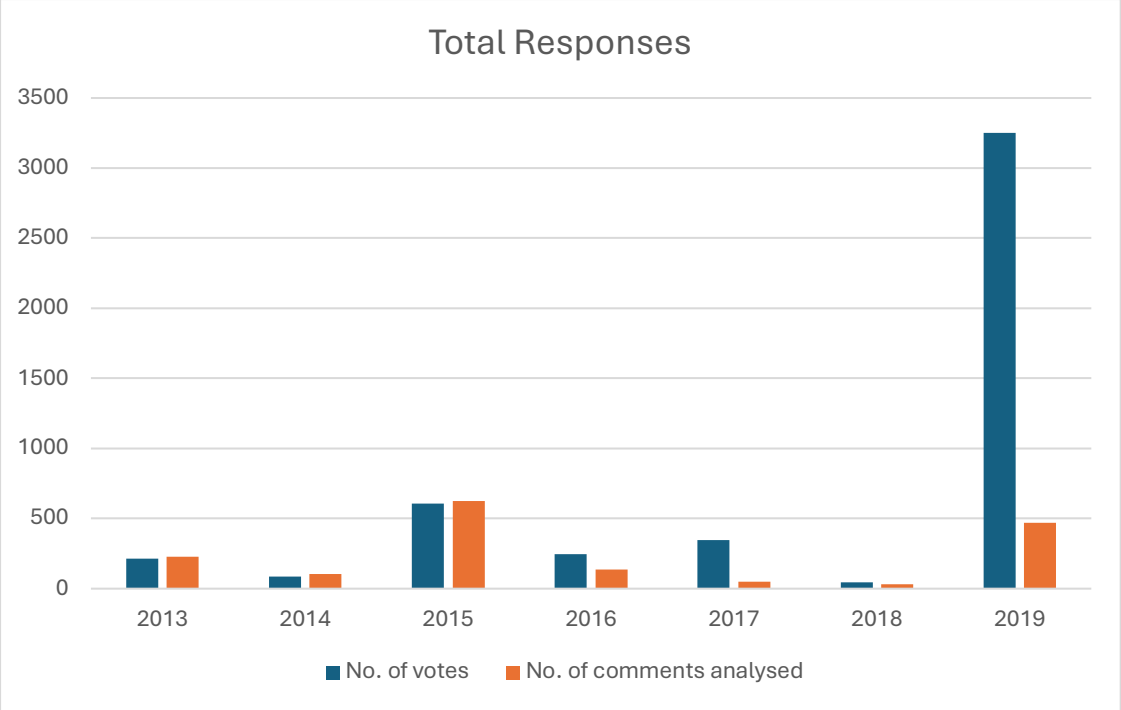


Fig. 5: Total number of Reddit responses (divided into votes and comments) analysed (2013-2019)

All the threads analysed were found on Reddit's public forum. This research did not require ethics approval as I did not collect personally identifying information and did not use human subjects. None of the identifying information of any user was gathered, as the posts and comments on the threads were anonymously coded and categorised. The anonymised list of Reddit users (RU) can be found in Appendix 6. The exact wording of entire posts and comments was also not used in this thesis – only parts of posts and comments have been quoted, with steps taken to remove identifying factors.

As the number of threads remained manageable and could be extracted manually, I did not have to use an external service to scrape the Reddit archive. The threads to be analysed were copied onto a Microsoft Word document after individual threads were put through OpenAI's ChatGPT (GPT-4). I used ChatGPT to clean up the data and not for any text reasoning and generation ability. I used the prompt "please remove all mentions of upvotes, downvotes, awards, and shares in this Reddit thread". This referred to removing text related to the last part of every Reddit comment, which looks like this:

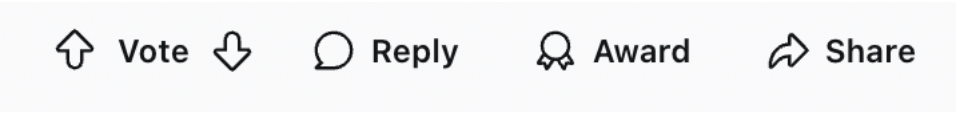


Image 7: Extra details in Reddit comments

ChatGPT would remove all mentions of ‘upvotes’, ‘downvotes’, ‘awards’, and ‘shares. This was helpful in removing text that would not be used in the analysis, and reducing the length of the transcripts produced from these threads. After the first prompt, I would then use a second prompt to check that ChatGPT had removed the indicated terms for the entire thread, asking it to “check that this has been done for the entirety of the thread”. I would then manually check the response from ChatGPT against the original thread online before adding it to the Word document. On this Word document, the individual comments were manually categorised according to the year, producing separate transcripts for every year between and including 2013 and 2019. All the Reddit data uploaded onto ChatGPT was deleted via the option to delete the entire conversation thread.

There are various ethical risks around using ChatGPT in scholarly work (Kim, 2024; Rao et al., 2023). Kim discusses how some of the risks around generative AI use include high similarity scores between works, and copyright violations. There are also anxieties “related to fabrication, falsification, plagiarism, and research integrity” (Kim, 2024: 101). However, have used ChatGPT in this project to remove additional details in online responses and not in any generative way. There are risks around the accuracy of the output of ChatGPT when the texts in the posts and comments have been ‘cleaned up’ through the removal of the terms indicated above. The second prompt and manually checking over the responses before adding the posts and comments into the transcripts aimed to reduce such errors.

There were two main entry points for bias here: The first was the online platform selection process and the second was the subreddit selection process. Firstly, this data collection method excluded all those who did not have access to online platforms like Reddit or would not post responses on this platform. Even with a significant number of members on /r/Singapore, 1.2 million, this method of communication is not accessible to most of the population. Marginal populations affected by the digital divide might also be doubly disadvantaged if their participation in these online platforms is further limited due to age, social networks, income level, and language medium. Secondly, the collection of the

subreddit data was not done through a software or program that directly connected to Reddit API to download posts and comments. This would have reduced errors in accuracy and human replication. I manually reviewed 111 threads. After omitting all unsuitable threads, I analysed 62 threads. If there had been more posts and comments, I would have had to use alternative methods. Additionally, my method of gathering data could only access the threads that would load online on Reddit, as the data was not accessed directly through the Reddit API. Online content on platforms like Reddit can be "ephemeral and dynamic" (Andreotta et al., 2019). Posts and comments can be transient. To limit the impact of this, the threads were accessed and collected on the same day for accuracy, 10 June 2024.

The newspaper data I reviewed consisted of articles that discussed the haze and haze data in The Straits Times. Although The Straits Times is not representative of all traditional media in the city, it is widely considered the 'newspaper of record' and is the most widely circulated newspaper in Singapore. Initially, I did an open search for articles on the 'haze', 'haze in Singapore' and the combination 'haze in Singapore' and 'PSI'. There were 2711 results for the 'haze', 1829 results for the 'haze in Singapore', and 464 results for the combination of the 'haze in Singapore' and 'PSI'. Out of these 464 articles, journalist Chew Hui Min wrote 30 articles, the newspaper's Science and Environment correspondent Audrey Tan wrote 25 articles, and journalist Lee Min Kok wrote 23 articles. The difference in the kinds of articles both Chew Hui Min and Lee Min Kok wrote, as compared to Audrey Tan, would be that while both Chew and Lee report on the general haze conditions and weather projections, Tan wrote five articles between 2015-2019 discussing haze data and the methodologies used to measure it. As the newspaper's Science and Environment correspondent, Tan wrote three different askST[22] articles on why NEA's readings differed from those from other indexes. While I discuss these five articles in Chapter 6, the intention is to show how critical discussions around the haze data, and not just reporting on haze data, could be found in traditional media sources in Singapore. The discussion of the articles in Chapter 6 is meant to provide context for the persistence of these discussions, rather than to account for an overall reflection of the issue in traditional media. The discourse around the inaccuracy of the official NEA data was not just limited to new media and online sources. There are clear limitations of using only three articles by a single journalist from The Straits Times. The discussion of the

[22] The Straits Times' askST is a section where journalists answer questions on everyday topics. It is unclear if these questions are specific questions from individual readers as little to no provenance is provided. In the askST section articles I refer to here, the journalists state that they are responding to "public opinion".

five articles in Chapter 6 does not represent a systemic media analysis of the ways in which haze data has been reported in the traditional media in Singapore.

I also included information from health advisories published by the NEA and the NEA website. As multiple health advisories are disseminated during each haze period, I used the advisory that contains the latest information (most recently published in that year) will be taken. I assume that the most recent advisory for each year reflects the most updated changes to the official haze data. The time period being studied begins in 2013, as PSI levels hit highs they had not seen in 16 years. Singapore experienced the worst haze levels between 2013 and 2019 (Velasco & Rastan, 2015).

5.4 Coding

The transcripts were analysed using qualitative content analysis. Delve, a cloud-based CAQDAS data analysis software, was used to code the transcripts. A codebook consisting of a small number of initial codes (refer to Appendix 2) was used to analyse transcripts. I did a content analysis of the comments under each post, indicating where there were:

- The sensory experience of the haze (consisting of the five senses, as well as experiences of heat or thermal comfort)
- Challenges to the NEA PSI figures
- Support or defence of the NEA PSI figures

One limitation of this coding was that specific bodily experiences were excluded from being categorised under sensory engagements, although they had sensorial aspects. Multiple comments mentioned ‘coughing’ and ‘sneezing’, which was related to the ‘felt’ experience of the haze. I did not, however, include this in the coding process as I considered these more indications of feeling unwell rather than a ‘sensory’ experience of the haze.

Additional codes were added in the coding process. The process involved multiple rounds of coding as codes were grouped into themes that allowed for interpretation of the threads from 2013 to 2019 and within the individual years. The codes were grouped into categories (refer to Appendix 3), their frequencies calculated (refer to Appendix 4), and their co-incidences identified (refer to Appendix 5).

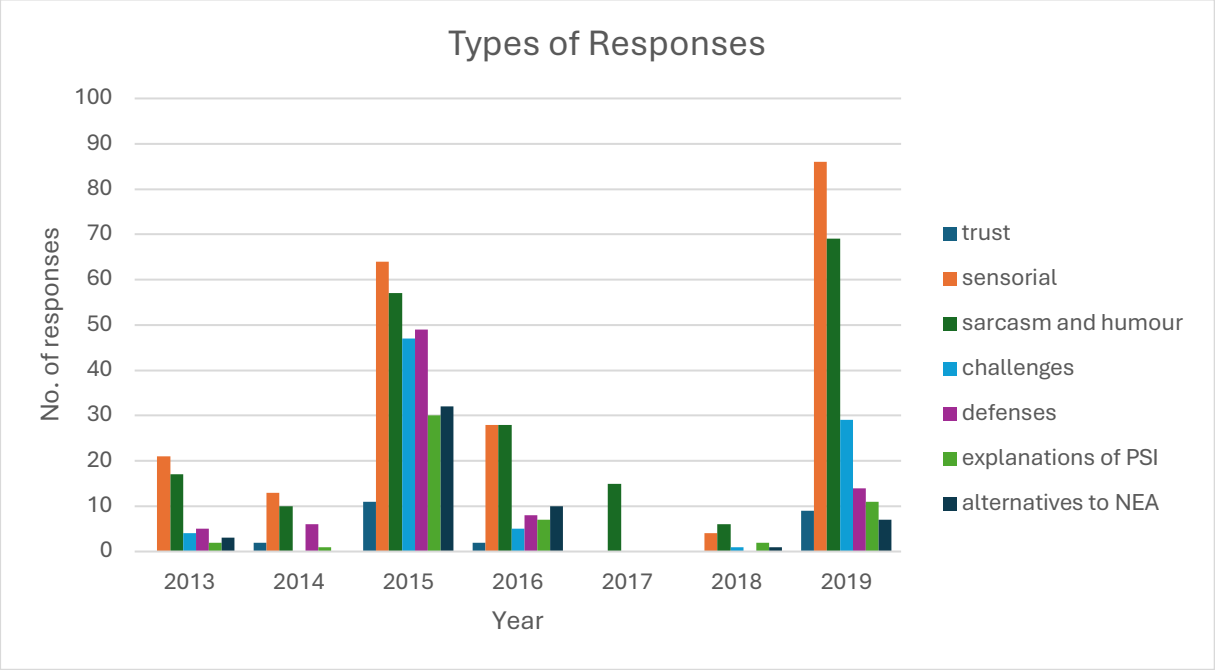


Fig. 6: Types of Reddit responses analysed (2013-2019)

While coding for the sensory experiences was fairly straightforward, with many of the same expressions of sensory engagement used across comments, coding for challenges to and support of the NEA PSI figures was more complicated. I could not depend on using only the initial codes for these two themes. The comments had to be analysed for tone as well. Humour and sarcasm emerged as common ways of expressing doubt over NEA's PSI figures. This was revealed when the comments were read in the context of the back-and-forth between users within the threads.

In the following sections, I will discuss my positionality, some ethical implications of this work, and the broader limitations of the research, which are not limited to those identified above.

6. Positionality

My positionality as a local Singaporean and female graduate researcher had implications on my fieldwork. Interviews, walk-alongs, and drawing sessions are methodological practices. As a researcher, I am a "practice-carrier" (Ropke, 2009) of smart cities and research

practices. I entered the field with expectations for what I would find. As a researcher with a pre-conceived conceptual and practical idea of what smartness might mean, I had an implicit bias that informed the kinds of reactions and responses I expected to get from respondents. Reflexivity was often difficult to maintain in practice. The use of reflexivity can be "multi-vocal, intersubjective and post-colonial" (Nencel, 2014: 75). The text then becomes a "co-constructed space that reveals the interaction between the researcher's assumptions and positionality and the voices, stories and experiences of the research subjects" (2014: 75). As much of ethnography is limited and informed by the researcher's positionality (Harding, 1992; Jacobs-Huey, 2020), it is thus important to explain the researcher's positionality in order to understand how access has been negotiated, and how the level of trust or involvement of their respondents was obtained. It also contextualises the kinds of information that is gathered from these respondents (Luttrell, 2000). Perfect reflexivity is unattainable. This has been recognised and discussed extensively within feminist studies (Rose, 1993) and should not be set as the goal of ethnographers engaging in reflexive practices. Therefore, researchers should continuously be reflexive about their positionality while acknowledging that their positions and implications are not static.

Being a Singaporean, my motivations for studying my home city and its transition to 'smart' came from my personal experiences in the city. Living in Singapore meant I was exposed to news, speeches, state initiatives, and messages around sustainability and the Smart Nation. This informed many of my biases, which often implicitly informed decisions I made during fieldwork. There were other implications of being local. Privilege of ease of access existed in some places and not others. As a local, I was familiar with some of the socio-cultural complexities and sensitivities of the local context. I found it occasionally helpful to have pre-existing social networks in Singapore – many interviews with industry practitioners, state actors, and academics were granted due to these networks. There was often a shared hesitation around commenting negatively on the state, perhaps due to concerns about the ways in which certain laws, such as POFMA[23], had been applied. My ethical obligations included consideration of these shared concerns. With respondents who lived in the smart estates in Punggol, however, the fact that I did not live in an HDB flat gave respondents the confidence to take on the clear role of guide and expert. This helped balance the power

[23] The Protection from Online Falsehoods and Manipulation Bill (POFMA), while not intended to restrict the freedom of expression of academic work, enacts some limits on what can be stated definitively as fact in the process of research, especially with regards to the Singapore state.

relations between our identities as researcher and respondent in those engagements. Abu-Lughod described how utilising her Palestinian-American background helped her engage reflexively with a dual positionality that made her better able to conduct research (Abu-Lughod, 2008). Saba Mahmood described something similar as a Muslim scholar who grew up in Pakistan and then did her fieldwork in another Islamic country, Egypt (Mahmood, 2006). This dual positionality created "the potential for a close relationship with her respondents whilst simultaneously leaving an open space for independent construction of their narratives" (Violaris, 2021: 65).

It is often linguistically challenging to fully capture the kind of English Singaporeans use in casual conversation within the confines of the standard English used in academic writing. Most Singaporeans speak Singlish. Singlish is a variety of English spoken in Singapore that includes elements of Chinese dialects (often Hokkien), Malay and Tamil. As a Singaporean, I found it to be beneficial to understand and speak Singlish. Respondents often spoke in Singlish, using colloquial terms to express what they were saying. Terms like 'bo-pian,' 'wah lao[24],' 'sian[25],' 'malas[26],' 'kampung spirit,' 'leceh[27],' and 'baik[28]' were all terms that came up in the transcripts. Most of these terms are Malay in origin, but 'bo-pian', for example, has Hokkien origins. These terms, used in specific syntax within Singlish sentences that the respondents used, were often meaningful in expressing their strong emotions about something. Speaking and identifying Singlish terms also helped me manually transcribe the interview transcripts, as well as analyse Reddit threads, which also contained a significant amount of Singlish.

Most of my respondents from the smart estates in Punggol were minority/Muslim women. This aspect of the project can be related to my identity as an Indian Muslim female researcher. I was aware that there were hierarchies of knowledge production that I was engaging in, especially with minority groups, when doing this research. It was necessary to represent them appropriately. Being female, I was also aware that some of the stay-at-home mothers I interviewed felt comfortable enough with me to do long walk-alongs, showing me routes they took with their children, often ending up in their own homes to carry on our

[24] From Teochew and Hokkien, usually used as an exclamation or interjection in speech
[25] From Teochew and Hokkien, usually meaning bored, tired, or sick
[26] From the Malay language, meaning 'lazy'
[27] From the Malay language, meaning 'inconvenient'
[28] From the Malay language, usually used to express agreement, means 'to like' something

conversations. I was granted the privilege of experiencing these extended, intimate interactions partly because of my shared similarities with these respondents.

There are opportunities and challenges as a native ethnographer. Positionality "reflects the position that the researcher has chosen to adopt within a given research study" (Savin-Baden and Major, 2013: 71). Some aspects of positionality can be culturally ascribed and therefore fixed, while others are more subjective and contextual (Holmes, 2020: 2).

7. Ethics

7.1 Disclosure of Positionality

I disclosed my positionality—as a DPhil student at Oxford, a government scholar, and a local Singaporean—to all respondents I interviewed. This disclosure happened via email, in my initial correspondence, and verbally when I met them. These details were also disclosed in all recruitment material I had used. Throughout all my engagements with respondents, I made my status as a researcher clear. It was challenging not to act as an interlocutor between state actors and the residents of the smart estates, however, as many state actors were interested in learning more about my conversations with the respondents who lived in the smart estates in Punggol, and vice versa.

7.2 Recruitment

My recruitment techniques for the interviews, walk-alongs, and participant drawing sessions involved posting calls for participation on my personal Facebook and Instagram pages. Sampling methods for the interviews encompassed several overlaps between three nonprobability sampling techniques, convenience, snowball and purposive sampling. I drew on my networks for advice and contacts to get in touch with industry practitioners, state actors, and academics.

The voluntary participation of respondents in the research was necessary. Participants were allowed to withdraw from the research at any stage—before, during, and after the fieldwork period. They were also provided with participant information sheets (refer to Appendix 7) and consent forms (refer to Appendix 8) prior to participation so that they could participate

based on informed consent. I also made the interview questionnaire available to respondents prior to the interview if they requested it.

The participant information forms provided information about the research, including:

- Details on what would happen if respondents agreed to take part in the project
- Details on how the data gathered from the project would be stored, and all quotes used would be anonymised, with all identifiers removed.
- Information on the publishing of the research
- Details on the funding organisations of the research
- My contact details and the contact details of my supervisor and the Research Ethics Committee at the University of Oxford
- Details on personal data protection rights

I did not give participants a time limit to reply to my request to interview them and reiterated in our communications that their participation was entirely voluntary.

7.3 Anonymisation and Data Storage

All respondent information was handled confidentially. All respondents were assigned a pseudonym in field notes, audio recording file names, and any writing or transcribing. These pseudonyms were randomly generated.

To adhere to ethical data storage guidelines, I deleted audio recordings once they were transcribed. I removed personal identifiers from transcripts and stored them in password-protected files and folders on my personal computer, which also required a password. Field notes were stored in physical notebooks that were only accessible to me. While most of the correspondence with respondents was from a secure university email, I communicated with a few respondents through WhatsApp. Their phone numbers were not used for other purposes outside of fieldwork.

8. Limitations

In this section, I will discuss some logistical and demographic challenges I faced and how they produced methodological limitations.

Firstly, one limitation of using the walk-along method in Singapore was the weather. Most of the discussion in scholarship that used the walk-along method have been centred in countries with colder or more temperate weather (Degen & Rose, 2012; Rose et al., 2010; Vannini & Vannini, 2017; Holgersson, 2016). There are fewer studies done in climates like Singapore (Mocnik et al., 2022; Loong, 2018). I found the heat and humidity to be a determining factor for how long the participants were willing to do the walk-alongs. It would sometimes get too hot to do the walk-alongs for more than five minutes. Thus, due to the weather conditions in Singapore and the fact that many of the common areas in the estates I was studying were located outdoors without air-conditioning, I occasionally rescheduled the walk-alongs to make sure they were comfortable for respondents.

Secondly, the research sample had demographic limitations. I interviewed predominantly young[29] residents of the Punggol smart estates, with most respondents between the ages of 21 and 35. There is a large body of work on smart cities and their impact on the elderly (Szewczenko, 2020; Battarra et al., 2018; Jurado & Salvachua, 2021; Woods, 2020; Chib et al., 2022) as well as children (Garau & Annunziata, 2019; Van der Graaf, 2020). However, most of the respondents who lived in Punggol were residents of BTO flats that they bought when they got married, skewing the area's demographics to favour a younger adult population. According to population statistics (Singstat, 2022), the median age in Singapore is 42.1 years. This was slightly older than the average age of the respondents in this project.

Item	Unit	Latest Period	Latest Data
Population and Population Structure (Mid-Year Estimates)			
Age Structure	‘000	2022	
Below 20 years	‘000	2022	788.6
20-64 years	‘000	2022	2,606.5
65 years & over	‘000	2022	678.1
Median age	Years	2022	42.1

[29] 35 years old and below is the official definition of “youth” in Singapore

Table 6: Population statistics (Singstat, 2022)

Additionally, I interviewed a disproportionate number of non-Chinese respondents. Respondents comprised a majority of Malay and Indian residents, who account for 22.5% of the citizen population (Singstat, 2022). This can be attributed to the nature of my social network. As I drew on personal social networks to recruit respondents who lived in Punggol, the respondents tended to be from a similar demographic. As I interviewed only HDB residents, the sample represents a demographic bias towards individuals who live in a particular type of public housing. HDB residents make up around 78.3% of all residents in Singapore (Singstat, 2022). Residents of condominiums and other apartments make up 16.5%, and those living in landed properties make up another 4.9% (Singstat, 2022). I also did not interview anyone living in rental estates. Furthermore, I did not interview non-citizens, including communities such as foreign construction workers who often worked to maintain these estates and domestic helpers who moved through them as part of their daily activities.

Lastly, there were methodological limitations in this project that emerged from the limitations of the methods chosen. The interviews of residents that lived in the smart estates of Punggol were in-depth and semi-structured. A more phenomenological approach was chosen as it allowed for the exploration of the world as it is experienced in an everyday way. The interviews with residents were used to study the smart city ways that some of them had little familiarity. There were instances where I was not sure how to effectively ask a question or express an idea in a way that would allow respondents to respond meaningfully. In addition to this, to gather data for Chapter 6, I did not engage in sensorial ethnography. Instead, I analysed threads on Reddit to try to understand the sensorial quality of the experience of the haze. As the chapter explores the sensorial experience of the haze, sensorial ethnography would have been a generative method to produce insights on this. Sensory ethnography attempts to unpack "taken-for-granted bodily practices, skills, experiences and tacit knowledge" (Calvey, 2021: 346). As a method that might have addressed the limitations of linear conversation, sensory ethnography could have generated data that I would not have been able to gather through other methods.

9. Conclusion

Harris (2007: 3) argues that there is no one type of knowledge about a phenomenon that is associated with one standard of practice. Knowledge can work in exclusionary ways, and due to this, there is a political charge to the methodologies we choose as researchers as they produce particular kinds of knowledge (Martens, 2012). This chapter outlines my methodological choices. Through a combination of linear and non-linear storytelling and verbal and non-verbal methods – which included in-depth, face-to-face interviews, walk-alongs, and participant drawing sessions - respondents were able to share their experiences living in smart estates and how engagements with smartness emerged through interactions with smart infrastructures, institutions, and discourse. By thinking ontologically about the smart city as relational, emergent, and lived, the dynamic and complex realities of these estates could not be reduced to their technological infrastructure alone. I also engaged in qualitative content analysis of Reddit posts and comments in order to explore the everyday affective experiences of smart city residents beyond these estates. The addition of Reddit data resulted from logistical, practical, and academic concerns that arose at the end of my research process. Although these posts and comments were not limited to those living in the smart estates in Punggol that I studied using other qualitative methods, they revealed meaningful and recurring behaviours around data practices, knowledge production, and political discourse in a smart city.

In this chapter, I have discussed the ontological perspectives underpinning this thesis's methodological choices. I specified the project's different physical and digital field sites and go through the different field methods in detail. I discussed the process of data analysis used for the different kinds of data gathered and go into detail about the process of gathering and analysing data from Reddit. This chapter also provided information on the respondents from smart estates in Punggol and the industry practitioners, state actors, and academics I interviewed. In addition to this, I discussed my positionality, some ethical concerns I faced during the project, and methodological limitations.

In conclusion, the methodologies chosen have been informed by the ontological perspective that the smart city is relational and an everyday lived reality. By understanding the smart city as inherently relational, I recognise it as an ongoing process shaped by dynamic interactions between technologies, governance structures, material infrastructures, state narratives, and the people who inhabit these cities. This relational view necessitated methods that could capture the complexities of these interactions, such as in-depth interviews and participatory

approaches. These methods allowed for the exploration of how different actors construct the everyday experience of the smart city. Additionally, considering the smart city as a lived reality required an emphasis on qualitative methods to produce insights into everyday life's individual and subjective experiences. Methods including the walk-alongs and thematic analysis of the responses on Reddit enabled a focus on how smart city residents navigate, interpret and emotionally respond to their smart environments on an everyday basis. These methodologies reflect the need to engage with both the material and affective dimensions of the smart city, revealing its complexities not just as a technical infrastructure but as an evolving, socially embedded space shaped by the many relationships that constitute it.

In the following three empirical chapters, I discuss and analyse the data gathered through the field methods, responding to the thesis's main research question. I study how smart city residents experience their surroundings affectively.

Chapter 4: The Affective Relations of Infrastructure

1. Introduction

The main research question of this thesis is: What kinds of affective experiences are characteristic of the smart city? To answer this, the thesis examines the practices through which the smart city's affective experiences become evident. This chapter explores the kinds of observations that can be made about everyday life in smart estates, focusing on the different affective experiences of residents. These experiences reveal relations between engagement and affect that are not fixed. They are dynamic, complex and involve a multiplicity of affects. In order to investigate this, I used methods that included noticing, observing and discussing the materiality of the estates with residents, who shared their experiences. Crucially, what emerged as significant to residents in their everyday lives did not align with my initial normative assumptions about what smart city residents 'should' care about. I assumed that a specific range of technologies within these estates would be representative of the smart city experience. This range of technologies included technologies I had read about in relation to the Smart Nation project such as solar panels, the pneumatic waste system, sensor lighting and surveillance cameras. This assumption imposed a discourse around smartness and sustainability on my respondents. After receiving feedback on this bias, it was then possible to identify instances where biases had emerged during interviews and walk-alongs. Cognizant of how these biases could have affected the responses from respondents, I have analysed the different affective experiences to highlight the dissonance between the kind of material engagements smart city residents cared about and what has been discussed in scholarship on smart cities and the Smart Nation project.

I focus on two types of infrastructural engagements residents have with their estates: the engagements with specific smart and sustainable technologies prompted by vernacular and perspectives I imposed, and the engagements with types of materiality within their estates that emerged more organically in conversation. Through exploring the different affective experiences on the ground, this chapter looks at how different affective experiences can be found in smart estates that make up part of the larger assemblages of the Singapore smart city.

Locally, smart urbanism has been applied through the state's Smart Nation project, a public-facing initiative to transform the city using technology. One of the ways in which this has materialised on the ground is through the material enactment of smart estates in Punggol. Some estate-based initiatives noted in the online material on the Smart Nation project include smart technologies such as sensors that can collect and analyse data and energy-saving technologies such as energy-efficient LED lighting with motion-sensor capabilities. By exploring how residents experienced these technologies in their estates, I discuss how engagements with the materiality of the estate produced different kinds of affective experiences. I expand here on Yeo's (2023) work on the everyday experiences of residents in Yuhua, a retrofitted smart estate in Singapore. Yeo argues that "smart urban interventions cannot be understood through a dichotomous perspective that reduces their impacts to either "good" or "bad", "positive" or "negative"…[these] experiences…are often a mixed bag of both" (2023: 13). Through exploring experiences on-the-ground, this chapter looks at how there are tensions resulting from affective experiences of the application of smart urbanism[30]. These smart estates are entangled in affective circulations in the larger smart assemblages across the city that make up the Smart Nation. I focus on two types of infrastructural engagements residents have with their estates: the engagements with specific smart and sustainable technologies prompted by myself and the engagements with types of materiality within their estates that emerged more organically in conversation. This distinction is made to limit the impact of normative judgements around how smart city residents should engage with smart infrastructure. Instead, I draw on the respondents' experience of Punggol's smart estates to understand on-the-ground engagements with smart infrastructure.

In this chapter, I explore what these engagements look like and how these engagements form different affective experiences that offer insight into the often uneven and complex localised application of smart urbanism. I explore two main affective experiences: the ambivalences around smart technologies and pilot tests. Secondly, I study the tension between the desire respondents express for both green spaces and urban development that make living in Punggol convenient. These affective experiences reveal some of the tensions and paradoxes of smart city experiences. I show how they result in a "mixed-bag" (Yeo, 2023) of feelings to emerge on the part of the smart city resident. By investigating these emotions and

[30] For a detailed discussion on the paradoxes of the ideology of smart urbanism, see Kong and Woods' 2018 paper

affectivities by specifying them beyond their ambivalent nature, I identify what this "mixed-bag" can consist of. Here, I draw on work on ambivalence that discuss ambivalence affectively by breaking it down into aspects that move towards positivity and others that lean more towards negativity (Wilson & Anderson, 2020). This allows a closer exploration of what makes up these ambivalent affectivities and what else circulates with ambiguous affects. In this chapter, I do not study the individual-technological engagements in specific smart experiments or situations[31]. Instead, I am using the everyday as the site of smart interventions (Yeo, 2023). As explained in the next section, this site will consist of multiple smart estates in the Singapore neighbourhood of Punggol.

2. The Smart and Sustainable Estates of Punggol



Image 8: Fieldwork photograph of the Punggol Edge estate

Multiple estates within Punggol have been deliberately designed to be smart and sustainable. These smart estates are integrated into the state through the HDB Smart Hub, which collects

[31] For work on this, see Ho's 2017 paper on smart governmentality, where he observes individual- technological engagements in hackathons and ageing-in-place initiatives

and brings together multiple sources of information, including real-time data on the energy usage of common services in HDB estates. Networks of sensors collect data and information on estate conditions such as temperature and humidity so that urban planners can better understand the needs of residents in certain areas. Smart technologies are also used in automated waste collection systems. In this section, I focus on the types of infrastructural engagements residents have with specific smart and sustainable technologies that were prompted by perspectives I imposed through my questions, as opposed to aspects of the estates that emerged more organically in conversation with respondents.

2.1 Solar Panels



Image 9: Fieldwork photograph of solar panels on top of estates, seen from opposite block of flats



Image 10: Fieldwork photograph of solar panels on top of the estate, as seen from a lower floor of the same estate

The installation and operation of solar panels in HDB estates is the main objective of HDB's Solarnova program[32], which is part of Singapore's transition to clean energy. Launched in 2014 and headed by the EDB, the project aims to increase the number of solar photovoltaic (PV) systems in Singapore through private-public partnerships. The Solarnova program is an example of a "whole-of-government" effort led by one agency, the EDB and deployed through the purview of another, HDB[33]. Additionally, the Solarnova program is a project that began experimentally, with a successful pilot test in Punggol in 2016. This led the way for all future HDB blocks to be built with solar-ready roofs where feasible. Solar-ready roofs and the retrofitting of older estates, which began as a 'test' in 2016, have now become a permanent feature of these neighbourhoods.

[32] A main site of this push towards solar energy can be seen in HDB, where all new public housing blocks with at least 400 sq m of open roof space will be designed with solar-ready roofs. This is part of the HDB Green Towns Programme, which was launched in 2020 and aims to bring sustainable living to all existing HDB towns by 2030. Power generated by solar energy is currently used to power common services, such as lifts, pumps, and lighting in common areas, potentially reducing carbon emissions by 132,500 tonnes each year (Co, 2020)

[33] In the case of HDB, it is a statutory board under the Ministry of National Development, which the Urban Redevelopment Authority also sits under. The URA is significant to the HDB not only because it largely deals with the leasing of land, but also its key role in developing and communicating urban planning directives to the public. With each evolving model of urban planning (e.g., "eco", "sustainable", "integrated", "liveable", "smart", "lovable"), the site of much focus remains HDB estates. Thus, HDBs can be thought of as one of the main sites of state power. They are the physical and material spaces that express shifts in policy or state priorities, which directly impact the ways in which these estates are planned and developed.

During walk-alongs with residents, I asked questions about the smart and sustainable features of their estates that I had read about online and in newspaper articles. I was prompted to be more reflexive later about my assumptions of what features should or should not be important to respondents. I had assumed solar panels would be an important smart and sustainable feature in these smart estates. Solar energy was, and continues to be, a significant part of the state's strategies to reduce carbon emissions, as outlined in its Sustainability Blueprint. Solar energy had also been included as part of the goals of the Smart Nation project in its mission to build more energy-efficient housing estates. In addition to its importance in policy, solar energy entered public discourse after the liberalization of the energy market in 2018 sparked interest in domestic uses of renewable energy. This can be seen in the EMA's report on solar energy, which indicated a sharp increase in domestic solar panel installations since 2017 (Energy Market Authority, 2024). My expectation that people would care about these solar panels determined the questions I initially asked in interviews and the kinds of responses I received.

In this section, the discussion of some of the affective experiences of residents of these smart estates originated from conversations that initially narrowly focused on certain pre-determined features. This narrow focus limited responses that might have otherwise revealed other insights about the estate. My assumptions about the significance of the Solarnova project to both the Smart Nation project and the respondents foreclosed discussion of other important infrastructures in the residents' everyday lives. I had assumed that the logic that underpinned the infrastructural project of the Smart Nation was consistent across the other political, socio-cultural and spatio-temporal aspects of life in the smart city. Here, there were normative notions of the 'correct' response or acceptance of the smart urbanism promoted by policy. I clarify this here, in order to provide some context for how my assumptions around the Smart Nation project informed the lens through which I viewed residents' responses. These assumptions prescribed a version of smart that contributed to the observation and exploration of versions of smartness that fit that mould. This limited definition of smart was consistently challenged by respondents, especially in discussions on how Punggol was depicted as 'smart'.

Calvin, a Chinese man in his early twenties, was particularly interested in discussing the definition of 'smart'. He started our interview by asking for my definition of 'smart'. In our discussion, he suggested several reasons Punggol did not "feel that way".

> “Smart in terms of what? Traffic layout? Architecture? So they just organise the roads and call it "smart town"? Cos Punggol, the road size is very predictable; it's just one straight line that goes all the way across. It's like New York, it's like a grid I guess. If you call that a smart town, sure.” (Calvin)

When discussing things like sensors and surveillance, including other kinds of data collecting technologies, Calvin asserted that “those are the things that are back-end smart…for residents right, they have no idea, cos you don’t see”. Here, Calvin challenged the assumption that Singapore’s label as a smart city was something to be taken uncritically. He also emphasised the role of infrastructural (in)visibility in developing consciousness about the smartness of a site. Without smartness in these smart estates being obvious, Calvin argued that residents would continue to “have no idea” about what ‘smart’ consisted of.

One way I observed the “back-end smart” as potentially visible to residents of these smart estates was through the smart and sustainable features that could be seen and materially engaged with in the estates’ public spaces. Another Chinese male resident, Nathan, who was in his fourties, expressed an interest in environmentally-friendly practices and talked about how “100% [of his neighbours] would not know” about the solar panels installed on their roof. He said, “I think they will notice it, but they will not go and ask about it: what is that? So, a typical Singaporean or HDB-dweller will think it’s a water tank. Or they know it’s a solar panel but that’s none of my business, because…it doesn’t do anything.” He reiterates this lack of engagement with his estate's smart and sustainable features, despite his general interest in the area: “I don’t feel it, it doesn’t translate [into] anything to me, so why do I go out and find out more?”

Occasionally, the discussion of solar panels turned into a conversation about money and living costs. The abstract idea of renewable or solar energy gets translated into something tangible through cost. This sentiment was reflected by another resident, Victor, a Chinese man in his fourties:

> “If they were to be using this to be powering up the blocks in certain areas, and they don't translate the savings to us, then I think it's a bit weird because we're still paying for the utilities, the conservancy charges that we pay to town council...I think if we

> allow it to be built on top of our block, shouldn't we be entitled to a certain percentage, for being green you know?" (Victor)

His frustration was aimed at the state, and he questioned if the state was "[hiding] the possible technologies that are available to reduce spendings…[while] benefiting [them]self, but…not benefiting the citizens". Victor here expressed suspicion and a sense of being wronged by the state. It is interesting to consider these strong feelings when seen together with his criticism of smart infrastructure below.

> "Nobody knows! It's a fantasy place, and then you hear the PM talk about what we have done, and it's like, what? Are you sure you did that? Nobody knows." (Victor)

While Calvin's criticism of Punggol's status as a smart estate included criticism of how "back-end" a lot of smart initiatives were, Victor's criticism above suggests that this smart infrastructure, while invisible to residents, might not even exist. The term 'fantasy' represents a vision that is idealised and somewhat detached from tangible reality – a crafted utopia. In discussing the smart city as a 'fantasy place', Victor described the city as an aspirational and utopian vision, imagined to promise seamless, efficient and technologically advanced urban living. However, as smart infrastructures are often physically hidden, there is a disconnect between what the state has communicated about the Smart Nation project and the everyday experiences of its citizens. 'Smart' as a label had to be materially evidenced to be believed.

> "What does it translate [to]? Nothing. If it does translate to some sort of rebate for us, then yes, we will get to notice it, and we might even do more - so why not?" (Victor)

For Calvin and Victor, there was a sense that the smart city was a construct that could exist 'out there', but not where they were. The invisibility of the infrastructure contributed to the perception of the smart city as a place built more on ideals and narratives rather than tangible, lived, visible changes. The abstract promise of the smart city required translation in order for it to be knowable to them. Even then, the tangibility of the promises it makes were not static. Nathan went back and forth when asked if having solar panels in his estate matters. Initially saying that "personally, yes", he would care about the panels whether or not they had an impact on him, he considers the question for a while and says the below.

> "If it translates to rebates, I don't mind. If it translates to conservative rebates, I don't mind, you know, I'll be happy, to have my block to install all these technology stuff, I could be proud - look, I live in an eco-block." (Nathan)

The emotional combination of pride, originating from his interest in environmentalism and efforts at practising sustainable behaviours like recycling, and also frustration at the lack of tangible cost savings suggest that even for residents who consider themselves supportive of environmentalism, there are still complex feelings around the smart and sustainable features in their estates. This is because there are additional material conditions that affect their reception that move beyond the ideological. Although the 'translation' to cost savings is one way the smart city becomes more than an abstraction, the material benefits are not consistent, continuous or permanent. Therefore, the feelings the 'translation' to cost savings foster in respondents, and the visibility it brings to the smartness in the estates, are constantly shifting.

The disconnect between the visible and invisible, tangible and intangible, highlights how smart cities can be abstract and conceptual spaces, where what people feel about the city is shaped more often by discourses and representations rather than something observable. Calvin discussed how his indifference to the smart city often stemmed from how its materialisation did not affect him. He emphasised to me that this was a shared sentiment.

> "If it affects you then you care. If it's just there, it's hard to relate, hard to care...people will start caring if there are direct effects." (Calvin)

As residents interact with the idealised version of the city, they affectively engage with it based on relations like scepticism or unease, as the invisible workings of the city remain inaccessible. However, when visible and tangible aspects emerge, individuals might feel differently about the smart city, oscillating between negative and positive perceptions. Ambivalence is an affective construct that can describe how many of the respondents I interviewed felt. While some residents expressed feelings that leaned heavily into negative emotions, others had recounted experiences that encouraged their ambivalence towards more positive affects. One of these positive affects was a sense of pride in the features of the estate, which often led to positive emotions being associated with living there. This can be seen in how Tina, a young minority/Muslim woman in her twenties and a relatively new resident of Punggol who had only lived there for less than five years, talked about solar panels in her

estate. In our conversation, she offered to show me the panels. When asked how she discovered the panels, she said she "went up to the highest floor and…saw that there were solar panels". Tina went on to discuss why she goes up to the highest floor of her estate:

> "My top floor is fun. That's why I like this place…it's like a garden…you can just sit there and chill and have a picnic. Oh, there's a lot of people always come up to this and they will just have like a BBQ, picnic, just chill out. You know [how] people chilling below the block right? For this estate it's upstairs…[which has a] view." (Tina)

Tina had lived in Punggol for less than five years, and most of her concerns were about socialising with her neighbours and finding a sense of belonging in the estate. She found it difficult to socialise with people in the estate and contrasted her lack of interaction in Punggol with the many friends she made in her previous neighbourhood, Ang Mo Kio. She expressed more positive emotions when describing some of the infrastructural aspects of her smart estate. Tina felt proud of her estate's rooftop garden and revealed that she had noticed the solar panels on her roof while enjoying her time in the garden. At the beginning of our conversation, she had talked about how she did not consider her estate smart or sustainable "at all". However, her recollection of her time in the rooftop garden, a sustainable feature in her estate, encouraged her ambivalence toward more positive affects. This suggests that the smart and sustainable features can be affectively experienced not just as a type of smart technology purposefully installed in these estates; instead, they exist as part of the larger landscape, contributing to often shifting ways that residents feel about them. The affectivities of smart and sustainable features can be explored through how they are part of the assemblages of the estate as a whole and not in their specific engagement with residents.

Another young, minority/Muslim woman, Humairah, who had lived in Punggol since childhood, brought up features of her estate on her own in our conversation. She talked about having read newspaper articles about the kinds of smart estates that were being built and how the Punggol Digital District was being developed.

> "I mean, we did see some developments over the years. We have a few HDB blocks that run on solar power…You can actually see it. I think it did come out in the news quite a long time ago. And also, we have an increase in our parks, there's like so many

parks that are connected to each other. And we have Coney Island. I think they kind of revamped the Punggol Beach area." (Humairah)

Humairah talked about the smart and sustainable features of her estate as part of a larger neighbourhood development. Humairah added, "I think we're going to witness more", suggesting that she anticipated more change. The unpredictability of constant change and their estate being "in the process" of becoming had also been brought up by respondents who discussed their experience with pilot tests and trials that were held in Punggol. These tests and trials were considered 'experiments' in order to "recognise their often tentative nature, the sense of testing or establishing (best) practice that frequently accompanies their development, and how they are used as a means of supporting or contesting knowledge claims and discursive positions" (Bulkeley & Castan-Broto, 2013: 363). This tentative nature, however, combined with a lack of transparency on the results of the experiments, impacted how individuals felt about the experience of being involved in these tests. This, in turn, affected how they felt about their estates.

2.2 Pilot Testing

In 2003, Singapore's Economic Review Committee revealed its aim of positioning Singapore as a "Living Lab" in which they aimed to create, test, commercialise and deploy innovative ICT-based solutions. Ideally, this govern-by-experiment approach (Bulkeley & Castan-Broto, 2013) would produce "living labs" (Cardullo et al., 2018) responsible for testing and developing urban solutions. The sustainable and smart infrastructures and urban planning projects in Punggol exist within the larger HDB project around sustainability and smart that involve older estates and various other test-bed estates, where pilot programs and experimental tests are carried out consistently[34]. These pilot projects, testbeds and other experimental sites are part of Singapore's development as a 'living lab', which includes improving Singapore's capabilities to allow both local and foreign companies and researchers

[34] 'Greenprint,' an initiative under HDB launched in 2012, focuses on test-bedding these retro-fitted features in older estates such as Teck Ghee and Yuhua. Under the 'Greenprint' framework, HDB intends to "extend the concept of green and sustainable lifestyles beyond Punggol, to build Green Neighbourhoods, Green Flats, and Green Communities" (Housing and Development Board, n.d.). There have been various other efforts at "enabling a culture of innovation & experimentation" (Smart Nation Singapore, n.d.). In 2019 alone, various trials, some of which have been considered to be key milestones for strategic national projects, were launched. Under the 'Smart Nation Sensor Platform', the Lampost-as-a-Platform trial was launched. Under 'Smart Urban Mobility', trials of on-demand autonomous shuttles, autonomous buses, on-demand public bus services, and hands-free ticketing technology were all launched.

to develop, prototype and pilot their technological solutions. In Minister Vivian Balakrishnan's speech in September 2017 at the 2nd Raffles Dialogue on Human Well-Being and Security, he stated that while Singapore "will never have a monopoly on ideas", where it can play to its strengths is "that [it is] already ahead as far as the deployment of infrastructure is concerned, and [it] can make Singapore a living laboratory for new ideas, prototypes, and proof-of-concept" (Smart Nation Singapore, 2017). This emphasis on developing conditions for experimentation and innovation through smart governance has been conceptualized by scholars as a kind of "governance by experiment" (Bulkeley & Castan-Broto, 2013). Thus, the sites that host these experiments have political implications (Dowling & McGuirk, 2022). Under this type of governance, experimental sites are set up to solve issues and achieve certain outcomes that are often state-directed. Even though state initiatives heavily lead these sites, scholars argue that there is also the opportunity to explore unintended and unplanned outcomes (Bulkeley & Castan-Broto, 2013), problematising the top-down nature of 'government-by-experiment'.

In my interviews with residents, two respondents talked about being in constant "pilot mode". Victor, a resident of HDB's first eco-estate, Treelodge@Punggol, described how the estate was part of various pilot projects. He discussed projects involving the use of separate recycling chutes, and more recently, a pilot trial for utility monitoring devices. These devices helped him and his family track their water, electricity and gas use. He said, "I guess it's interesting, but like I said, it was just a pilot ah… [there are] a lot of the trials and stuff". Victor went on further to question the purpose of these pilots below.

> "I guess to the wider public, it's like so you conducted this trial, and then you're not rolling it out on a mass scale, it makes people wonder…and because you do not tell people what's going on, what's the results and stuff, so they will take it as okay, you're not rolling it out because it's not satisfactory." (Victor)

Here, he reveals how the experimental feedback loop is not closed – residents have little sense of what the tests they participated in have revealed. Due to this, there was often frustration, which he was candid about.

> "There are many pilot tests but not much follow-up or follow-through to engage residents in using technology consistently - it's not like they go back and fix it, think

about how to make it more efficient, and then roll it out again. So it does seem very experimental." (Victor)

Victor expressed how the tension between the present reality of smart city living and their aspirational futures was being experienced through unpredictability. This unpredictability brought with it affects such as anxiety, doubt and frustration. The absence of transparent communication created ambiguity over the testing process, where the potential benefits or risks of the new technologies were not clarified. This uncertainty was compounded by the inability to gauge the impact of these technologies on the everyday life of smart city residents. Pervasive uncertainty reflected the gap between the state's technological ambitions and the lived experiences of those involved in these experimental interventions.

A Centre of Innovative Cities (CIC) researcher, Natalia, affirmed that these pilot programs have not resulted in long-term change. She studied the landscape of innovation in Singapore and discussed how these pilots have had limited impact on Singapore's capacity as an innovative city. She revealed that there had been "serious considerations" about how Singapore benefits from many "inputs" into its innovation ecosystem but suffers from producing little "output". This was unlike other countries like India, where there is far less "input" available to innovators, with more "output". An energy expert, Walter, from an international financial institution, expressed a similar opinion. He said that Singaporeans are 'smart subjects' in terms of how "forward-looking they are, [but] not in innovativeness". Here, 'governing through experiment' is not a unitary process as it not evenly experienced and does "not…[go] uncontested" (Bulkeley & Castan-Broto, 2013: 367).

Paul, a senior civil servant who worked on climate change, discussed how Singapore test-beds "a lot in urban planning and water" and is an example of a "nimble system that works". He emphasised that this was the system's strength and what had allowed the city to emerged as a major exporter of urban solutions. Not all experimental processes are necessarily processes of learning with an adaptive framework that facilitates open-endedness (Evans et al., 2021). While the respondents involved in these tests expressed frustration and powerlessness over the uncertainty of the experimentation process, there are other stakeholders that benefit from these processes more directly. Victor recalled various names of companies he knew of that would conduct experiments in energy efficient and renewable energy solutions in Singapore but stated that Singapore's renewable energy market was "too

small" for "solutions to work here". These experiments by foreign private companies developed solutions that were not applicable to Singapore and would not benefit those involved in the tests here.

These experiments then, across various sites of the smart city, involve fragmentary and spontaneous emergences of power. They change the nature of the political space of the collective in a different way than that identified in Bulkeley & Castan-Broto's 2013 paper. The authors argue that political spaces developed through experiments become more democratic and can allow smart city residents to be more agentive. Instead, residents in Punggol who were involved in these experiments felt like public interest was not being considered appropriately. Victor, for example, felt like the state-led experiments followed "a weird system". This system was "half in a pilot mode, half on a commercial level, yet…are not given a better, proper green light to go out of pilot mode and into commercial [use]". Another smart estate resident, Nathan, discussed how the lack of inclusion of residents post-trial "makes people wonder" about the outcomes of these interventions. He explained how "because [the state does] not tell people what's going on…the results and stuff, [people] will take it as okay, you're not rolling it out because it's not satisfactory enough [and] it's failed for whatever reason". Whatever the reason – "maybe it could be that the trial was a success but it's just that uh, certain technologies right, to have mass market adoption is actually very expensive", Nathan remarked that the lack of transparency had created an atmosphere of uncertainty in these estates around the trials. The commercialization of smart technologies involved state-led pilot testing. The introduction of private interests in these estates led to increased anxiety around the experimentation process. The unpredictability of whether the smart estate residents had access to this anticipated future involving these technologies that were being tested, and the solutions that were being developed added to the emotional complexity of these tests.

Ambivalence emerged in the smart estates studied, where smart and sustainable features had been introduced without requiring resident engagement, buy-in or participation. Many residents used the colloquial Hokkien term for ambivalence, "bo-pian," to describe their feelings about living in their estates. This term translates to 'no choice' but also refers to feeling 'indifferent'. Below, Fathin, a minority/Muslim woman in her 30s, and Nathan both use the term 'bo-pian' to describe their ambivalences around living in the Singapore smart city:

> “I think in Singapore, it's a 'bo-pian' situation; if the direction is there, then bo-pian, you just have to go through there. But of course they wouldn't be that selfish to not have any assistance for the elderly you know?” (Fathin)

> “Nobody knows…you hear the PM talk about what we have done and it's like what? are you sure you did that? Nobody knows. What does it translate [to]? Nothing. If it does translate to some sort of rebate for us, then yes, we will get to notice it and we might even do more - so why not?” (Nathan)

Although insufficient by itself to account for how residents relate to the state through smart infrastructures, looking at how ambivalences like the feeling of ‘bo-pian’ can account for the ways in which affects get entangled. These tangles of ambivalences do not represent fully developed ideologies – they do not have to “await definition, classification, or rationalisation before they exert palpable pressures and set effective limits on experience and action” (Williams 1977: 132). Their pre-emergence give significance to worldviews and feelings not fully felt or developed but lurking – which describes the way respondents conceptualised their often fleeting and shifting sense of agency within their estates.

In the middle of our interview, Nathan lamented, “What can I do? Just keep quiet”, almost as a comment rather than a response during our discussion about the state. He later stated, “You can’t do anything”. In addition to this feeling of powerlessness, respondents often practiced self-censorship by pointedly prefacing their views with statements like “I’m not against the government” and “I don’t want to be political”. Perhaps this was so that what they said would not be inferred as being political. Anderson (2016) discusses Fisher’s work in Capitalist Realism (2009) and how the ‘sense of inevitability’ that “infuses multiple spaces of neoliberal restructuring and, at the same time, connects those spaces…[is a] sense that is present through the absence of the imagination of alternatives and is (re)enacted in resigned or fatalistic claims that, whether desirable or not, capitalism is the only realistic system for the organisation of today’s economy” (Anderson 2016: 747). There are parallels to the way this ‘sense of inevitability’ is described, and how the feeling of “bo-pian” was expressed by respondents.

These smart and sustainable technologies that have been implemented in a heavily top-down way can be perceived as simultaneously beneficial and alienating to respondents. Respondents expressed mixed-feelings – excitement, pride and frustration all emerged in response to these technologies. Their lack of involvement in shaping their built environment created a complex emotional landscape that reflected the tension between the ideals of smart urbanism and its lived realities.

3. Unhelpful Solutions: 'Smart' Taps, Laundry Machines and Car Sharing

To understand how the material engagements between smart estate residents and smart infrastructure produce affects, observing the frustrations residents had with technologies installed by the state was insightful. These affects resulted in practices of smartness that often did not follow the "normative notions of 'correct' use promoted by policy" (Ozaki & Shaw, 2014: 594). This can be seen in the actions of respondents that expressed frustration and annoyance about smart and sustainable features in their estates they considered unhelpful. A new minority/Muslim mother in her twenties, Zareen, talked about how she "[didn't] know whether it's "smart" but…[there was a] filter for the washing machine" that she disliked. This was a new smart and sustainable feature introduced into her BTO estate. The filter, however, was "really slow", leading to Zareen removing the device. She described some of the issues with the filter and how other residents in her estate were also looking for ways to remove it.

> "It takes very long to fill up! And then I feel like it takes a longer time right, so it uses higher electricity. So eventually I told Irfan (her husband) to remove it. We were actually googling [on] how to remove [it]. Because our project's FB (Facebook) also [had] people asking each other "how to remove"...so I'm not sure whether it's smart." (Zareen)

In this conversation, we were joined by a new Punggol resident, Sharon, a Chinese woman in her twenties, who had been longtime friends with Zareen. She also mentioned removing the filter because of how long it would take to fill the washing machine. Additionally, Sharon did not think this feature could help them reduce their household bills. She mentioned the amount of electricity used as possibly being higher, as the washing machine took more time to operate. Here, the filter, a new technology introduced into the homes in the smart estate, was perceived as unnecessary and electricity-intensive. Instead of solving an existing problem, these filters were thought of as creating new problems. This led to respondents removing

these features instead of using them. This led to them feeling a sense of disconnection from the broader Smart Nation project. Rather than fostering a sense of inclusion and empowerment, these features represented the mismatch between the advanced technologies being introduced through the project and the practical needs of smart city residents.

Victor recalled how new water-saving basins had been installed into units in his estate. He explained how they worked:

> "When you flush, the water will come from a pipe and fill the tank, so instead, there is a period where this new fresh batch of water comes out from the small little sprout before it goes to the tank. I guess that's something very innovative." (Victor)

He recounted how his neighbours had removed these basins. So many of them removed these basins that there were online pages where people who collected them could buy them from these residents. Victor, however, did not remove his basin. He reasoned:

> "Besides the actual cost to change it, I felt it was something tangible that could translate into cost savings. Because instead of you having to go to your tap to wash your hands, you can wash your hands there, you don't have to waste extra water. There are some cost-savings." (Victor)

When asked if he had seen a reduction in his water bill, Victor said that he did not know if it did in fact lower his bill, "but at least psychologically, [he saw] that [there could be] cost-savings." Ho (2017) criticised the outcomes of smart interventions, arguing that "the [limitations] of such smart interventions [are that] they are stunted by the neoliberal-developmental logics of the state, thereby facilitating authoritarian consolidation in Singapore" (Ho, 2017: 3101). Bulkeley & Castan-Broto (2013) discussed moving away from looking at institutional accounts of government to those that consider governing a process, where what is studied is how "power is conducted…[and] the critical role of the manifold sites, techniques and practices through which conduct is shaped" (2013: 363). Here, both authors suggest that power be understood through a Foucauldian lens of biopolitical power. Through discussions with respondents, however, multiple other types of fragmentary power sources emerge, as there are various ways in which they had been able to exercise agency over their surroundings.

Yeo emphasised that it is "important to recognise that the use of smart technologies, as evinced from the initiative's aims, is taken by the HDB as capable of producing "solutions" to address the challenges of everyday living in the home and neighbourhood spaces" (2023: 2). As respondents here have discussed, the smart technologies that have been installed in their homes have not solved problems for them. Yeo argues that this expectation within discourses around smart technologies is problematic as they "are underlined by a fatalistic assumption that residents are passive recipients of technological change, who will unquestionably accept the initiative and new technologies" (2023: 2). Respondents raised two main concerns around the smart and sustainable features in their estates, focusing on how the application of smart urbanism did not fully resonate with the lived realities and problems faced by residents. Even though the infrastructure of their estates was heavily standardised, and they have little say over the kinds of features their HDB flats come with, their ability to curate these features after moving in provided them with an opportunity to actualize their desired version of smartness. If a particular kind of smartness was not going to 'translate' to cost savings, these respondents were able to reject enacting it.

Another feature of the estates that respondents considered unhelpful was the lack of planning around heavy car use. Many smart and sustainable estates had been designed to be 'car-lite'. Victor talked about how his estate encouraged car sharing by providing four car-sharing lots in the car park.

> "One issue with it being eco over here right, is the number of parking lots is so much lesser than other estates in Punggol. So I did ask HDB cos there was one time I forgot to renew my season parking and I couldn't get a lot here, so I went to the HDB branch office, then they told me that...usually when HDB plans for this, they usually have in mind how many units, how many blocks [there are] and they will roughly see - that will equate to how many lots….but maybe it was imagined lah [as car-lite], but the imaginations were not very realistic." (Victor)

Here, Victor expressed a disconnect between the top-down implementation of smart urbanism and the ground-level concerns of the people it serves. While the state identified an opportunity to nudge behaviours by restricting parking lots, respondents did not discuss responding to this. On the other hand, respondents discussed how they were inconvenienced by these initiatives. This represented a situation where the priorities of the smart city

residents were overshadowed by the Smart Nation project's future vision. It also emphasises the idea, initially discussed in this chapter, that visions of smart are often perceived as abstract or conceptual until tangible benefits can be experienced. In place of tangible benefits, however, there can also be tangible drawbacks. Negative emotional responses reveal that the Smart Nation, as an infrastructural plan, is not just purely about infrastructural endeavours. It is also a profoundly political project that reflects broader relationships around power. The gap between conceptual ambitions and lived realities reveals a sense of disconnection between the everyday lives of smart city residents and the visions of the state.

The issues that emerged in Punggol due to perceived poor planning came as a surprise to some residents. A young minority/Muslim man in his twenties, Haikal, who lived with his parents, talked about how he wished that "when [the state] made Punggol, HDB and LTA would talk to each other" due to the issues around transportation. He doubted the gap between implementation and ground-level concerns, as Hanif believed the state had enough data to solve issues and anticipate problems before they happen.

> "They should have already anticipated because the data's there…the roads, the jams were bad because for the longest time they had one exit. Then they made the second exit, but it was on the other side, and at that point in time, there was nobody there. Then they made a third exit...but that doesn't go to the KPE so no one cares...so then they did that single lane short-term solution right, that temporary road that caused another set of jams, because it's just a single lane. So, we had to endure that for a few years." (Haikal)

This highlights again that the affective consequences of smart interventions and the planning of smart estates like Punggol underscore the dual nature of the smart transition. While a heavily infrastructural project, it is also as much a means of reproducing political authority as it is in building digital infrastructure. Occasionally, these reactions to smart interventions are complex, at times leaning more towards positive emotions and, at other times, leaning towards more negative ones.

In the next section on green spaces, I discuss the affective experiences of residents of smart estates that focus less on ambivalence stemming from mixed feelings and more from the tension between paradoxical desires. While this section discussed some of the affective

experiences shared by respondents around technologies they were prompted to discuss, the conversations around green spaces, nature, and greenery emerged more spontaneously in discussions with respondents.

4. Green Spaces

In this section, I discuss the significance of green spaces as a kind of affective-material experience of the smart estate. The importance of green spaces in conversations with respondents highlighted the necessity of balancing the development of Punggol with preserving its natural environment. In this way, green spaces brought attention to the importance of planning the absence of smart infrastructure, not just its presence. Parts of the neighbourhood, like the river, park connectors, green fields and trees, often emerged as aspects of the neighbourhood that respondents enjoyed the most. I return to Ahmed's conceptualisation of affect as necessarily addressing "histories that preceded and directed…encounter and emotion" (Schmitz & Ahmed, 2014: 97). Ahmed describes how "bodies are brought into conformity with cultural norms through the iteration of linkages between affects and normative orientations". In this section, I show how smart city discourse in Singapore can shape bodies and desires in ways that result in residents viewing constant development as something not just to be expected, but also, as preferable to the alternative. Nature has also been given value through these same discourses. Nature then becomes affective and emotional.

In this section, I explore the paradox between urban development and the preservation of green spaces and nature. While the development plans for Punggol has brought about the planning and design of various green spaces that smart estate residents in the neighbourhood enjoy, this development has also limited the amount of undeveloped land. This undeveloped land, which can consist of fields, hills, and open green spaces, also makes up the natural landscape of the neighbourhood. Smart estate residents in the neighbourhood enjoy greenery from the undeveloped land and the planned green spaces. Their ability to enjoy these spaces is made possible and limited by urban development. The tension between their desire for green spaces and further development is also part of this paradox. The dual desires of these smart estate residents produce affects that implicate how residents perceive the benefits of the infrastructural transition to smart.

In a URA poll on long-term land use plans, eight out of ten Singaporeans felt that parks, nature spaces and greenery were key to making Singapore a good place to live (Ng, 2021). The significance of green spaces as an eco-feature in smart estates lies in how residents affectively relate to spaces cultivated due to state initiatives or the "Garden City" legacy. Much has been written on the relationship between Singapore's landscape, urban planning and state control (Han, 2017; Comaroff, 2014; Amir, 2015; Shatkin, 2014). As the green spaces in these estates – consisting of urban gardens, parks and park connectors, and rivers – are heavily curated, maintained and managed by the state (Comaroff, 2007; Comaroff & Ong, 2016), it is helpful to think of these landscapes as constructions of the state. These green spaces are not neutral parts of the state. They are deliberate displays of a particular kind of urban planning style and agenda informed by the legacy of the "Garden City". The way these places have developed to become 'green' through urban development also problematises the assumption that development necessarily threatens nature. In these neighbourhoods, residents enjoy the green spaces brought about by development and the existing green spaces due to the lack of development. This complicates the relationship that residents have with the development of their neighbourhoods.

During walk-alongs, Punggol residents regularly pointed out where the parks were, often at a distance. When asked about their favourite part of the estate, many residents talked about green spaces like roof-top parks, gardens on the tops of carparks, parks in the neighbourhood, and open green spaces. The forms of greenery and nature take on an affective quality when residents talk about their estates. Fathin, who works full-time while living with her parents, expressed how returning to such a green space at the end of the day helped them relax. When asked if she was involved in Community Centre (CC) or estate activities, Fathin mentioned needing to be more relaxed with work. She knew about these activities through posters in the public areas of her estate and on Facebook.

> "I'm aware. But I don't have time…they always promote to eat with the family, go out with the family...it's a stressful environment, they know. When you come back, you see greenery, and you're much more at ease and relaxed." (Fathin)

Fathin rarely visited the parks or green spaces near her house. Instead, she enjoyed their presence from afar—she 'sees' the greenery, which, as mentioned above, was enough to bring her ease and relaxation. Other residents enjoyed visiting these green spaces. Lily, a

minority/Muslim mother of two in her thirties, enjoyed having green spaces in the estate because she enjoyed bringing her children to them. Lily talked about how she appreciated that her estate was “greener than others”, with “many parks, green spaces, which is good. I can always bring the kids out, one park to another.” In addition to interviews and walk-alongs, I asked eight respondents to draw their neighbourhoods. Out of eight of these drawings, seven featured green spaces and nature prominently. The frequency and prominence of green spaces in the drawings signified the common positive feelings about these spaces. It suggests that these spaces are essential to residents – both in the quality of their everyday life and their imagination or conceptualisation of where they live.



Image 11: Participant drawing of estate featuring a playground, park connector and other green spaces



Image 12: Participant drawing of estate featuring Punggol Park

These two drawings were picked randomly from the seven that significantly featured green spaces and nature. From the two examples of drawings above, the centrality of green spaces in the respondents' experience of their estates can be observed through the presence of parks, trees, and open spaces. However, this desire for green spaces exists in tension with another aspect of living in these estates that respondents enjoyed: the convenience of nearby facilities and services.

As Punggol developed, it often encroached upon these beloved green spaces, forcing a difficult choice between preserving natural areas and accommodating the infrastructure needed for more estates. Felicity, a longtime Chinese resident of Punggol who moved into a newer, smart eco-estate when she got married, described witnessing the development of Punggol - "Punggol took a very long time to build up. For my family, my parents, we were the first batch to move into the first cluster, and it's been 17-18 years. We took that long to have shopping malls. When I first moved to Punggol…there [were] no buildings, even opposite me, all around, there were no flats." Wendy, a mother in her thirties, lived in a premium HDB estate 5 minutes from a 24-hour supermarket. She was in a dense and busy area near the train station and large shopping mall. She had "access to the different modes of transportation, like public transport…and [didn't] have to go out of Punggol to go to the parks, [as] there are plenty here." Unlike in the past, Punggol was now "self-contained…[and it was] convenient to get to other places, to the East, Central, even Town area." Another young mother, Sarah, who was a minority/Muslim, spoke of how the level of convenience she enjoyed in Punggol had exceeded her expectations when she first moved in, saying she had "imagined that there [would] be amenities, but [she] didn't imagine that it [would] be this

much". She noted the presence of a 24-hour supermarket and many eateries around her that would stay open till the early morning hours.

Respondents discussed the connectivity and access to facilities that the intensive development of Punggol brought about. They described this connectivity and accessibility as a convenience that they valued. Sharifah, a minority/Muslim mother of two in her twenties, enjoyed living in Punggol because of its convenience. When asked how much she enjoyed living in the neighbourhood, she rated Punggol a nine out of ten.

> "My area here, (I like) the accessibility… starting last year, they have a 24-hour supermarket, a salon, hardware stores, so, and even coffee...a Kopitiam nearby, it opens till 2 am." (Sharifah)

Both Sarah and Sharifah mention the benefits of living near a 24-hour supermarket and an eatery that stayed open till past midnight. Although Sharifah valued being close to these amenities, she also enjoyed living in Punggol because "it [was] quieter, as opposed to when I stayed in Jurong…now it's still quite quiet, and I like quiet areas". The desire for tranquillity coexists uneasily with the aspirations for modern urban conveniences. Residents are caught between two conflicting longings—one for preserving green spaces that enhance their quality of life and another for the advancements that promise improved convenience and accessibility.

5. Development of Punggol

Singapore as a 'Garden City' can invoke various memories and associations, sometimes not necessarily drawing on the 'greening' that Singapore has undergone since its independence, but rather, a reverse greening that has resulted in the replacement of much of Singapore's natural landscape with manicured and modern spaces. Singapore has been used as an example in post-developmental state literature as engaging in "state intrapreneurialism" (Miao & Phelps, 2019: 2), which is defined as "latent or actually existing entrepreneurialism apparent within public sector bureaucracies" (2019: 2). In Singapore, the state's heavy intervention in the country's economic development has brought about rapid economic transformation. In an interview, Paul, a senior civil servant, said that "the balance between protecting the environment and pursuing economic growth has always been on the agenda" and that it was a basic belief of the country's founding leader, Lee Kuan Yew. He emphasised that Singapore

has always strategically balanced economic growth with environmental protection due to necessity, as Singapore "cannot be unlivable, and everything has to co-exist". His colleague, Karen, another senior civil servant who worked in urban planning, discussed how careful planning had achieved this balance. She echoed Paul's sentiment while bringing into focus the role of high-rise public housing in the greening of the city:

> "In many places, you could have less greenery and shorter housing, but I think it's significant that we chose the model of high-rise public housing. I think, of course, that the 'Garden City' policies are significant. Many cities are industrialised and modernised, but they don't keep a lot of greenery. For Singapore, all along, from Lee Kuan Yew's time, the city has had this 'Garden City' mantle around it. I think that's very significant." (Karen)

Karen expressed pride and optimism over how Singapore has developed, which she felt had primarily been informed by Lee Kuan Yew. Both Paul and Karen believed that Singapore developed in a green and sustainable way because Lee Kuan Yew drew on the 'Garden City' model from the beginning. This generated a sense of visionary purpose, and they both reflected an affective attachment to the narrative of progress achieved in harmony with nature. I observed clear affective relations to these spaces amongst the residents of the smart estates in Punggol. These affects were often sharpened by the sense that these green spaces would be taken away. Sharifah described how the greenery around her estate had changed due to increasing development since she moved in.

> "About three to four years ago…it was very quiet. All these [flats] were not up yet. It looked quite different...these grey blocks behind us, there are 10 of them. Four years ago, they weren't there. My block was one of the first few to rise. And then last year, all the grey blocks behind came up…In the first year, when I went jogging, it was quiet. There was nothing; it was basically bushes. There's this really nice field out there, but sadly they're going to build something there. Sometimes when I go for a jog and I use that route and it's nice to see some trees…but they're probably building it up, next year." (Sharifah)

Another minority/Muslim mother in her twenties, Nora, talked about how she could previously "see the sea over that side…[as] there [weren't] any flats". Nora mentioned how

she could “even hear the sound of the ship…but [not anymore] after all the construction”. In this case, the desire for green spaces can be seen as an affective response to the natural environment they provide—a response rooted in the comfort, pleasure, and sense of well-being that residents derive from them. This desire is not just an individual feeling but a collective affect that shapes the residents' attachment to their living environment. However, this attachment is also influenced by the broader context, where the push for increased development introduces a competing set of affects—perhaps feelings around anxiety and the worry of being left behind in the future. Below, I discuss some respondents' responses that suggest a tension between the desire and enjoyment of green spaces and the convenience that further development will bring.

Sharifah discussed how the accessibility and availability of facilities and services were essential to her. Previously, while she highlighted the green spaces and tranquillity of her neighbourhood as aspects she particularly enjoyed, below, we see a tension between her desire for green spaces and her desire for convenience and the development of facilities.

> “Accessibility, that’s very important to me. Ya, there are buses and the LRT[35] is just there, but to be honest, once in awhile I get lazy to walk there. There’s no shelter. I got caught in the rain many times…before I had a baby, it was a 15, maybe 20-minute walk. It can be quite tiring. Sometimes, over the weekend, I think: 'What can I do for Ezra'? [We] can go swimming, [I] can send him for classes...there's, like, a kid’s gym at SAFRA. I'm hoping there will be more activities for kids. At SAFRA, they have a really popular indoor swimming pool that’s getting a bit too crowded because everyone's there every weekend. And even Waterway Point Mall is crowded every day. I'm hoping they could open up one or two more malls.” (Sharifah)

Here, Sharifah expressed a desire for more amenities, which would require the further development of her neighbourhood. This desire for amenities comes into direct opposition to her desire for green spaces. These dual desires, both closely held, are paradoxical. This paradox emulates the more profound affective struggles influenced by systemic promises – through the Smart Nation – and space constraints. Lauren Berlant's concept of "cruel

[35] LRT refers to the ‘Light Rail Transit’, which is a series of localized automated guideway transit systems in Singapore, used most commonly as a feeder service in neighbourhoods, connecting commuters to the main heavy rail Mass Rapid Transit (MRT) system. There are two lines, serving three new towns – Bukit Panjang, Sengkang and Punggol.

optimism" (2011) is particularly relevant here, as it captures the idea of holding onto desires that are ultimately incompatible or self-defeating. The simultaneous desire for green spaces and increased development reflects this kind of cruel optimism as the fulfilment of one desire often undermines the other. The affective relation respondents have expressed between the desire for green spaces and the demand for development highlights the complex ways in which affect is not merely a personal or psychological state but is deeply embedded in the material and social world. The respondents' profound affection for green spaces represent a longing for emotional well-being and a heightened quality of life. Simultaneously, the desire for increased connectivity and development embodied hopes for economic advancement and integration into the broader narratives of progress and modernisation. This dynamic reflects broader socio-political processes where neoliberal development agendas prioritise economic growth and infrastructural expansion over communal and environmental well-being.

One of the main critiques of smart cities has been how it is enacted as a capitalist or neoliberal strategy or form of development (Hollands, 2015; Sadowski & Bendor, 2019; Cardullo & Kitchin, 2019; Grossi & Pianezzi, 2017), Kitchin argues that smart cities are, or have been built to be, neoliberal technocracies (2014). The neoliberal characteristic of the transition to 'smart' involves deliberate decisions around deploying resources – which is a political decision (Goldsmith & Crawford, 2014). City management can sometimes focus on "results, not compliance" (2014: 4). Neoliberalism provides a unique context for affective lives to emerge from. Theorisations of affectivities during late capitalism have also been explored variously (Ash, 2010; Woods, 2024; Massumi, 2015). Anderson discusses how "attending to neoliberalism's affective life is one way, then, of tracing how neoliberal reason is attached to and invested in as it travels and is (re)formed" (Anderson, 2016: 735). Neoliberalism "entails an ideology and a political practice that aim to subordinate the state and all social domains to the market- to its logic and to the economic powers within it" (Laruffa, 2023: 586). Berlant adds to scholarship on the embeddedness of affect in political-economic systems by discussing how neoliberal restructuring impacts fantasies of the good life (Berlant, 2011). Her discussion of cruel optimism provides "a materialist context for affect theory" (Berlant, 2011: 14). She argues that optimism "manifests in attachments and the desire to sustain them" (Berlant, 2011: 13) and becomes cruel when:

> "the object/scene that ignites a sense of possibility actually makes it impossible to attain the expansive transformation for which a person or a people risks striving; and doubly, it is cruel insofar as the very pleasures of being inside a relation have become sustaining regardless of the content of the relation, such that a person or a world finds itself bound to a situation of profound threat that is, at the same time, profoundly confirming" (Berlant, 2011: 2)

Berlant discusses this optimism within the present context, where fantasies are "fraying" (Berlant, 2011: 3), and there is "the dissolution of optimistic objects/scenarios that once held the space open for the good-life fantasy." (2011: 3). This becomes particularly salient through the role of state narratives. While the concept of the Garden City reconciles both the need for development and the preservation of nature and greenery, in application, this is a much more complicated process. Berlant's framework helps elucidate how systemic structures and promises of progress can produce affective states where individuals are compelled to negotiate between competing desires, often without the agency to reconcile them satisfactorily.

Aside from this tension, some respondents did not consider the presence of green spaces as paradoxical to the development of Punggol. Hope circulated along with the uncertainty of development, as shown by Haikal's response here:

> "How do I see Punggol? More crowded I guess. Ya, because...you see all the empty land that they still have, that is not yet opened...they're going [to] build more houses and things...so it's going to be much, much more crowded. But at the same time, I think that the development is going to be interesting, because there are a few places where they really, really plan green spaces. I think N Parks[36] is also moving in a new direction with green spaces…with more not-so-manicured parks, right? With Coney Island, Tampines Eco-Park, or activity-based parks, right? So it's going to be fun. [There will be] more places to take pictures." (Haikal)

Haikal talked about how the further development of Punggol would not result in less green spaces. Because green spaces had been factored into the planning of Punggol, the state

[36] 'N Parks' refers to the National Parks Board, which is a statutory board under the Ministry of National Development. They are tasked with managing the city's gardens, parks and other green spaces.

“really, really, [planned] green spaces” in Punggol. As Haikal believed that further development would bring him access to more nature, he did not see the desire for green spaces as competing with the desire for convenience. This lack of tension was not reflected by other respondents, however. Respondents themselves were invested in developmental aspirations that promised betterment but ultimately compromised their existing sources of happiness and well-being. The optimism tied to development becomes "cruel" because it sustains attachments to transformative promises that, when realised, may dismantle the landscapes that sustained residents' daily lives.

This section discusses how certain kinds of tensions and co-occurrences of emotions about different aspects of smart living can elucidate the emotional content of affective experiences of residents in smart estates, bringing more precision to what ‘ambivalences’ and ‘tensions’ might consist of. To understand some of the ambivalences that emerged in conversations with respondents, I suggest examining how emotions and affects oscillate between hope and uncertainty, anticipation and frustration, insecurity and comfort. The emotional landscape of the smart estates can be conceptualised as marked by conflicting affects where the excitement for potential improvements coexists with the fear of losing the green spaces that provide respite.

6. Conclusion

This chapter explores how these unintended and unplanned outcomes materialise in the everyday lives of smart city residents through their engagement, or disengagement, with smart infrastructure. In the case of the smart estates in Punggol, tangible relationalities generated differentiated affective relations and, consequently, strong emotional responses to infrastructure on the ground. These affects and emotions were produced despite the absence of actual breakdown or failure. This expands on existing critical work on infrastructure that problematised the assumption that infrastructures are made visible only through breakdown (Star, 1999; Collier, 2011; Elyachar, 2010; Graham & Marvin, 2002; Larkin, 2008). Star (1999) argues that breakdown or failure need not happen in order for infrastructures to become visible. In the sites of experiment of the Smart Nation, including the smart estates of Punggol, the relationalities that make smart infrastructure visible are not easily captured by the feedback loops developed by the state. Although there have been extensive outreach programs and many attempts to encourage residents to contribute to the urban planning

process[37], the feedback loops that exists between society and state are often assumed by residents to be superficial, or limited.

The discussion in this chapter is split into two main parts: First, I analysed the kinds of engagements residents have with smart and sustainable technologies that I expected to be significant in their lives but did not emerge as important in conversations with respondents. Specifically, I prompted our discussions on solar panels and the pilot-testing of smart home technologies. Following this, I discuss how smart cities portrayed as 'living labs', such as Singapore, often conduct experiments that may produce unhelpful solutions for its residents. Focusing on smart and sustainable bathroom taps, laundry machines, and initiatives around car-sharing, I found that the limitations of smart interventions were revealed when the technologies did not address residents' everyday problems. Here, the disconnect between the top-down implementation of smart urbanism and the ground-up concerns of the people it is meant to serve often creates friction that respondents describe through feelings of ambivalence.

In the second part of this chapter, I analysed residents' engagement with the smart and sustainable technologies they expressed as significant in their everyday lives. Less a technology, and more a feature, green spaces represented an aspect of smart and sustainable urbanism that residents experienced affectively. There is tension between the dual desires for green spaces and increased convenience and access to facilities and services through development. Drawing on Berlant's concept of "cruel optimism", I discussed how the ambivalences that emerged in conversations with residents are part of their oscillating affections and disaffections for their estates. The emotional landscape in these estates consisted of conflicting feelings that brought precision to what 'ambivalences' and 'tensions' might consist of – ultimately, a "mixed bag" (Yeo, 2023) of good and bad. Without a robust feedback loop between the state and its smart city residents, there was often frustration and trepidation around the changes that the transition to smart brings. These mixed feelings fell short of immediate and compelling action. This produced feelings of 'bo-pian' in respondents. 'Ambivalences', then, as an affective experience, tends to generalise the targets of their specific emotions – while residents might be frustrated or confused about some of the

[37] These include the Smart Nation Builder, SNA Citizen Co-Creation Group, SCOPE Survey tool for collecting feedback from the public to test prototypes and new services, and the participatory GovTech Tech Kaki end-user community

processes and outcomes of the pilot-testing of technologies, they also felt excited about the development of new facilities and services that would bring more convenience to their everyday lives.

Politics is coded into the socio-technical infrastructures of the smart city. The urban transformation towards 'smartness' is not just a neutral enhancement from one kind of city to another (Sadowski & Pasquale, 2015), bringing about higher levels of efficiency and security. There are entanglements beyond the technological that implicate more extensive socio-political and cultural processes and impact what it means to be entangled in the mechanisms of a smart city. Although I did not judge whether these smart estates represent aspects of a larger 'good' or 'bad' smart city, I examined the entanglements that produce affective experiences that can be positive or negative. By doing so, I also demonstrate how smart infrastructures are as much about technical efficiency as they are about the capacity for agentive action. They are where the modalities of everyday can be understood. In the next chapter, I discuss what these affective experiences result in in terms of social practices.

Chapter 5: The Smart Nation as a Social Project

1. Introduction

> "What is a smart city? It's…where people are happy to be living in it. Loveability means that you love to live in this city because it's so great, that you love it because it's more than just a liveable place." (Nusrat)

In this chapter, I discuss how affective experiences are produced by, and also produce, socialities – the relation between these affective experiences and socialities will be shown to be multi-dimensional. I show how these socialities, which Pink refers to as "different sets of concrete…social relationships that develop around actual activities" (2008: 172), emerge out of affective experiences that are site-specific but not necessarily 'smart'. At first glance, these social practices might seem unrelated to the transition to smart urbanism. However, the centrality of these practices in the everyday lives of residents suggests that the engagements between smart estate residents and their surroundings do not automatically centre engagements with smart technologies. Additionally, the tools and strategies that improve their quality of life and address their problems do need to be technological or 'smart'. These two observations challenge the assumption that smartness should be collapsed only into what can be observed or expressed in people's engagement with so-called 'smart' technology. This assumption risks leaving out a range of meaningful and affective experiences in the smart city. By expanding observation to both smart and non-smart infrastructure, the affects that emerge in the emotional landscape of the everyday reveal complexities and tensions that problematise binary assessments of the smart city experience as 'good' or 'bad'.

In the sections below, I discuss how residents regularly expressed loneliness, frustration, suspicion, isolation and distrust in relation to the social lives they lead in their smart estates. Their emotional landscapes were not just made up of negative feelings, however. The tensions between positive and negative emotions, along with their ambivalence about Punggol as a neighbourhood suggest that the emotional landscape of their estates is dynamic and shifting. Affectivities can indicate the complexity of this landscape as they involve the back-and-forth movement between different emotional states and perceptions of residents' surroundings, informing their social lives in one way or another. These dynamics enact the

social practices that produce and reproduce these smart estates. This discussion has implications for the sociological definition of the smart city – especially in its social aspects, such as what constitutes a 'smart subject' or 'smart citizen.' Firstly, a focus on practice demonstrates how smart city residents do not automatically become smart citizens. Smartness is developed through what people do (social practices) in addition to who they are (identity). The idea that smartness is a process rather than a state of being suggests that there is flexibility in the concept of the smart citizen within the rhetoric of the Smart Nation. This flexibility reflects the various ways smart city residents relate to smart infrastructure rather than prescribing the universalising identity of a "smart citizen" to all those who live in smart cities, regardless of their everyday experiences. Secondly, this chapter shows how smart city residents construct emotional landscapes through everyday social practices. These emotional landscapes consist of dynamic and complex affectivities. They also produce, and are produced by, the social worlds in these estates.

1.1 Loveable Smart Cities

In our conversation with her long-time friend Sharifah and her husband Irfan, Zareen talked about how their neighbourhood lacked "that gotong-royong[38] spirit". This 'kampung[39] spirit' has been studied variously in the context of HDBs (Chua, 2002; Nallari & Poorthuis, 2021; Chong, 2018; Tong, 2024). What this 'kampung spirit' consists of, and how we can observe it now, has been the subject of inquiry in various initiatives that sought to understand the social aspects of life in HDBs. Recent surveys have shown how over one-third of the adults in the country consider themselves lonely (Duke-NUS, 2021), driving community-based efforts at increasing the quality of public spaces to encourage interaction and activity between residents. In 2022, an integrated community platform was introduced in Toa Payoh to empower Singaporeans to take a more significant stake in building homes they have affective attachments to (Ministry of National Development, 2022). The initiative aimed to foster positive social norms and values and facilitate community-led solutions in HDB's high-density housing environment. Neighbourliness and reciprocity have thus been shown to be

[38] "Gotong-royong" is a Malay term that refers to the spirit of communal work where people come together to help each other and the community. It is often used in addition to, or in replacement of, the "kampung" spirit, as both describe a conceptualization of sociality that is similar.
[39] Kampung is a Malay word that means 'village'

central to HDB living[40]. In order to ensure social harmony, certain aspects of neighbourliness, like kindness, care, trust and a sense of reciprocity, are necessary. Both the 'gotong-royong' spirit and the 'kampung' spirit are thus conceptualisations of a sociality ethos that outlines the obligations the individual has to the collective, and the ways in which this sharing of burdens builds community.

There has been a recent emphasis on building such an ethos, reflected in the shift in agenda of the URA, Singapore's urban planning governmental organisation. Its focus has moved from ensuring post-independence 'livability' to ensuring that the city achieves 'loveability' (Heng, 2016). The loveable city is one that "current and future generations of residents can cherish, even through rapid development" (Urban Redevelopment Authority, n.d.). In 2021, the DesignSingapore Council released 'The Loveable Singapore Project' with the stated aim of answering the question: "How can we measure the emotional attachment and belonging to a place?" (DesignSingapore Council, 2021: 3). In this study, researchers outlined six ways to measure loveability: through a sense of inclusion, connection, attraction, attachment, agency and freedom in the city. The study also emphasised how neighbourhoods allowed respondents "to feel connected to a micro-community beyond the family, where neighbours care for and can count on one another" (DesignSingapore Council, 2021: 47). 'Neighbourliness' emerged as central to how individuals conceptualised a loveable place, with everyday interactions like 'saying hello and smiling', 'spontaneous conversations' and 'giving away food' all indicated as types of behaviours that showed care at a neighbourhood level.

Singapore aims to be a "thriving innovation-driven economy and Loveable City by the year 2025" (DesignSingapore Council, 2021: 3). This dual emphasis on smartness and loveability is reflected in a smart city ranking developed by the IMD World Competitiveness Centre and Singapore's Lee Kuan Yew Centre for Innovative Cities. This ranking is focused on how technology engages with people. The ranking also includes various metrics that measure how technology helps people improve their lives. Thus, the working definition of the smart city used by the ranking includes not just the presence digital technologies, but how these

[40] HDB has an official page on 'neighbourliness', detailing tips for residents to improve their relationships with their neighbours (Housing and Development Board, n.d.) Under the "Then How" poster series, HDB has produced posters that show how neighbourliness is stil important, even during the 'new normal', where the Covid-19 pandemic changed many usual ways people socialized

technologies have been utilized to improve society. Nusrat, a senior civil servant who worked on digitalization efforts discussed how this ranking had been developed to fill a gap as "the other benchmarks did not define the smart city the way they should be defining it".

> "Definitely, the focus is on people and technology and on loveability as opposed to just liveability. You'll sometimes see in cities where they have all the technology, but nobody uses that, and the city just becomes a showcase. Singapore is more of a place where people actually live." (Nusrat)

Nusrat's opinion was that the smart city needed to be a place where residents could develop attachments. The affective experience of attachment is rooted in local cultural intricacies. There is both an ascribed sense of smartness (when applied top-down) and smartness as enacted through practice (when understood in bottom-up ways). The contribution of this chapter lies in its attempt to understand smart urbanism within its lived and material contexts to explore the kinds of social practices it develops and is developed by. Here, I consider the implications of social practices for the production and reproduction of smart estates and the agency of smart city residents to exercise various levels of control over the social aspects of their lives in these estates. In the following sections, I will analyse how tensions between privacy and connection emerged in conversations with residents living in the smart estates in Punggol. I will discuss two interconnected paradoxes between privacy and connection that discuss the affectivities around loneliness and disaffection. These affective experiences of the smart city can be observed while the Smart Nation project simultaneously applies digital technologies to address citizens' needs and improve their quality of life (Ponting & Zhou, 2016). I will also discuss the uneven experiences minority/Muslim respondents go through as interlocutors of their estates. Theorists have described certain kinds of smartness as particular types of ethnocentric enactments (Tolia-Kelly, 2006). In these instances, universalist ideas of what smart subject formation is fails to account for the kinds of emotional and affective geographies that exist in the lived realities of these subjects.

1.2 Who is the 'Smart Citizen'?

The state, known for its substantial consolidation of power and single-party system, has long ruled in a largely top-down manner (Calder, 2016; Abdullah, 2018; Ho, 2017). Singaporeans have been variously described as passive in terms of their participation in politics (Chan,

2022; Ng, 2016), with a different kind of culture around participatory politics (Diehl & Chan, 2021; Jianli, 2006; Skoric et al., 2009). The conceptualisation of an "active citizen" that emphasises visible participation in public space (Vanolo 2016, Hollands 2008) prioritises a specific type of political engagement. This ideal excludes the less visible and multiple ways smart city residents participate the smart city. By focusing on the everyday and less visible aspects of participation, this chapter observes the smart city resident in instances that might not be characterised as 'smart citizenship' but are important to the producing and reproducing of smart spaces.

The topic of political participation emerged in conversations with residents when we discussed the concept of the 'smart citizen'. Nathan suggested that one of the reasons for passivity was the unwillingness to "disrupt the way of life [we] have right now". This cautiousness informed a "kind of mentality…[a] nature… [where we] are not that kind of aggressive type of citizens". Nathan described the tensions that emerged from wanting to preserve the status quo and desiring to express oneself - "Sometimes [when] we voice out, we want our voices to be heard". Here, Nathan noted that there was a desire to engage with the state while still not wanting "to go into a riot or protest mode…[as we] have families to take care of". This tug of war between the yearning for change and the desire to continue to enjoy stability suggests limits to the willingness of individuals to push back against the state.

Foucault describes how neoliberalism results in 'state-phobia' and "describes it variously in terms of a fear or anxiety regarding the state" (2008: 77). This anxiety around the state and how it governs its population can be seen through Calvin's discussion of what 'smart' means.

> "I feel like in general, Singapore has a very elitist system. These terms like "smart citizens", "smart residents", [are] usually written by the scholars that are perceived [to be] smart when young, and then they disregard everything else that's not smart…they take the opinions of [this] small group…and then everyone else like huh, *gong jia wei*[41]? You see all the taxi uncles? They can be smart [but] they're like: *gong jia wei*, what is this? What are you talking about?" (Calvin)

[41] Gong jia wei is a Singlish term that directly translates to 'talk bird language'. The colloquial meaning of the phrase is to talk nonsense or engage in idle banter.

Calvin repeatedly expressed his concern about the discourse of the 'smart citizen'. He worried about how it was being conceptualised by an elitist system that narrowly defined what 'smart' referred to. He expressed suspicion over this, arguing that the specific conceptualisation of smart was being used as an exclusionary elitist strategy. His suspicion intensified when he considered how the conceptualisation of a 'smart citizen' was not just exclusionary but also superfluous:

> "All [the talk around] "smart citizens" or "smart residents" is bullshit. It's just a term...to make us feel better. Oh, we're smart, but we don't know what that implies. Sometimes smart doesn't mean good." (Calvin)

Here, Calvin continued to express his doubts over the top-down conceptualisation of the` 'smart citizen'. He felt anxiety around the conceptualisation because there he felt like there was something both exclusionary and disconnecting about it. This sentiment was echoed by other respondents below, which will be discussed further. In the next section, I discuss the actual practices of smart city residents that focus less on becoming legible to the state[42] as a 'smart citizen' and more on being legible to each other through being known. In this move from the individual smart subject to relationality in smart cities, this chapter focuses on how the smart subject is formed through relations in the smart city. The smart estates in Punggol constitute a "domain of practice" (Slaby, 2016: 18) where affective practices around neighbourliness can be observed through social behaviours and actions. Paying attention to "the dynamics of affective life may become political as a counter to forms of biopower that work through processes of normalisation" (Anderson, 2012: 41). Anderson argues that a focus on affect can reveal the parts of 'life', as defined by Foucault, that escape the techniques of governance of a smart city (Anderson, 2012: 41). Neighbourliness, and the social practices and relations they contain, represent one of these parts of life that can be revealed through affect. In the section below, I discuss the paradox of privacy and explore the two kinds of tensions that residents face between privacy and connection.

2. The Paradox of Privacy

[42] This has been discussed variously in work on data-driven smart urbanism, including Gillian Rose's work on cybernetic socialities (Rose, 2020)

The social practices residents engaged in that produced and was produced by neighbourliness was the most significant sociality I observed. Looking at the everyday social practices of neighbourliness also responds to the recent calls to look at the actual lived experiences of the city (Anjaria & McFarlane, 2011) and "actually existing socialities" (Rose, 2020) instead of generalised theories of broad social processes that focus primarily on the political-economic changes brought about by urbanisation. The centrality of neighbourly relations has been discussed in recent work on understanding diverse spaces like urban cities (Peterson, 2017; Terruhn & Ye, 2022). Work on the socio-spatial and sensorial experiences of non-metropolitan cities has also been done (Jha & Pathak, 2022). In attempting to understand the everyday social practices in neighbourhoods, these authors focused on neighbourliness. I draw on their Jha and Pathak's (2022) definition of neighbourliness, which refers to the residents' relationship with the urban social as expressed through their relations to each other.

In these new BTO estates, where most residents were not familiar with each other at the point of moving in, I assumed there might be an acute sense of loss of neighbourliness due to the loss of older kinship and community ties. One aspect of everyday life that emerged as meaningful in conversations with respondents was how they enacted social practices that helped them manage the issues around proximity and the constant presence of others. Respondents expressed a yearning for privacy in these environments to carve out personal space in highly dense spaces. However, as discussed below, there was tension between this desire for privacy and the feelings of isolation and loneliness that residents also expressed. It is worth noting, however, that what can be observed as social practices central to the forming of community bonds in these new estates consisted of many practices that have existed for a long time in HDBs. Studies on past HDBs that do not feature smart infrastructure (Chee, 2017; Chong, 2018) contain discussions on the kinds of social practices that residents interviewed in this project still find meaningful. Studies on smart eldercare technology have discussed how negotiations of proximity and privacy occur, revealing relations of trust, surveillance and care in the negotiation of the "dialectic of remoteness and proximity" (Woods & Kong, 2020: 1322). This chapter expands on these studies that provide insight on sociality and connection in instances where there is smart technology, and where there isn't, in order to understand the kinds of affective experiences in smart estates.

One of the concerns that emerge in studies on life in smart cities is the issue of privacy (Woods & Kong, 2020; Braun et al., 2018; Kitchin, 2014; Kitchin, et al., 2015). Early work

on the conflict between privacy and surveillance assumed that most individuals made rational disclosure decisions (Westin, 1968). Currently, there is a growing body of work in the field around the privacy paradox discourse that challenges this model[43]. This work investigates how inconsistencies between stated privacy-related concerns and their associated decisions show how disclosure choices are not made in vacuums (Acquisti et al., 2015). I refer to work around the privacy paradox discourse in order to understand the social practices that produce and are produced by connection and disconnection in these smart estates for two reasons: First, recent work in the field has been mainly around the use of communication technologies and social media platforms, suggesting that there are changing relations between trust and privacy brought about by digital changes in society. Secondly, some of the ways smart estate residents have negotiated issues around high-density living involve using online social platforms, which increasingly act as public spaces. For these reasons, the scholarship on the privacy paradox is relevant to the smart estate context studied here. The paradox is that while smart estate residents sought out privacy, the physical and social isolation that high-rise, high-density living can foster often made them feel disconnected from their neighbours. The emptying pf public spaces further exacerbated this sense of loneliness. The affective relations within the paradoxical desire for privacy and connection reflects a complex emotional landscape where individuals simultaneously craved personal boundaries and social connection.

2.1 Privacy/Connection: The Experience of Loneliness

The paradoxical desire for privacy and connection produced norms of reciprocity between neighbours in the smart estate. Zareen, her husband Irfan, and her longtime friend Sharon all lived in their new Punggol BTO flats for less than five years. Zareen and Irfan talked about how they avoided their neighbours in order to preserve a sense of distance that would allow them not to feel obligated to reciprocate neighbourliness.

[43] Many of these studies investigate how the privacy paradox lies in how users of new technologies, such as social media platforms or smartphones, are concerned about their privacy but engage in actions that work against their ability to protect their privacy (Blank et al., 2014). With data being collected at unprecedented levels, there are "on one end of the spectrum, individuals [who] are anxious about the misuse of their data, but on the other end, they share personal data by clicking onto terms and conditions with the blink of an eye" (Chhabra, 2022: 1).

> Irfan: I think the reason we don't really…go to the other side to ask, "Hey, I'm your neighbour", is that…I think, same as us, we don't want to…say the neighbour gives us [something], then we don't want to have to give [them something] back.
>
> Zareen: We don't want to be obligated to [them].
>
> Irfan: It's…too close for comfort.

Irfan mentioned how they "don't want to have to give [them something] back", suggesting an unease with forming attachments of reciprocity while living in close quarters. This unease required the management of proximity through creating distance in the social relations formed. This sentiment was echoed by Zareen when she recounted how she was "close but not too close" with a neighbour who, similarly to her, would avoid visiting spontaneously. Both of them had implicitly agreed not to drop by each other's house casually.

Haikal, who lived with his parents in Punggol, discussed something similar.

> "[People] only help [you] when your laundry falls down…[that's when] they might knock on your door. It's a very Singaporean thing to do, or if you don't know what to do then you put it in the common space near the lift landing. I've seen someone's keys get lost, so then they just hang it up inside the lift in case you were to see it. It's hilarious. It's unique I guess, very pragmatic…kind of like, I want to help but I don't want to help too much and get too busy...I don't want to trouble myself but I want to help, so I'll just put it here." (Haikal)

Haikal discussed how neighbourly relations manifested in these estates when individuals would help each other while still preserving their own privacy and distance from their neighbours. Haikal termed this approach as "pragmatic" and discussed how it was a good way to foster community bonds without troubling oneself. It is this sentiment of not causing trouble (either to oneself or others) from which the nature of the help neighbours extended to each other was perceived. Acts of connection were carefully calibrated in order to avoid threatening the privacy between neighbours. This maintained the distance between neighbours that the respondents from these smart estates valued. This was how they maintained being "close, but not too close". Ye (2016) described this kind of relationality as one based on "fleeting encounters" (Ye, 2016: 78), which blur the boundaries between "the

fleeting and the routinised" (2016: 78). The significance of the fleeting nature of interactions "lies in the principle of living together without personal recognition and through this…ambivalence…underlies the majority of encounters one has in diverse urban settings" (2016: 79). This emphasis on a respect for distance rather than cohesion is "an indication that on a micro level people can get along, despite their ambivalent relationship with one another" (2016: 79). This view of sociality reflects the kind of social relations that have developed in the smart estates studied, where the preservation of distance and privacy between neighbours allowed them to continue to interact. There are affects that emerge from this preservation of distance and privacy. In addition to Haikal's observation of "pragmatism" as a reason, more 'minor affects' (Ngai, 2004), such as irritation and unease emerged in conversation with respondents. Sharon discussed why there was the desire to avoid reciprocity.

> "I think people [are] quite private lah, because we spend a whole day working, interacting with other people, [so] when you get home, you don't want to talk to people." (Sharon)

Sharon suggested that reciprocity would take up time and energy, which had become scarce resources in her daily life. Daily stressors around work and family were some reasons why Zareen, Irfan and Sharon prioritised their private time. There was a heightened importance for privacy in their domestic spaces, where individuals could control the demands being put on them. Zareen discussed how daily stressors caused her to seek disconnection after a hard day at work:

> Zareen: You get so tired you just don't want anyone to talk to you anymore. Like, sometimes people knock on the door right and our door's closed right, and then…I really don't want to open the door.
>
> Irfan: I'll be in the shower, so I ask her to open [the door]
>
> Zareen: I'm never opening the door.
>
> Sharon: I'll tell my dog to keep quiet.

> Zareen: That time I was with Amelia[44], so I tell my mum to [keep quiet]. Then we try to peep. But cannot peep also because once you peep, they can see. My mum always has this idea that [you keep quiet] then she will peep...but [they] can see you're peeping already! Might as well not peep at all, just be quiet.

Zareen revealed a performative element related to the norms of reciprocity within neighbourly practices. Unlike the neighbour she was "close but not too close with" whom she shared a common understanding around the maintenance of privacy, some other neighbours did not share this understanding. This inconsistency increased her sense of unease. Zareen mentioned how the neighbours that come over unannounced tended to be "slightly older, like in their 40s, 50s? 50s…[and] they always open their doors." One of the ways she could tell if her neighbours shared this norm around privacy was by observing their everyday practices around keeping their doors open (as a way of welcoming interaction) or closed (as a way of signalling a need to disconnect). This co-created logic of proximity developed a specific material infrastructure within these estates through a series of open and closed doors that signalled availability for interaction. Residents like Zareen, Irfan and Sharon would open or close their doors to embody and perform a common understanding of neighbourliness. By giving each other the opportunity for "impersonal affective immediacy" (Berlant, 2016: 402) through material demarcations between private and public spaces and ideas around neighbourliness, neighbours gave each other the chance to have agency over their own private spaces.

> "I would say we close the door like 90%, [older people] usually open like 50%, close 50%. So when we…come out of the lift right, we can see oh they open the door, they stay in the hall watching TV then we just raise our hands, acknowledge each other. But once we come inside our house right, we close the door." (Zareen)

Zareen describes here a clear and strategic retreat from interaction. She closed her door in order to avoid interacting with neighbours. There was an expectation of welcoming interaction when one's doors are open. Despite not being an open-door person, Dinah would interact with her neighbours when she passed them and their doors were open. Here, the

[44] Amelia is the young daughter of Zareen and Irfan

materialities of the estate reinforced distance and maintained privacy, producing affects like disconnection.

It is interesting to consider if these antisocial behaviours reflect a desire to be left alone. Zareen's recollection of her husband, Irfan's, imaginary friend Benson, contradicted some of her earlier discussions about maintaining privacy from her neighbours.

> Zareen: We're seeing invisible neighbours. After throwing rubbish he always like: "Okay, bye Benson, okay bye, bye"
>
> Irfan: Don't tell her!

In our conversation, Irfan mentioned that he was more social than Zareen. Irfan expressed embarrassment over Benson being brought up. Irfan expressed a genuine desire for connection through his interactions with Benson.

> "We're seeing invisible neighbours. After throwing rubbish he always like: "Okay, bye Benson, okay bye, bye". But actually, [there's] no one. Then I'll be like: who you talking to? The first time he was like, oh, that one Benson. But actually, there's no one. He just acknowledges some Casper…he's doing it almost every time he throws the rubbish. In fact, not only that but suddenly there's a new character. The wife! The wife also just came back...she's also invisible. Basically, our generation would rather have invisible neighbours than real neighbours...because you don't [get] attached, you see." (Zareen)

Irfan did not only create Benson once. He interacted with Benson on an everyday basis. Over time, Irfan created a family around Benson, building up a life-world for his imaginary character. At the end of our conversation, Irfan spontaneously returned to the subject of Benson.

> "He will never [come over]. I don't know why, I keep inviting him but he never comes." (Irfan)

Here, privacy and connection are not seen as mutually exclusive. In these estates, personal space is a premium. For young, working professionals like Zareen, Irfan and Sharon, the daily demands on their time meant that they yearned for privacy when they returned home at

the end of the day. This informed how they managed their interactions with their neighbours. The affects that circulated through these estates as a result included flows of connection and disconnection. These could be temporally interrupted and restored later (Hunter & Kivinen, 2022: 143). The restoration, however, was not guaranteed to involve actual neighbours, as there was a lack of interaction in the informal, common areas of the estates. The unintended effect of the emptying of the common spaces in these estates was the production of the lack of "expressions nonreflexively transmitted and received by faces, arms and legs, gestures and postures" (Bissell, 2010 in Edensor 2012: 1116). There was an absence of a "communality of…[the] emotional and affective sense of place" (Edensor, 2012: 1116). The lack of interaction in the common spaces was not something that had been entirely replaced by increased interactions online. Zareen and Irfan discussed how they kept track of the posts on the estate's Facebook group but were reluctant to engage with their neighbours:

> "We don't want to expose ourselves. We want to lay low, we don't want to be known - like, oh, this one, always updates [on] good stuff, or this one always complains...we don't want to be like that." (Zareen)

Even without the expectations of reciprocity that she faced in person, Zareen was still reluctant to engage with her neighbours due to the fear of being 'exposed' or known. Irfan likened receiving attention from neighbours to being exposed. Both Zareen and Irfan would read through the posts regularly but would not comment themselves. Despite not wanting to be 'known', they wanted to know about their estate. This 'knowing' did not only serve practical purposes however. It also satisfied their curiosity about their neighbours:

> "From the first post, I see whether is it interesting to continue with the comments…cos our lives quite mundane right, so these are the things that give us hope in life, like to read through..." (Zareen)

'Hope' is mentioned here. As an affect, hope has been described variously by theorists (Anderson & Holden, 2008; Anderson, 2006; Ahmed, 2010). Ahmed discusses the idea of the "hopeful performative" (2010), where tasks are given to subjects in order to think or talk themselves into a happier state of being. Recent work in feminist and affect theory "problematise affirmative conceptualisations of hope…calling for a more complex vision on the topic" (Olivi, 2023; 227). In this context, it is possible to understand how Zareen's use of 'hope' alluded to a sense of being able to experience something beyond the confines of her

everyday life through passively engaging with her neighbours' lives on Facebook. She compared their lives to her own 'mundane' one. The ability to engage passively allowed Zareen, who did not want to interact with her neighbours actively, to access the larger social world of her estate while still refusing to participate. She continued being a silent observer. Zareen's silence with her neighbours emerged as a significant social practice that developed her social world. It was not an empty silence however. It was hopeful. Anderson and Holden (2008) discuss hope as a kind of "state of suspension" (2008: 155) and describe "how the "not-yet" that hope names are part of how events take place" (2008: 155). The temporal perspective on the emergent and fleeting nature of hope is useful in understanding the nature of Zareen's affective experience when she is online. Her access to her neighbours' lives did not just carve a space of connection. Zareen was able to experience an anticipatory excitement that overcame the monotony of her everyday life. Although her online interactions were passive and often fleeting, they provided a sense of possibility, representing "the things that [gave her] hope in life".

2.2 Privacy/Connection: The Experience of Conflict

As residents sought out privacy to cope with the challenges of high-density living and the stressors of everyday life, they unintentionally fostered disconnection. This disconnection could be understood as a result of the residents' paradoxical desires for privacy and connection, which they experienced simultaneously with loneliness. This led to disaffection as residents became emotionally detached from their immediate environments. Disaffection has been explored as a state where individuals or groups become emotionally disengaged or distanced from their spaces and social environments (Wilson & Anderson, 2020). Disaffection involves a withdrawal of emotional investment, and is often tied to broader feelings of frustration, alienation, isolation and dissatisfaction. Wilson and Anderson's (2020) work highlights how disaffection is not simply a personal feeling but can be spatially distributed and socially contagious. In these smart estates, the more residents retreated into the privacy of their own homes, the more public spaces lost their affective charge. These spaces then became places of disconnection rather than interaction and connection. The repetition of these acts that produce disconnection intensified the affects around it. This repetition was key to residents accepting disconnection as a norm. Residents then expressed low expectations of closeness with their neighbours. Instead of reproducing "loveable"

spaces, the flows of disconnection that travelled through these smart estates produced unintended affects such as isolation, loneliness, and exclusion.

Calvin described his neighbours in Punggol as “professional acquaintances”. He gave a few reasons for this.

> “I live in one of the new HDBs, so there's a lot of privacy, residents just get one door next to each other…we just know that this person exists. Cool, let's just go back to our lives. Unless we need something, then we'll start asking.” (Calvin)

He also contrasted the dispositions of his neighbours in Punggol and Yishun[45], his former neighbourhood. In Punggol, he found that “everybody [was] generally understanding...it [was] a neighbourhood of understanding.” He noticed how people were happy to “comply and help [each other]”. He made the caveat, however, that this help only came when you asked for it. His description of conditional help expanded on what another resident, Haikal, had said about the nature of neighbourly help in Punggol. While Haikal seemed light-hearted when recounting his experience, Calvin was more serious as he believed that the conditional nature of help in Punggol represented a larger issue around spontaneity and closeness in the estate. Calvin compared this ethos of polite ‘understanding’ to what he experienced in Yishun.

> “[With] the older generation right, [there’s] no privacy at all, your living room is right there in the corridor, you can have fights across the corridor with one another…things happen spontaneously in Yishun compared to Punggol. In Punggol right, for things to happen, everything is planned. It's all planned. In Yishun right, [it’s like] oh shit man, this guy is asking me for help, and [we’ll] just meet in the corridor.” (Calvin)

Here, Calvin brought up the difference in the nature and frequency of interactions neighbours had with each other in the public spaces of different estates. He attributed the lack of spontaneity in Punggol to its design, where common spaces did not foster the same kinds of social interactions and socialities as those in the estates in Yishun. Without spontaneity, things happened in Punggol only if they were planned. Calvin mentioned how this

[45] Yishun is a residential neighbourhood in Singapore, located in the North.

consideration resulted in “no conflict at all”, along with “no bonds”. Calvin continued to compare this to the situation he experienced in Yishun:

> “There's a lot of conflict in Yishun. But, with a lot of conflict right, comes with a lot of strong bonds. Bonds formed through conflict is usually stronger.” (Calvin)

To Calvin, the emptying of public spaces and the decreased spontaneous interactions between residents led to the lack of bonds between them. While this maintained the peace in the estate, the lack of conflict was due to a lack of interaction and connection, rather than the resolution of differences. Calvin hypothesized that conflicts could not occur when there were no opportunities to be known by others. This sense of disconnection from his neighbours was reflected in Calvin’s drawing of his neighbourhood, shown below.



Image 13: Calvin’s drawing

When asked to draw his estate, Calvin drew his front door. He was the only respondent who took this micro-view of his estate and did not include other aspects of the neighbourhood such as green spaces or parks. He also included a question mark in the centre of his drawing, near the entrance to his front door. The question mark suggests there is a sense of ambivalence that Calvin feels about his estate. While he was able to verbalize in conversation how he felt about the different aspects of his neighbourhood and the larger smart city, his drawing reveals an uncertainty and silence that was not as present when he spoke. The dominant affects of loneliness and isolation that was present throughout our conversation

sheds light on how the ambivalence Calvin feels can be analysed. Calvin felt isolated in his neighbourhood. Despite pointing out the lack of conflict in Punggol, he also experienced this tranquillity negatively as he felt disconnected from others.

When asked about his neighbours, Calvin expressed disinterest in connecting with them. He mentioned that he had "no idea" about any resident groups in his neighbourhood, and that he did not spend time with his neighbours in his spare time. When I asked if he interacted with them on other platforms, such as Whatsapp or Facebook, Calvin replied with: "It doesn't matter. My hands are tied with the amount of friends I have right now." Calvin was clear about not wanting to seek more social interaction with his neighbours. Although he previously expressed feelings of loneliness, Calvin did not express a desire to get closer to his neighbours. He described how "everyone is just working for this company called Singapore. I feel like Singapore is slowly turning into a company rather than a home…everybody will just interact with each other like professional acquaintances, like colleagues." This 'professionalisation' of social relationships can transform spaces that should foster community and connection into more impersonal, lonely environments. This professionalisation sheds light on Calvin's disinterest in forming deeper bonds with his neighbours. Instead of seeking emotional support, which may have once come organically from neighbours and community members, he expected these relations to be regulated by goal-oriented and impersonal interactions. The professionalisation of social relationships can depersonalise the shared spaces of these estates, making them feel more transactional and less friendly and communal. This shift changes the quality of emotional engagements, which Calvin was attuned to, as comparisons to his experience in Yishun has shown. Tina also felt this sense of disconnection. Both Calvin and Tina were in their twenties, lived with their families, and had recently moved to Punggol. Tina described feeling isolated in her new estate. When asked about her neighbours, Tina talked about how she was unfamiliar with most of them:

> "I only know two people, and the only reason I know them is because I knew them from outside… except for the neighbour in front of me, because [they're] living in the house across from me, so every time I see them. That one, that's the only one. Oh, and maybe some others who live on the same floor…we will meet at the lift when going to school, work, whatever. Ya, so, only those two to three [neighbours]…I don't know

> anything much other than their jobs, the age of their kids. I don't even know when they got married, or anything." (Tina)

Tina mentions here aspects of the design of her estate that encouraged interaction with her neighbours. Calvin discussed something similar in our conversation, where he compared the design of his estate in Punggol against the design of the older estate in Yishun he lived in.

> "When I lived in Yishun, everybody walk past can see what the hell you're doing…cos they can see, they can walk by and see what you're doing…People [in Punggol] generally [keep] to themselves and respect privacy so they're just alone in one corner...people in Yishun are more invasive and spontaneous. You can't escape, it's in your face." (Calvin)

Here, Calvin makes a different point than Tina had earlier, about the design of these estates. He discussed how a certain kind of sociality emerged through a specific type of design. Depending on the design, estates can encourage or discourage residents' movement through them, thus encouraging or limiting interaction. Sarah, another resident, discussed how these new estates limited residents' interaction with one another by reducing the number of units individuals have to walk past before reaching their unit.

> "There's just four houses...just turn right [outside of the lift] and that's it...here it's all at the end, you cannot see the windows." (Sarah)

Zareen also discussed these design features of the estates that maintain privacy and distance between residents.

> "These units stretch until all the way over there. I don't think we'll go that far, but they have to go here to throw rubbish and take the lift. We just take the lift and go to our unit...but initially we would take a walk down to see how's their gate like…[but] all of them closed their door." (Zareen)

The effect of intentionally avoiding neighbours and maintaining their privacy had caused Calvin, Tina and Zareen to feel disconnected with their neighbours. Even though they achieved privacy, they also wanted connection. In this way, positive emotions – such as the relief resulting from being able to maintain privacy – can have adverse affects (Hunter & Kivinen, 2020). While limiting interaction might limit conflict, the low levels of interaction

have resulted in a “peaceful” but lonely neighbourhood where residents interact as “professional acquaintances”.

Calvin’s hypothesis that limiting interactions will limit conflict is challenged in two ways by other respondents. Firstly, through the collective care of community cats, which brings residents together. Secondly, through the example of minority/Muslim respondents who discuss how a lack of interaction has caused separateness and a lack of understanding between different groups. I will discuss the first point here and then return to the second in the next section on the uneven experiences of minority/Muslim respondents.

2.3 The Collective Care of Animals

Through the collective care of community cats in the smart estates, I observed how respondents talked about building connections with their neighbours another. These cats encouraged interaction between residents in two main ways. First, by coordinating their care, which encourages residents to communicate. Secondly, the community cats encourage interaction by moving between houses – even when these cats belong to one resident, they tend to roam the resident’s floor, making themselves known to the rest of the neighbours. Scholars have argued that the relationship residents have with cats is an attempt to alleviate feelings of alienation after being removed from a dependence on nature (Chan, 2016; Chee, 2017). Cats have become a central figure in the local, collective imagination of everyday life – particularly due to the strict rules of ownership, which result in cats roaming the public spaces in HDBs as ‘community cats’ rather than belonging to a single individual.

Sharifah recalled how, after a serious incident with stray cats being overfed and injured in their estates, she banded together with a few neighbours to take care of the strays. Coordination of their efforts took place in person and through Facebook.

> “So I met this girl and this girl met another guy and we found out that we've been feeding these stray cats and of course we don't want to overfeed the stray cats so [we decided]… I'll feed it on Monday, you do Tuesday, that kind of thing. So it works. Once in awhile we'll post something in the group about the stray cats.” (Sharifah)

Sharifah describes how her neighbours collectively took on the responsibility of caring for the community cats. Through this, they not only ensured the well-being of these cats. They

also formed connections that strengthened their estate's social fabric. This connection happened in both physical and digital spaces that they shared. The connections they made across hybrid spaces represented both a shared love for the cats and the kinds of social connections that was present in their community, through a repopulation of common spaces. Humairah, a minority/Muslim woman in her twenties who lived with her parents in Punggol, described how caring for cats created an emotional bridge between her neighbours and herself. Below, she recalled an instance when she was asked to pet sit for a neighbour.

> "Our neighbours asked us to take care of their cats for them, but it was quite long, for two to three weeks…That was nice, I guess. There's a sense of trust and comfort in knowing that (we) would do the job for (them)." (Humairah)

Here, Humairah recalled how it was 'nice' that there was a sense of trust between her and her neighbours. A 2014 survey on community bonding by HDB and the National University of Singapore's Centre for Sustainable Asian Cities and Sociology department found that interactions between HDB residents were "incidental and minimal", with few displays of trust among neighbours (Cho, 2021). The survey stated that displays of trust, such as looking after a neighbour's home keys or lending and borrowing items, were reported to be rare practices in HDB estates. Humairah's experience shows how there is trust that develops between neighbours who share pet caring practices. The trust these neighbours shared, and the generosity Humairah showed become part of the larger narrative around neighbourliness in her estate (Terruhn & Ye, 2022). The shared caring duties reveal dynamics in such estates that produce feelings of camaraderie, comfort, and dependability among the residents. The same narrative and shared norms can also create friction however. Sharifah recounted an incident where a neighbour who was perceived to be mistreating his hamster was reprimanded on the estate's online page.

> "This lady, she saw a poor little hamster in a hamster cage at the side of the staircase…she brought the hamster home, cleaned the cage, fed the hamster, [then] she posted on the Facebook page…and this guy commented: it's my hamster. Why did you take my hamster…and could you put the hamster back at the staircase… They've never met, it was online. The guy wants the hamster back, but she's not returning it because she feels like [he's] not taking good care of it so [she's] taking it in." (Sharifah)

Here, it is not just disagreement that emerges from their online interaction. The disagreement resulted in punishment for the original hamster owner. The entire disagreement took place via Facebook, with the residents never meeting. The issue with the hamster had not been resolved when Sharifah recounted this story to me. She said that the new owner of the hamster still refused to return the hamster. The transgressions committed here such as neglecting pets, using common spaces for seemingly 'incorrect' purposes, and failing to respect the shared norms and spaces in the estates elicited frustration, resentment and anger among neighbours who had different expectations around responsible pet care. At the same time, these responses highlighted the importance of these pets in community dynamics. Much like Humairah's experience above, these pets can reveal norms around responsible animal care that is closely tied to levels of social cohesion. The breakdown of these norms exposed unspoken disagreements around the latitude residents had to exercise agency and autonomy in these estates. There are specific norms that have developed, and must be adhered to as part of being a resident of that estate. Sharifah, who was aware of these norms and agreed that there had been the mistreatment of this hamster, was supportive of the woman who took in the hamster. This suggests that these incidents are also opportunities for neighbours to bond over the norms they have developed in their estates and build forms of understanding between each other.

Non-smart technologies are often overlooked as spatial instruments and potential tools to imagine, organise and control smart environments and conditions. This chapter has shown, however, that they are significant to the everyday experiences of smart city residents and, therefore, could be significant to the smart imaginary. Although the discussion on neighbourliness reveals social logics that do not necessarily differentiate the spaces from those existing in older types of estates, the implications of these estates and residents being part of the larger Smart Nation project must be considered. One of the significant aspects of the affective experience that residents' discussions on smart reveal is how 'ambivalence' about the smart city (as discussed in Chapter 4) can be expressed through the residents' oscillations between positive and negative effects. The lack of a consistent affective experience that characterizes smartness reflects how the experience of these smart estates can contain paradoxes and tensions that shape how residents envision their futures.

Calvin described Punggol as "dead" due to being over planned, unlike Yishun. He discussed his concerns about the dehumanisation he predicted would come from disconnection.

Paradoxically, however, after Calvin discussed how "dead" Punggol was, he also mentioned how he "can't complain" because Punggol is a "peaceful neighbourhood". His positivity about Punggol reveals how Calvin had chosen not to disengage with his estate.

> "Everyone is very level headed when things break down, just talking calmly. Whereas it's a riot in the older neighbourhoods, things are breaking, some people get injured…it's not to say right now neighbourhoods are good or bad, it's just changing… Punggol, is a good place to retire, honestly…if I didn't achieve the things I want to do, I could see myself living here forever. But I would want to move out." (Calvin)

Calvin moved back and forth from expressing positive and negative feelings about Punggol. Despite complaining about Punggol and wanting to, ideally, leave the neighbourhood, his desire to leave was not separate from him being able to "see [him]self living here forever". Calvin regarded Punggol as "a good place to retire". These paradoxical feelings reflected an "ongoing interest" (Wilson and Anderson, 2020: 591) in living in Punggol. Calvin's frustration with the sanitised nature of Punggol and his isolation from his neighbours could coexist with his continued belief that Punggol is a "good place to retire". The "stickiness" (Ahmed, 2004) of these paradoxical affective flows reinforce specific understandings of how respondents felt about living in these smart estates. The "stickiness", which can be observed through the repeated explorations of the paradoxes in conversations with respondents, as shown above, suggests that "affects are being attached to objects and persons through the repetition of that affect" (Hunter & Kivinen, 2020: 130). Power relations are located in these affective flows, where we see how the conditions around the paradoxical emotions often involve larger market and neoliberal forces and state decisions. However, the stickiness of these paradoxical emotions demonstrate how respondents can both enjoy and resent living in their estates.

3. Uneven Experiences in Smart Estates

HDB estates can be understood as "highly contested urban spaces" (Chong, 2018: 19). They have been used by the state to organise the population through various policies, laying the groundwork for the use of public housing for social cohesion. In addition to the Ethnic

Integration Policy (EIP)[46], BTO estates have also been designed as 'integrated estates'. Integrated estates combine both owner-occupied and rental estates within the same neighbourhood, when previously, these two housing types would be separated. I build on Ho's (2017) work to show that there are other ways to observe power relations within smart cities beyond analysing how technological shifts exert biopolitical control over smart city residents. The transition to a Smart Nation has not been a neutral, even process (Ho, 2017; Guest, 2021). There are now new forms of marginalisation and practices of exclusion emerging. (Azzali et al., 2022). Issues around inequality and access remain significant in the city-state, with notable issues around digitalisation, the ageing population (Azzali et al., 2022), and inequality in access to technologies (Das and Zhang, 2021). Singapore Minister Heng Swee Keat, at the launch of a Smart Nation event in 2021, said that "while a digital future holds tremendous potential, we must ensure that we progress together as a society" (Andres, 2021). Here, he was emphasising the importance of bridging the digital divide.

These reflect the macro-level social impacts of the transition to smart. Pink et al. (2022) discussed how the smart home imaginary is dominated by a gendered vision of "technologically deterministic lives of affluent young white men". The authors argued for a "more realistic, plausible and ethical approach…[that] needs to originate from the different starting point of gender diversity and equality in the home" (Pink et al., 2022: 117). While their study argued for a more feminist approach to studying smart homes, applying this perspective to diversify the smart city imaginary can also be done by focusing on sites like the common spaces in HDB smart estates. In this section, I will discuss how conversations with respondents revealed how there were distinct experiences in the neighbourhood that only minorities encountered. Female minority/Muslim respondents discussed their everyday lives in their estates through experiences of isolation and separateness, revealing aspects of smart city living that often escapes conceptualisation. Much research around the significance of ethnicity and race in smart cities discuss how surveillance and algorithmic bias exacerbates existing racial inequalities (Safransky, 2020; Kontokosta & Hong, 2021; Raza, 2022; D'Ignazio & Klein, 2023). However, in the following discussion of the minority/Muslim experience, understanding an under-researched community reveals how there are material-discursive impacts of the unevenness of smart urbanism that go beyond that. In order to

[46] The EIP sets quotas for the ethnic mix of HDB towns. The main is to make sure that there is a balanced mix of the different ethnic groups within HDB towns, with EIP limits set at both block and neighbourhood levels based on the ethnic make-up of the city.

understand these impacts, I draw on a sociocultural perspective on affect and how affects are shaped by and help shape societal norms and relations, focusing on the emotional and lived experience of the everyday smart city.

3.1 Minority/Muslim Experiences: Embeddedness

The specific focus on the female minority/Muslim experience of the smart estates emerged from their over-representation in this research's sample. Most of the respondents I interviewed and did walk-alongs with were female minority/Muslim mothers under 35 years old. This demographic was over-represented, with 11 out of 19 of my respondents who were residents of the smart estates in Punggol belonging to this group. Through our conversations, these women discussed social practices and how they felt about their estates. Across these conversations, I found that many of these respondents shared similar experiences. What was also significant about their collective experiences was how embedded the daily lives of these respondents were in spatiality of their estates. Embeddedness here refers to the degree to which they were firmly and deeply implicated in the production and reproduction of their estates through their extensive use and presence within its spaces. This differs from other definitions used in work on urban diversity, such as coexistence (Ye, 2017), which highlight the flourishing of "micro-publics" (Amin, 2002: 959) and "civil engagements as neighbours, vendors and customers" (Ye, 2017: 1). Minority/Muslim female respondents who were mothers were embedded in their estates as they most frequently used the common spaces in these estates. They often moved through their estates in order to carry out activities related to caregiving, such as accompanying children to play areas, bringing them to school, and going along with their children to common spaces, such as the playground, to play. Asiya, a mother of two in her thirties, recounted her daily walks through her estate:

> "[This] is the park that I go with him every time, before I send him to school…usually I will just send the bigger one by bus transport, then I will slowly walk to his school. There will be [a] 15 minute time difference, so I will walk around the park with him, sit down, read stories." (Asiya)

The bodily practices of these women referred to specific actions and activities they engaged in through movement around the estates. Their presence fostered an emotional landscape where the common spaces became sites of familiarity and connection for these women, who

were brought closer to other members of their female minority/Muslim community. Asiya discussed how she would meet with the same people in her neighbourhood every week due to her routine:

> "Recently I just joined this lady, she goes exercise, this aerobics thing, I join also. Then my son also, every Monday he has ngaji[47] class over at the neighbours' house." (Asiya)

Both these activities involved the participation of other minority/Muslim women in Asiya's neighbourhood. Her estate became more than just a physical backdrop for her activities – it developed into a meaningful place that shaped, and was being shaped by, the activities she engaged in in order to take care of her family. The value of studying this group of women lies in their ability to reveal how these shared spaces are constantly produced and reproduced through everyday practices. Their frequent use of these spaces meant they were deeply embedded within the neighbourhood, often creating informal networks of care and sociality such as the ones around exercise and religious practices. They frequent these quiet common spaces, transforming them into places where interpersonal connections can thrive.

In addition to using these spaces frequently, their experience of these spaces and their movement through their estates should also be understood within a specific social and cultural context. As female minority/Muslims, these women engaged in unique patterns of space use that help illuminate the dynamic relationship between different groups of people and the infrastructures of these estates. Sarah, for instance, discussed how there was a lack of Muslim-focused childcare services in Punggol:

> "The childcare services, all [are] like a problem for me. I'm very particular about the Muslim thing, so that one is a problem lah, because there's not much over here. I have to enrol him into a 1-hour playgroup instead." (Sarah)

As a minority/Muslim mother, Sarah used specific services that catered to her social and cultural needs, such as enrolling her children in Muslim-run childcare services. When these services were not available nearby, Sarah and a few other minority/Muslim mothers would rely on their social networks or travel outside their estates for childcare. Both male and female minority/Muslim residents navigated shared spaces in different affective ways, shaped

[47] 'Ngaji' is a term in the Malay language. 'Ngaji' classes refers to classes where individuals study more about their religion, and practice religious activities. Often, it refers to classes that teach Quran reading.

by emotions such as loneliness and isolation, which influenced their bodily experiences of these social spaces. Both male and female minority/Muslim respondents also discussed how the neighbourhood mosques were a site of community support and connection. These mosques gave them a sense of belonging in an otherwise alienating environment. Among minority residents, there was a sense that belonging was contentious and not guaranteed. This exclusion resulted in the experience of separateness, which can be expressed spatially. Two respondents, Haikal and Fathin, described how they felt a strong connection to their local mosque. The mosque was a central part of their social lives, where they formed close-knit ties to other Muslim residents. When asked about making friends in his estate, Haikal mentioned the mosque as playing a big role in not just his own social life, but the social lives of his family members:

> "I think the mosque also helped. I think the mosque in Punggol is also very active lah. A lot of activities. I think people would actually interact more at the mosque than at the corridor…my dad would stay from Suboh[48] prayers until 10 o clock. And that's when you meet all the other pakcik-pakcik[49] retirees lah, and then they will go eat together after that or they stay down and talk rubbish, or something like that. I think that's how my dad got to know more people." (Haikal)

Haikal discussed how his "closed-door" kind of father would frequent the mosque. This helped him to socialise and get "to know more people". Although similar to loneliness, isolation carries a slightly different weight here. When Haikal's father frequents the mosque, his isolation is both physically and emotionally overcome. The use of mosques as social spaces provided relief from his previous isolation and disconnection.

This lack of communication within shared spaces further amplifies the affective experience of separateness or isolation for minority/Muslim residents.

> "Once I'm done with my work, I'm going home. I shut my door, and that's it. There's no longer [the] opening [of] doors, [where we] say hi, bye. There's no such thing. Or…I don't know, sweeping your front [area], it doesn't happen anymore. If there's

[48] Suboh prayers refer to early-morning prayers that Muslims do at sunrise. More commonly, they are referred to as 'Fajr' prayers
[49] 'Pakcik' refers to old man in Malay

> no interaction, you have friction, you don`t understand each other. At the same time, if you need help, you can't help, you're not able to get help as well." (Fathin)

This lack of communication within shared spaces further amplifies the affective experience of separateness or isolation for these minority/Muslim residents. Shared spaces, like the walkways between the HDB units, as Fathin described, are, ideally, areas of connection. This is where neighbours from different ethnicities and religious backgrounds can coexist and engage. However, without physically sharing these spaces, there is little chance for communication and connection. This can leave minority residents feeling excluded and disconnected. It is not just a personal feeling of separateness. Haikal's father's isolation reflected a spatial and affective distancing – being cut off from networks and social groupings in his everyday life in the estates. His turn to the mosque as an alternative shared space, while providing connection, emphasised the boundary between him and his non-Muslim neighbours, potentially reinforcing the distance between 'us' and 'them'. This shows how these estates are occasionally divided landscapes, where shared spaces are places where residents co-exist despite differences while occasionally feeling like they are experiencing these estates in isolation.

3.2 Minority/Muslim Experiences: Separateness

> "Teruk[50]. [They] lack compassion...when you have no interaction as well, you don't know your neighbour well...if you talk about the kampung days, people tend to get together and say hi…but now, there's no kampung spirit. " (Fathin)

Fathin argues here that more interaction will lead to more connection and, therefore, less conflict. This is slightly different from Calvin's earlier claim about the connection between sociality and shared spaces. He claimed that residents often encountered conflict in Yishun with more use of shared spaces and interaction between neighbours. In Punggol, with less use of shared spaces and interaction between neighbours, residents did not encounter conflict as often. While both Fathin and Calvin suggest a clear relationship between levels of communication and conflict, their varied experiences show how interaction produces both instances of less and more conflict. This separateness draws on an understanding of the

[50] In the Malay language, 'teruk' means 'terrible'

structuring of difference in everyday shared spaces (Ye, 2017) that recognize how encounters have the ability to "frequently reflect and reinforce positionalities of those involved…[and] also hold possibilities of change because they are mediated socially" (Ye, 2017: 4) . Scholars have shown how interaction can sometimes bridge differences, and at other times exacerbate them due to existing hierarchies (Ye, 2017; 4; Matejskova & Leitner, 2011). The inclusion of the minority/Muslim perspective, through Fathin's response, reflects this complex understanding of the relationship between interaction and conflict. The isolation of a minority group can be magnified when there is no communication or interaction to bridge the divide between different groups. In shared spaces such as parks, void decks, or common corridors, the absence of mingling and casual conversation can create an indifferent or unwelcoming atmosphere. Isolation can then feel even more pronounced, encouraging these minority groups to seek support and connection from those more familiar.

Tina discussed how she felt like it was challenging to make friends in her estate, and when asked about a feature she wished was part of her estate, her response was to have a map that would indicate the ethnicity of the residents in her estate.

> "I wish right, that we have a map...like you know when you enter an exam hall right…[there's a] main list outside the exam hall? And then after that got the seating number. I wish they had something like that for HDB blocks, and you can go see the name of the first person in the house…and the race also, maybe. Or, actually, I don't know if want to include race or not….[but] it's so you can see who you can talk to. Some people maybe want to talk with other Malay people...or Chinese people talk to Chinese people, like that…. I'm not racist, my idea is racist. If you think I'm racist then whatever, okay." (Tina)

Tina's desire to know the ethnicity of everyone in her estate, in order to use ethnicity as a basis for deciding whom she would interact with can be affectively understood through disconnection, rather than simply an act of racism. Tina's desire can be linked to how she felt disconnected. She believed that gathering knowledge of her neighbours' ethnicity would be a way of assessing commonality. It can be understood as a way of mitigating the risk of exclusion or adverse treatment. This 'map' Tina talked about might not necessarily be a tool to reject others based on their ethnicity, but rather, represents knowledge of residents who might share similar experiences and be more likely to be interested in fostering a bond with

her. This map would make one's minority status obvious. Tina's loneliness and disconnection could have made her more aware of social dynamics and ethnicity as an identity marker, as seen in the following quote, which followed the previous quote in our conversation, when Tina explained the idea of the map, which she sees as resembling a list or index.

> "Singaporeans, you know, always like to ask: 'Why must everything be about race'? But I don't know, what is wrong with that…[it's] like, so you can see the percentage [of different races], is it really matching? You know HDB always says that we have some kind of ratio that we need to match...so you see really, if your estate matches." (Tina)

Tina's feelings here seem to have emerged from a complex interplay of emotions rooted in the lived experiences of minorities, where feelings of exclusion or vulnerability shape one's attempts to navigate social spaces safely and meaningfully. She emphasised the importance of following HDB's ethnic quota and raised some doubt that it had been adhered to. Tina might have felt like there were spaces that felt unwelcoming, and she could have attributed this to the lack of presence of other minorities. Knowing the ethnicity of others in her estate and being assured that there will be a minimum number of them per estate, as per the EIP, offered Tina a sense of security. The knowledge of the ethnicity of her neighbours represented an affective strategy to reduce the potential for harm or rejection by seeking connection with those perceived as having shared experiences as fellow minority/Muslim individuals.

Relatedly, Haikal discussed how his parents used a similar strategy when getting to know their neighbours after their initial move into Punggol. He described his parents as introverted, "door-closed kind of [people]". They did, however, make an effort to get to know their Muslim neighbours.

> "My parents do go to Hari Raya[51] at some of the neighbours' houses. Like when we first moved in, they did make it a point to get to...knock on all the [doors of those] they know are Muslim neighbours. You can see from the lights, and then Malays have a certain way of decorating their house, it's "over" lah, so you can see from the door." (Haikal)

[51] Hari Raya is commonly called 'Eid' by the larger international Muslim community and is celebrated yearly on 1 Syawal (according to the Islamic calendar), after the month-long Ramadan period of fasting

Haikal discussed how his parents observed and identified the ethnicity of their neighbours through their external house decorations, such as lights. They interpreted these lights as visible cultural symbols, as they were the lights that Muslims customarily would hang outside their homes during Ramadan. These festive decorations signalled shared religious beliefs. In observing the 'over' decorations, which referred to the stereotype of the 'over the top' way Malays decorate their house, Haikal's parents observed other visible cultural symbols such as colour schemes and aesthetics as signalling shared cultural practices. Haikal's parents sought out signs of cultural and religious affinity to find emotional resonances within an environment that usually felt exclusionary. These visual symbols become affective markers in the estate, signalling which homes were more likely to belong to other minority residents. This strategy, which involves initial observation but not close interaction in order to make assessments on sameness, maintains a level of distance without the risk of missing commonalities.

Affectively, then, Tina and Haikal's parents used information – whether specific information on ethnicity, or visual cues through decorations –to navigate their neighbourhoods. Both Tina's desire to map out the ethnic landscape of her neighbourhood and Haikal's parent's use of visual cues and symbols to identify Muslim neighbours were bids for connection that could have mitigated feelings of isolation and foster a deeper sense of community. Framing Tina's desire as purely racism overlooks the affective dimensions of why her views might have emerged. Instead of automatically wanting to reject others, Tina's suggestion for the map represented a move towards establishing familiarity to create a sense of connection and belonging in an isolating environment. This is one way to see how her suggestion for the map is rooted in vulnerability rather than racism, which is often about asserting power and superiority over others based on ethnic differences.

The dynamic between embeddedness and separateness that I have discussed here involve the religious and cultural differences of the minority/Muslim community that live in the smart estates in Punggol I studied. In addition to these differences, other forms of difference emerged in conversations with residents of these estates. These differences, which included perceptions of rental housing occupants and foreign construction workers, are essential to understand. They show how there are many intersections of difference and marginalities, where issues around class and citizenship are implicated, in the uneven experience of the smart city. Difference and marginality in smart cities can take many forms. Although not

within the purview of this chapter, these aspects of difference would be important to explore in future research.

4. Conclusion

'Smart' as a proposition has also been shown to be a loose concept – sometimes referring to digital technologies, technological infrastructure, a kind of 'digital readiness' and ability to use technology, or even, as shown in this chapter, a locational quality. Even with the advent of social media and other digital technologies that have facilitated communication between residents, the hybrid physical-digital space is insufficient in explaining the current social infrastructure of these estates. 'Smartness' cannot be understood as an automatic or natural consequence of transitioning to 'smart.' Other changes occur in this transition, and as demonstrated, some of these changes will occur during the spatio-temporality of the smart transition but will be largely unaffected by smartness. This chapter discussed the relation between affective experiences and socialities as multi-dimensional. I showed how socialities, which Pink refers to as "different sets of concrete…social relationships that develop around actual activities" (2008: 172), are produced by, and can produce affective experiences that are site-specific, but not necessarily 'smart'. Through studying these ordinary practices, this chapter showed how smart city residents engage in interactions that do not always automatically centre on smart technologies.

The observations in this chapter challenged the assumption that smartness can be collapsed into what can be observed or expressed in people's engagement with technology. This assumption risks leaving out a range of meaningful and affective experiences with the smart city. The affects that emerged from the tensions between privacy and connection revealed the emotional landscape of the everyday, which can contain feelings like loneliness, frustration, isolation and distrust. The emotional landscape is not just made up of negative feelings, however. The tensions between privacy and connection, as well as the uneven experience of the smart estate, suggest that the emotional landscape can be dynamic, one in which residents might have conflicting and fleeting feelings that enact certain kinds of social practices. Moving back and forth between different emotional states and perceptions of their surroundings and social lives suggests a complexity to this landscape that affectivities can capture. Calvin's mixed feelings, for example, reveal how infrastructure impacts social lives, and residents' connection with each other can come to represent an aspirational future. As discussed in the last section of this chapter, infrastructures can also reveal how the present is

being stratified. Thus, infrastructures are not neutral. Smart infrastructures, similarly, produce smart futures that are not disembedded visions of the future. These visions are drawn out of trajectories that stem from the realities of smart city residents on the ground. As a site of the Smart Nation project, these smart estates in Punggol are then a type of infrastructure by which the city imagines its future at an everyday level. These futures contain a multitude of shifting affectivities.

Chapter 6: The Haze

1. Introduction

> "[The state] told you to reject the evidence of your eyes and ears." (RU 1, 2019)

Data is essential to the functioning of the smart city. The smart city is often characterised by "the production of sophisticated data analytics for understanding, monitoring, regulating and planning the city" (Kitchin, 2014: 12). As the volume of data produced in cities has increased exponentially, information about cities and their citizens provides insights into everyday life in these cities. In Singapore, the state has extensive control over the official data infrastructures and techniques for measuring air pollution. Much of the material-technological data infrastructures implicated in managing air pollution in Singapore are state-owned[52], with the state controlling the haze data gathering and dissemination technologies through the NEA. Through a study of the contestations over haze data online in Singapore between 2013-2019, this chapter problematises the treatment of official haze data as neutral. In this chapter, data is shown to be dynamic, subjective, and contestable.

The haze materialises air, giving it form, colour, smell, and taste. Air is not just a substance 'out there' anymore but becomes something felt and seen. The perceived materiality of the haze refers to the particulate matter of the haze (PM2.5 or PM10), and through engagement with the body, it becomes a "sensible concept" (Massumi, 2002: 98). These sensations make up the overall sensorial experience of the haze – how it looks, smells, feels, tastes – and act on the bodily surfaces of people. Ahmed argues that sensations matter to circulations of affect because "you are left with an impression that is not clear or distinct" (Ahmed, 2017: 22). This suggests that the bodily-material engagements of the haze produce sensory experiences that are not experiences of certainty. They are dynamic "experiential registers" (Gabrys, 2017) produced by the materialities of the haze. Drawing on Gabrys' work on citizen sensing, this chapter examines how environmental monitoring, or sensing, can be understood from experience rather than haze data. Sensing the environment and producing data about that experience can be seen as a kind of practice-based engagement with the larger assemblages of

[52] Since 1993, the NEA has been using the Airvivo System, which is responsible for handling air quality monitoring stations across the island. This system is used for data collection, validation, storing and reporting (Airvivo Online, 2024)

the smart city. The generation of 'evidence' through responses to sensory engagements with the haze and contestations of official data "seeks to articulate new forms of participation and political possibility for citizens" (2017: 179). Data, then, is no longer only produced by the state and state apparatuses. By applying a feminist lens on working with data – from data collection to analysis and communication, D'Ignazio and Klein (2023) identify pluralism as an essential principle of "data feminism". Embracing pluralism allowed "a range of participants to contribute their knowledge to a data project and to do so at all stages" (D'Ignazio & Klein, 2023: 147). Counterdata is defined in Olojo's work as "data that is collected to contest a dominant institution or ideology" (2024: 171). Drawing on this body of work around new forms of data and feminist thought, I use counterdata in this chapter to refer to the data generated by individuals "to contest numbers or official statistics produced by institutions" (Olojo, 2024: 172). Specifically, this data consists of descriptions of the sensations individuals experience during the haze, which moves beyond numerical PSI figures. By drawing on multiple perspectives and positionalities, the taken for granted objectivity and neutrality of the official PSI figures is challenged.

The concept of a smart city is closely linked with the sustainable development of cities (De Jong et al., 2015). In Singapore, the development of smart city solutions has often come in addition to sustainability-related issues around pollution and resource management (Miao & Phelps, 2019). While this framework of normativity helps make urban solutions more attractive as exports (Miao & Phelps, 2019), the on-the-ground experiences of the haze reveal that there are everyday forms of environmental problems that smart city residents experience. For example, the PM2.5 levels in the air of the five most polluted cities worldwide exceed recommended levels by over ten times (IQ Air, 2022). In London, an organisation called London Air provides residents with an interactive map that shows current pollution levels across the city. Environmental monitoring has become an increasingly significant aspect of studying how cities are developed and maintained, especially in the face of worsening climate change (Gabrys, 2017; Suman et al., 2022; Tse et al., 2016). Many cities have chosen to address the issue of pollution through data. Various state and non-state online websites provide real-time data on air pollution. Furthermore, sources of air pollution are not just restricted locally. The Southeast Asian haze is one example of transboundary air pollution, where the source of the pollution can sometimes lie outside of the country that experiences the pollution. While the source of the haze is usually Indonesia or Cambodia, the countries that experience the haze extend to Malaysia, Singapore, and Thailand. To address air

pollution's transboundary nature, legislation and agreements have been used to manage air pollution (Varkkey, 2022)[53]. I expand on work on the affective politics of air pollution (Shilon & Marom, 2023) and citizen sensing (Gabrys, 2017) to show how direct, sensorial experiencing of the haze allows individuals to produce counterdata and, in this process, reveal how data is entangled in larger smart assemblages. Through this, conversations on the haze, especially those focused on haze data, become part of larger political discourse.

In response to the research question, the kinds of affective experience I discuss in this chapter focus on sensory engagements when experiencing the haze. I critically analyse patterns in online communications on the subreddit /r/Singapore to understand what people were discussing when discussing the haze and Pollutant Standard Index (PSI) levels. This chapter shows how bodily experiences of the materiality of the haze produce a critical engagement with data. While Chapter 4 observes the Smart Nation as experienced at an estate scale and Chapter 5 observes it at a more inter-personal scale in both domestic and public spaces, this chapter observes the Smart Nation project as it is experienced through the materiality of air; between 'sensing' parts of the body, such as the skin or eyes, and haze particulates. Thus, the haze as a case study is important to the thesis as it allows for a micro-level observation of the mechanisms that produce infrastructural (in)visibilities in the Smart Nation. Everyday interactions in the larger assemblages of the smart city implicate infrastructures across the city. The examination of haze is reveals entanglements with the body, city-wide data infrastructures, state efforts and national and transnational policies.

1.1 The Centrality of Weather

The haze in Singapore can be understood as relatively seasonal and predictable[54] – especially during 2013-2019. Alternative perspectives on the haze can potentially add to the current

[53] In 2014, Singapore introduced the Transboundary Haze Pollution Act, which extends extraterritorial application for liability for pollution causing the haze.

[54] Although the haze has been a regular seasonal weather-event in Singapore since 2013, there have been recent changes to the patterns in its occurrence. In 2020, the first year of the COVID-19 pandemic, Singapore did not experience seasonal haze the way it did in previous years. Wetter weather during the usual dry season, due to climate change, and the impact of the COVID-19 pandemic on business, labour management and other factors that could impact farming and peatland burning are all possible reasons for the change in the occurrence of the yearly haze. In 2021, after a relatively haze-free 2020, Singapore experienced shorter bouts of the haze during non-seasonal periods, especially in the first half of the year. Overall, however, the risk of a severe transboundary haze event, like that in 2019, was deemed to be low (Singapore Institute of International Affairs, 2021: 3). Experts have cautioned however, that climate-change induced weather changes and the impact of COVID-19 might not necessarily lead to less haze over the next few years. Additionally, NGOs have warned of the impact

body of literature on smog and haze, which tend to concentrate on specific and identifiable socio-temporalities (e.g., the smog in Beijing and air pollution from car exhaust in many North American cities, such as Los Angeles). Pollution and toxic weather are not new to the urban city experience.[55]

In Singapore, 2013 marked the beginning of yearly haze periods. The haze occurred mainly during the hotter months of June to September and was caused by large-scale burning in many parts of Sumatra and Borneo. Satellite images showed that the haze that affected the region was largely caused by fires in the Riau province of Indonesia.

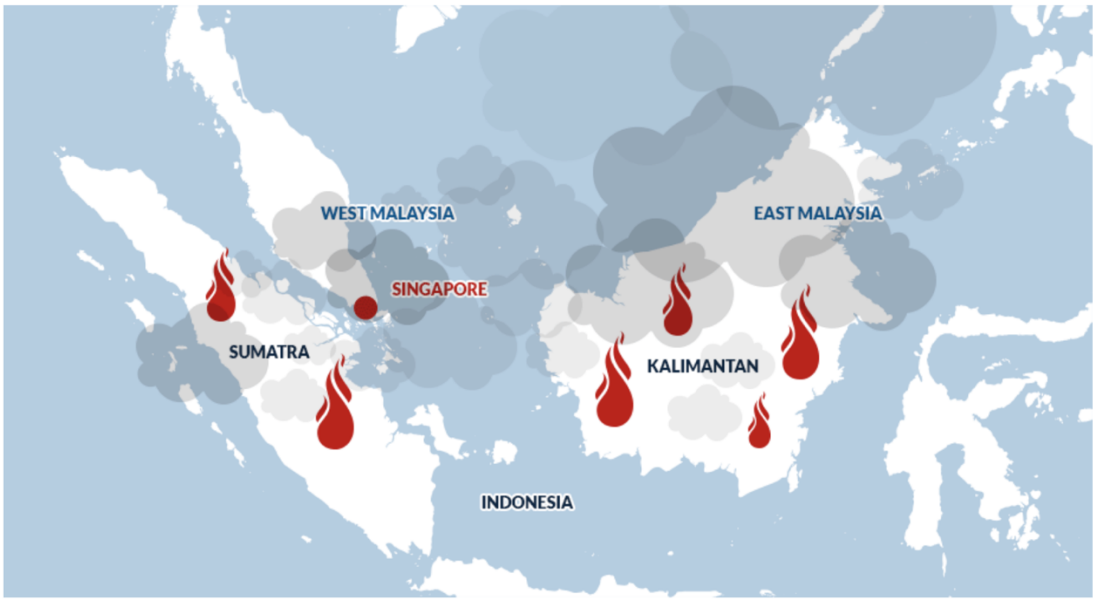


Fig. 7: This map shows the different hot spots in the region that commonly contribute to the haze in Singapore, specifically the ones in Indonesia (National Environment Agency, 2019)

of the passage of Indonesia's Omnibus Law in October 2020, which has loosened various environmental laws and regulations to allow for the easing of doing business in the hopes of promoting economic growth (Singapore Institute of International Affairs, 2021: 3).

[55] There have been numerous studies on the effect of air pollution on people (Liu et al., 2018; Anderson et al., 2012; Schlatter, 1994). The link between CO2 emissions, especially from fuel combustion, and the level of smog in cities has been demonstrated. However, in the specific case of Singapore, it is interesting to note that while Singapore has ranked as one of the most carbon intensive countries, the carbon emissions per capita for Singapore cannot be offset by lower rates found outside of the capital city (as is the case in other countries such as China, which ranks much lower in carbon emissions per capita, but experiences worse pollution issues in its capital cities such as Shanghai and Beijing).

According to historical PSI readings available on the National Environment Agency (NEA)'s online haze portal[56] (National Environment Agency, 2022), the 2013 haze caused record high levels of pollution in Singapore (Lin, 2019). The 3-hour Pollution Standards Index (PSI) of Singapore reached 401 on 21 June 2013, surpassing the previous record of 226 during the 1997 Southeast Asian haze. The haze returned to the city-state every year between 2013 and 2019, with the haze in 2013, 2015, and 2019 hitting the highest levels (Varkkey, 2022). In 2014, the highest 24-hour PSI was 107-125 on October 7. In 2015, the PSI on the 25th of September reached 341, which is hazardous to health. Schools were forced to close, and fast-food chains had to suspend delivery services to ensure their workers' health (Goh, 2019). In 2016, the 24-hour PSI hit unhealthy levels above 100. The transboundary Southeast Asian haze still occurred in 2017 and 2018, albeit at lower PSI ranges. In September 2019, the PSI again rose to unhealthy ranges, and the additional PM2.5 readings incorporated into the official NEA statistics showed similarly unhealthy levels of air pollutants.

In the following sections, I will first discuss how smart infrastructures are implicated in the management and experience of the haze. I then discuss how air pollution monitoring systems, data infrastructures, media, and digital or online platforms construct the haze experience. Secondly, I challenge the taken-for-granted nature of data infrastructures by analysing how data on the haze can be produced in bottom-up ways. I do this by analysing online Reddit threads that discuss haze data to show a correlation between expressions of sensory engagement with the haze and challenges to official data. This reveals various affective engagements that widen the space of political discourse online.

2. Haze Infrastructures

In this thesis, haze infrastructures refer to the organisational and structural facilities – physical, social, and techno-material – enacted to manage the haze during hazy seasons. Much of the material-technological data infrastructures implicated in managing air pollution in Singapore are state-owned[57], with the state controlling the haze data gathering and dissemination technologies through the NEA. In addition, haze infrastructures consist of

[56] NEA is the source of PSI figures that inform local news sources (e.g. The Straits Times and Channel News Asia). It is considered to provide official data, but is not the only source of data available

[57] Since 1993, the NEA has been using the Airvivo System, which is responsible for handling air quality monitoring stations across the island. This system is used for data collection, validation, storing and reporting (Airvivo Online, 2024)

other non-state entities, such as ground-up or citizen-led organisations that provide alternative data and information on social media sites. These infrastructures intersect and are entangled with other infrastructures within the assemblages of the smart city. This chapter explores the interdependencies and overlaps between different data sources, using the haze as a case study to understand how data is mobilised in new and collective ways to widen the political discourse online.

2.1 Sources of Haze Data

A central aspect of the haze infrastructure is the generation and circulation of haze data. Though the NEA owns air pollution monitoring stations across the city, the data circulation and communication systems individuals have access to are diverse. The table below lists the sources of information on haze data that are available.

Source of information on the haze	Type	Country of origin
myENV app (NEA)	Official, governmental, digital	Singapore
NEA website	Official, governmental, digital	Singapore
Haze portal (haze. Gov)	Official, governmental, digital	Singapore
NEA Facebook and X (formerly Twitter)	Official, governmental, digital	Singapore
The Straits Times newspaper	Official, governmental, physical	Singapore
US EPA (United States of America Environmental Protection Agency) AQI	Official, governmental, digital	US
World Air Quality Index (WAQI)	Nonprofit organization, digital	Beijing
PM Haze	Nonprofit organization, digital	Singapore

SG Real Hourly PSI	Independent, digital	Singapore

Table 7: Sources of haze information

Alternative local sources, such as PM Haze and SG Real Hourly PSI, as well as alternative international sources, like the US EPA AQI and WAQI, have gained popularity in recent years, gaining the most traction in 2019 when the haze was arguably at its worst. Of the alternatives, there are two main reasons why the haze data presented differs from the official NEA figures. The first difference is due to the calculation of different sets of particulate matter (US EPA AQI, 2024[58]). The second reason can be attributed to how different figures correspond to different aggregations of data (e.g. WAQI, PM Haze, SG Real Hourly PSI). Both differences are methodological differences. Although PM Haze and SG Real Hourly PSI use NEA data, they present PSI numbers that differ from NEA as they present hourly data on the PSI, instead of NEA's 24-hour data.

The differences can seem significant when PSI figures are compared directly. The graph below shows the difference between the PSI figures from the SG Real Hourly PSI site and NEA's official PSI figures.

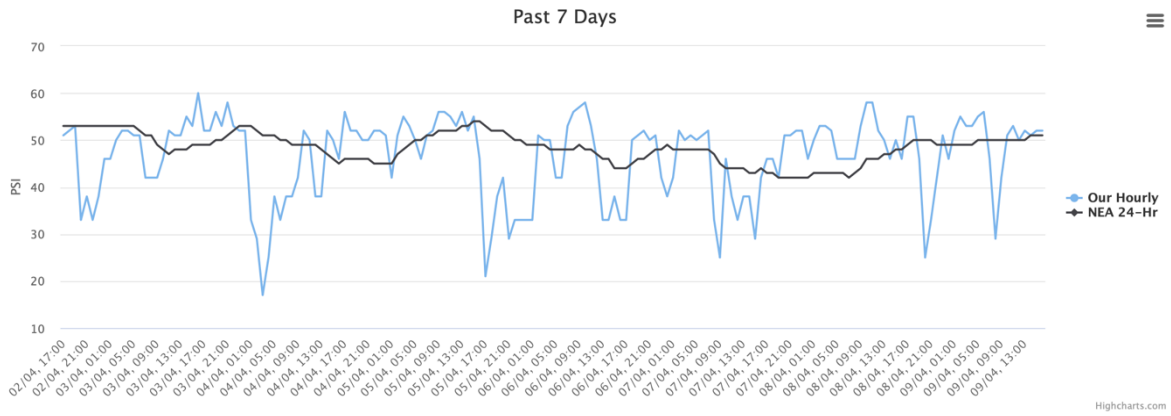


Fig. 8: Comparison between the site's hourly data and NEA's 24-hour data over seven days in 2020

[58] The US EPA AQI follows an air quality reporting system set out by the US Environmental Protection Agency, calculating four of the US' major air pollutants that are regulated under its laws including ground-level ozone, particle pollution, carbon monoxide and sulfur dioxide. The Singapore PSI calculates particle pollution in two individual figures – PM10 and PM2.5, and nitrogen, in addition to sulfur dioxide, ozone and carbon monoxide.

As indicated on the site, the difference between the figures can be attributed to methodological differences in calculation. These differences have also been discussed in traditional media, such as the national newspaper The Straits Times.

2.2 Traditional Media

The haze has been reported on regularly since 2013 across both traditional and new media forms (Lin, 2019). A study looking at traditional and new media material around the haze in 2013 revealed how traditional media has reported on the haze in an overwhelmingly positive way, while new media, particularly social media, published views that have been overwhelmingly negative (Lin, 2019). In the later sections of this chapter, I analyse online posts and comments on Reddit to understand the affectivities of the haze and haze data. Here, I observe how these conversations have been reflected in traditional media. Drawing on newspaper articles published in the Singaporean daily newspaper, The Straits Times, I refer to five articles written between October 2015 and late 2019. These articles have been written by The Straits Times' Science and Environment correspondent, Audrey Tan. This section is not meant to reflect the findings of a thorough media analysis of the haze. It is limited in scope. I discuss the rationale behind the methodological choice to use only five articles in the Methodology section (Section 5.3). I now discuss those articles here to show how the persistence of the debate around haze data has been reflected in the traditional media. These five articles show how the contestations over official haze data have circulated for a few years outside of the Reddit threads analysed in this chapter.

Audrey Tan's article, "Official one-hour PSI figures, please," dated October 8, 2015, reported that the PSI readings that were posted on the official NEA haze portal "do not provide up-to-date information which people can use to plan their day" (Tan, 2015a). Furthermore, "some individuals, volunteer groups and organisations, [were] turning to at least three different sources to judge how hazy it [was] here at any given moment" (Tan, 2015a). She wrote that the issue was that "amid periods of intense haze, when PSI readings fluctuate and air quality [did] not always correspond to the smell and look of the air, hourly PSI readings are needed to help people better plan their activities to avoid exposure to air pollution at its worst" (Tan, 2015a). In another article published the next day, on October 9, Tan reported that the NEA "[would] not heed calls for it to provide one-hour Pollutant Standards Index (PSI)

readings…because converting raw pollutant concentration data into one-hour PSI readings is not supported by health studies" (Tan, 2015b). This stand from NEA was communicated to Tan by Indrani Rajaram, a project director and chief scientific officer in NEA's pollution control department. Rajaram explained that "the NEA calculates PSI by inputting pollutant concentration data into a formula that takes into account breakpoints - upper and lower concentration limits derived from health studies" (Tan, 2015b). Rajaram maintained that "if tomorrow, there is a very rigorous health study that tells us that (there is a) one-hour PM2.5 concentration that is harmful, we will use that to do a conversion" (Tan, 2015b). This suggests that the main driver for adapting the haze data depends on health studies and not other factors like popular opinion. In 2016, Tan responded to an askST section question, "How do I interpret the new 1-hour PM2.5 readings?" Tan discussed the different kinds of PM2.5 data NEA provided, including health advisories that specified the kinds of activities that would be safe to do depending on the different PM2.5 bands (Tan, 2016a). This article did not discuss contestations over the official data.

In 2019 however, both of Tan's responses in the askST section in September and November focused on these contestations. Tan's article on September 20, 2019, titled "Why air quality measurements in Singapore differ from other indexes" explained the different methodologies used by NEA and the World Air Quality Index (AQI), stating how the different calculations were meant to serve "different functions" (Tan, 2019a). Alternative data sources like AQI did "not follow Singapore's system of computing PSI" (Tan, 2019a). This article, similarly to Tan's article in 2016, provided detailed information on NEA's methodology. In this 2019 article however, Tan wrote explicitly about the contestations over haze data, stating how "many have questioned whether the figures on the NEA's website have downplayed the severity of the haze" (Tan, 2019a).

Tan's second askST article was titled "Why are Singapore's PSI readings so different from those used elsewhere, and which are correct?" In this article, Tan addressed NEA's methodology once more. Tan emphasised the point early in the article that "neither are incorrect" (Tan, 2019b). Tan reported on growing public frustrations, stating that "during hazy episodes over the past week, people have pointed out that while the AQI reflected unhealthy levels, the NEA's 24-hour PSI showed "moderate" air quality" (Tan, 2019b). She then drew on a response from NEA in The Straits Times on September 25, 2019, where the

agency argued that the differences in the two readings "[boiled] down to the way the readings are calculated" (Tan, 2019b). Tan wrote about how alternative air quality readings have gained popularity. NEA's response to this, as conveyed by Tan, clarified that these alternative air quality readings, such as aqicn.org, "[do] not follow Singapore's system of computing PSI" (Tan, 2019b) and that this "difference in methodologies is why the final PSI or AQI readings can be different" (Tan, 2019b). Tan's articles from 2015 to 2019 show how the NEA has justified its PSI calculations through explaining how their methodology is scientifically sound.

These articles show the period of coverage of NEA's haze data and its methodology in traditional media. The articles in 2019 also explicitly reported on public frustrations around NEA's haze data. These frustrations were significant enough in 2019 that Tan responded to two questions posed to The Straits Times about the validity and accuracy of NEA's haze data. These articles show that the kinds of data contestations found online are not limited to the new media space. To some extent, the sentiment underlining individuals' frustrations and suspicion of official data is reflected through the reporting of clarifications, discussions and contestations around haze data in the media. In addition to traditional media, official sources of information on the haze, such as NEA's health advisories, also provide information on the kind of haze data being collected and disseminated to the public.

2.3 Official Health Advisories

The table below shows what is included in the NEA's official computation of haze data. Initially, in 2013,[59] the PSI figure only consisted of 24-hour aggregations (Velasco & Rastan, 2015: 23). In 2015, NEA reported on 24-hour PSI figures and 3-hour figures, but not hourly ones. By 2016, although hourly PSI figures were not yet made accessible to the public, the official haze data included hourly PM2.5 and PM10 figures. The 1-hour PSI figures are still

[59] The time period being studied begins in 2013 as PSI levels hit highs that it had not for 16 years, with Singapore experiencing the worst levels of the haze in its history during the period between 2013-2019 (Velasco, 2015)

not presented on NEA's official haze data portal. Currently, the website states the 24-hour PSI[60] and the 1-hour PM2.5[61] readings.

Year	PSI	PM 2.5 and PM. 10	Health advisory information[62]	Data used in health advisory
2013	24-hour	24-hour	18 October 2013: "Refer to the 1-hr PM2.5 for immediate activities, and the 24-hr PSI forecast to plan ahead." (NEA, 2013)	24 hour PSI (band range indicated) 24 hour PM2.5
2014	24-hour 3-hour moving averages	24-hour	4 November 2014: "The health impact of haze is dependent on one's health status, the PSI level, and the length and intensity of outdoor activity. Reducing outdoor activities and physical exertion can help limit the ill effects from haze exposure. Persons who are not feeling well, especially the elderly and children, and those with chronic heart or lung conditions, should seek medical attention. Given the air quality forecast for the next 24 hours, everyone can continue with normal activities." (NEA, 2014)	24 hour PSI (band-range indicated) 24 hour PM2.5
2015	24-hour	24-hour	15 November 2015: "The health impact of haze is dependent on one's health status, the PSI level, and the	24 hour PSI (band-range indicated)

[60] The 24-hour PSI is calculated based on six air pollutants – PM2.5, PM10, ozone, Sulphur dioxide, nitrogen dioxide and carbon monoxide. It was developed as an indicator of Singapore's daily air quality and is the data that NEA bases its health advisories on.

[61] The 1-hour PM2.5 readings represent the hourly average of the PM2.5 pollutant levels. PM2.5 is a fine particulate matter with a diameter of 2.5 micrometers or shorter and is the dominant pollutant during hazy periods. It is also harmful to health; PM2.5 readings are therefore important indicators of air quality and the risks PM2.5 might pose to vulnerable groups of people, like children and the elderly.

[62] This information is taken from the health advisory published by NEA, from the NEA website. Where there are multiple health advisories published, the advisory that contains the latest information (most recently published in that year) will be taken.

	3-hour moving averages		length and intensity of outdoor activity. Reducing outdoor activities and physical exertion can help limit the ill effects from haze exposure. Given the air quality forecast for the next 24 hours, everyone can continue with normal activities. Persons who are not feeling well, especially the elderly and children, and those with chronic heart or lung conditions, should seek medical attention." (NEA, 2015)	1 hour PM2.5
2016	24-hour 3-hour moving averages	Hourly	1 November 2016: "The health impact of haze is dependent on one's health status, the PSI level, and the length and intensity of outdoor activity. Reducing outdoor activities and physical exertion can help limit the ill effects from haze exposure. Given the air quality forecast for the next 24 hours, everyone can continue with normal activities. Persons who are not feeling well, especially the elderly and children, and those with chronic heart or lung conditions, should seek medical attention…1-hour PM2.5 concentration readings are a good indicator of the current air quality. Use this for immediate activities like going for a jog." (NEA, 2016)	24 hour PSI (band-range indicated) 1 hour PM2.5 (band-range indicated)

2017	24-hour 3-hour moving averages	Hourly	27 October 2017: "The health impact of haze is dependent on one's health status, the PSI level, and the length and intensity of outdoor activity. Reducing outdoor activities and physical exertion can help limit the ill effects from haze exposure. Given the air quality forecast for the next 24 hours, everyone can continue with normal activities. Persons who are not feeling well, especially the elderly and children, and those with chronic heart or lung conditions, should seek medical attention. Air quality indicators and health advisories during periods of transboundary haze refer primarily to the 24-hour PSI. There are no accompanying health advisories for any other air quality indicators. In addition, the main air pollutant during the haze season is PM2.5. Hence, the 1-hour PM2.5 concentration readings are a good indicator of the current air quality. Use this for immediate activities like going for a jog." (NEA, 2017)	24 hour PSI (band-range indicated[63]) 1 hour PM2.5 (band-range indicated[64])
2018	24-hour	Hourly	No health advisories in 2018	NA

[63] The official PSI bands on NEA's website is provided in Appendix 9
[64] The official PM2.5 bands on NEA's website is provided in Appendix 10

	3-hour moving averages			
2019	24-hour 3-hour moving averages	Hourly	3 November 2019: "The health impact of haze is dependent on one's health status, the PSI level, and the length and intensity of outdoor activity. Reducing outdoor activities and physical exertion can help limit the ill effects from haze exposure. Given the air quality forecast for the next 24 hours, everyone can continue with normal activities. Persons who are not feeling well, especially the elderly and children, and those with chronic heart or lung conditions, should seek medical attention. The main air pollutant during the haze season is $PM_{2.5}$. Hence, the 1-hour $PM_{2.5}$ concentration readings are a good indicator of the current air quality. Use this for immediate activities like going for a jog. Health advisories during periods of transboundary haze are based primarily on the 24-hour PSI, as there are no major health studies done for other air quality indicators." (NEA, 2019)	24 hour PSI (band-range indicated) 1 hour PM2.5 (band-range indicated)

Table 8: Yearly health advisory information from NEA

The objective of including this table in the chapter is to observe the changes in the kinds of haze data made available to the public through NEA. The table included the last health advisory given during each haze period in the year, which represented the kind of haze data being communicated. In 2019, unlike in 2013, there was more information given in the health advisory around immediate activities and a short justification for continuing to use the 24-hour PSI figures: "Health advisories during periods of transboundary haze are based primarily on the 24-hour PSI, as there are no major health studies done for other air quality indicators" (NEA, 2019). The data provided and health advice included in the advisories have been increasing in granularity. Between 2013 and 2019, hourly PM2.5 data was introduced and included health advisories. This is significant as these advisories are tools for public health. The haze is made sense of through this data in everyday mitigations of the risk of exposure, even when the 24-hour PSI aggregates do not always represent the immediate experience of the haze.

The three different aspects of the haze infrastructure discussed above show the kinds of data and information on the haze that are available to the public. In addition to official sources of haze data, a growing number of alternative sites often display PSI figures that differ from those provided by the NEA. In traditional media, contestations over the haze data have emerged as a topic of discussion, especially in 2019. They have persisted from 2015 to 2019 however, demonstrating how long-standing frustrations around the NEA's haze data are. They also show how data contestations have not been confined to online spaces or new media. The official health advisories show how the state has responded to public demands for more granularity in PSI numbers. These aspects of the haze infrastructure contribute to broader discussions on data accuracy. In the next section, I will discuss how the haze, as a particularly 'sensible' phenomenon, encouraged public discourse on the haze to widen.

3. Challenges to Official Data

3.1 Sensations

> "Then what's that hazy smell that's filling my nose in the morning?" (RU 16, 2019)

Tracing the affective experience of air can be difficult, with different affect and non-representational scholars suggesting various approaches (Adey et al., 2013; Vannini, 2015;

Anderson, 2016). I draw on a similar definition of affect as used in recent work on the affects of air pollution (Shilon & Marom, 2023) that takes bodily experience, feelings, and emotions into consideration. Drawing on Sara Ahmed's work, these emotions and affects are not found in the individual's interior but expressed through engagements with the material or social world (Ahmed, 2024).

Affect has been used in work to deconstruct how we think about data (D'Ignazio & Klein, 2023). In analysing content from Reddit, I focused on expressions of sensory experiences. This central theme was analysed through the codes around sight, smell, taste, touch, and sound, which frequently appeared in the posts and comments. Particularly salient was the sense of sight and smell.

Nested Level	**Code Name**	**Number of Snippets**
>>	smell	101
>>	see	50

Table 9: Details for the codes 'smell' and 'see'

These two codes corresponded to descriptions of experiencing the haze through sight and smell. The haze was regularly described as having a 'burning smell'. Responses often included descriptions of how the haze looked – how grey the skies were or how bad the haze 'looked' visually, sometimes represented by photos of grey, hazy skies posted on the thread.

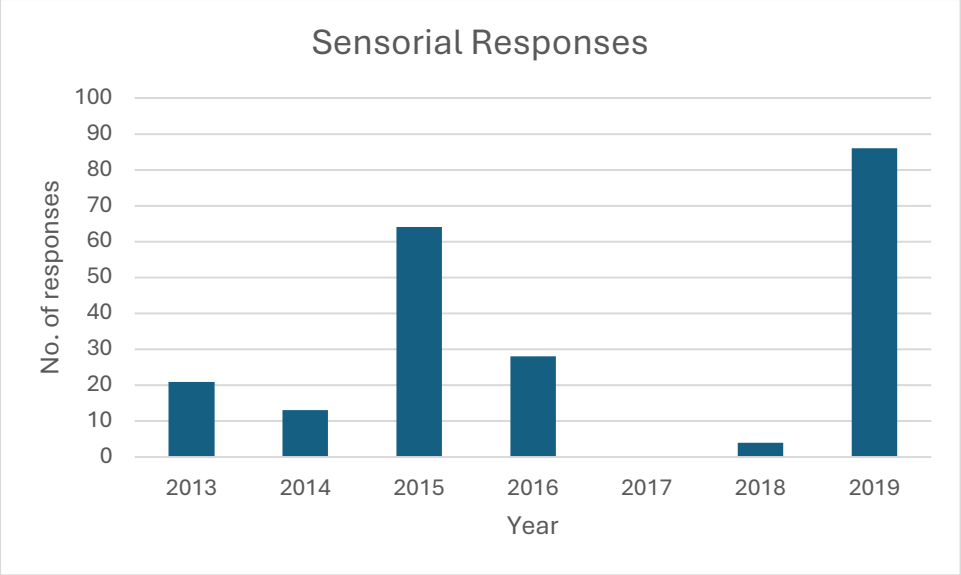


Fig. 9: Total number of sensorial Reddit responses (2013-2019)

The table above shows how the number of sensorial responses increased from 2013 to 2019. The increase in sensorial responses in 2019, compared to 2015, can seem disproportionate when we consider how significant the increase was, despite there being fewer total comments analysed in 2019. In addition to this, the number of responses that challenged official NEA data increased (by proportion) from 2015 to 2019:

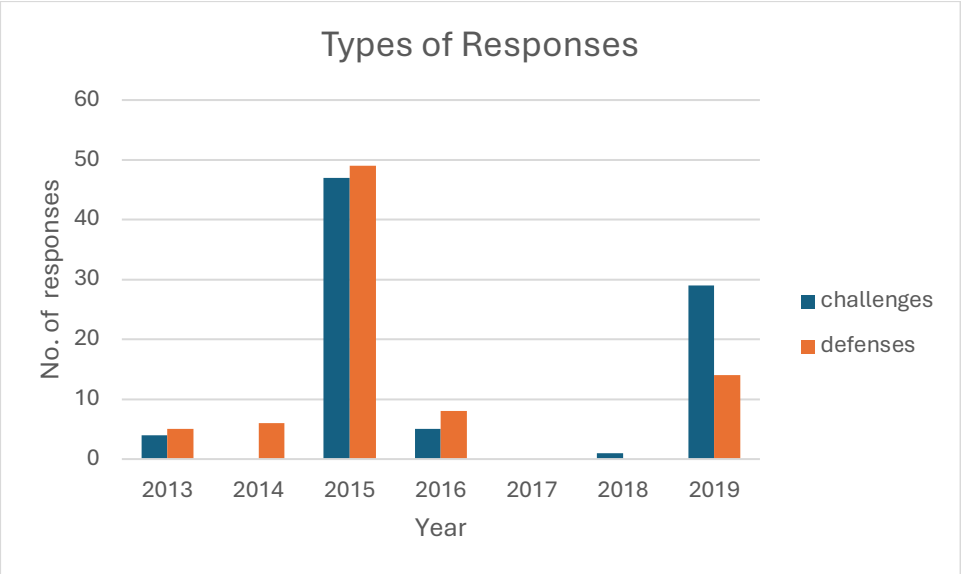


Fig. 10: Number of Reddit responses that challenged and defended official NEA figures (2013-2019)

The comparison of the total number of responses, challenges and defenses of NEA data, and sensorial responses from 2013 to 2019 revealed a few patterns in the online communications around the haze. Firstly, the higher the number of total responses, the higher the number of sensorial responses. Comparing the most recent two times the haze was at its worst, 2015 and 2019, the number of sensorial responses increased proportionately to the number of total responses. Additionally, there was a relationship between the increase in challenges to official NEA data and the number of comments that include sensorial responses. As sensory responses increased between 2013 and 2019, the number of challenges to NEA data also increased. What is interesting is the difference between 2015 and 2019. Despite the large number of responses discussing how the PSI was being calculated, the increase in sensory responses from 2015 to 2019 is accompanied by an increase in responses that challenge NEA data.

The sensorial here can be considered an affective index of challenges to official NEA data. There is a relationship between the frequency of the 'sensed' experience and the frequency of challenges made to the NEA figures. Additionally, there were more visual representations of the haze, in the form of photos, that were shared in 2019 as compared to 2013-2018:

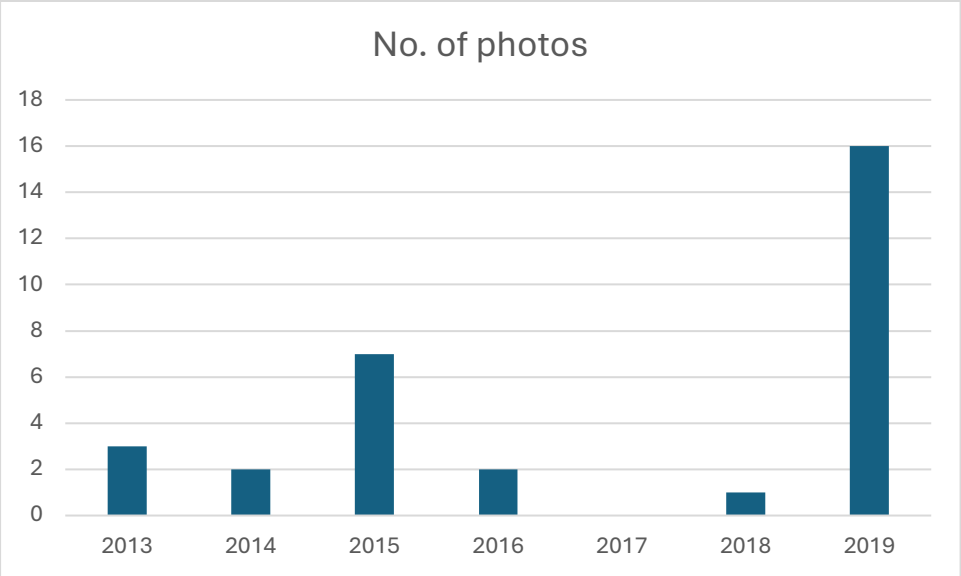


Fig. 11: Total number of photos accompanying Reddit responses (2013-2019)

Here, the visual aspect of the haze emerges as salient. There was a significant increase in the use of photos to show others in the community what the individual saw. Frequently, these photos would show hazy skies. This supports the earlier observation that there has been an

increase in sensorial responses from 2013 to 2019. What does this suggest about the prolonged experience of the haze? Firstly, it suggests that the ability to sense the haze provides individuals with a way to validate official PSI figures. As they experience the haze through their senses, individuals can 'feel' how bad it is, prompting them to use this information to check the accuracy of official state data. This idea of plural sources of data is seen in Gabrys' work on evidencing harm, which discusses how speculative practices "through and with environmental sensors…[become] part of this extended field in which collective experiences take hold" (2017: 176). This speculative undertaking does not just consist of collective quantitative environmental data and "experience, feelings and attachments" (2017: 179). This speculative approach puts forth an expanded engagement with "citizen sensing" and the bottom-up production of new forms of data. In addition, recent work on "counterdata" (Olojo, 2024) discusses how these new forms of bottom-up data can be used for grassroots resistance. Secondly, sensorial responses were not just through complaints of the haze. On Reddit, many people commented on threads to ask for reassurance from others and give reassurance about the direct experience of the haze and its discrepancy with the official haze figures. Due to the aggregated 24-hour PSI, which might not reflect current conditions, Reddit users would ask each other if they smelled anything or if the haze was bad in their area. Thirdly, the increasing number of responses, especially those that challenged official NEA data, suggest that communication from the state has not successfully addressed public frustrations. As information on the haze is also communicated to the public through health advisories, these advisories are a way of observing how the state responded to public demand for specific kinds of data. As seen in Table 2, state responses addressed data calculation and accuracy issues.

The most recent health advisory from 2017 stated the following:

> "The health impact of haze is dependent on one's health status, the PSI level, and the length and intensity of outdoor activity. Reducing outdoor activities and physical exertion can help limit the ill effects from haze exposure. Given the air quality forecast for the next 24 hours, everyone can continue with normal activities. Persons who are not feeling well, especially the elderly and children, and those with chronic heart or lung conditions, should seek medical attention.

> Air quality indicators and health advisories during periods of transboundary haze refer primarily to the 24-hour PSI. There are no accompanying health advisories for any other air quality indicators. In addition, the main air pollutant during the haze season is PM2.5. Hence, the 1-hour PM2.5 concentration readings are a good indicator of the current air quality. Use this for immediate activities like going for a jog." (NEA, 2017)

This health advisory did not directly address why the haze might 'feel' worse than what is reflected by the PSI level. Instead, it recommends that the public monitor PM2.5 concentrations to manage their exposure to the haze. The increase in posts and comments challenging official NEA data from 2017 to 2019 was significant. They reflect an increase in frustration and uncertainty over the official data being communicated.

These contestations over haze data suggest that certain sensations have become attached to the 'object' of the haze and the bodies that interact with its materiality. These bodily-material entanglements develop as they experience the repetition of these sensations, which emerge every time the seasonal haze descends on the city. These sensations form affects through specific and repeated experiences of the haze. Suspicion, for example, is expressed through challenges to NEA data. Suspicion and challenges to official NEA figures continue to emerge throughout 2013 to 2019. There are engagements facilitated by smart assemblages that stretch across the city, intersecting with discourse, narratives and temporalities beyond the moment of contact (Barua, 2021). The sustained bodily-material engagements across the years enable these affects, such as suspicion or distrust, to become mobilised as part of larger political discourse in 2019. This can be seen through the overall increase in responses that challenge official NEA data and discuss sensory engagements with the haze.

While the haze is immediately felt, these bodily-material entanglements are also "always situated in much larger spatial and temporal cycles, schemes and ranges" (Verlie, 2017: 5). In this way, Ahmed's argument to contextualise affects within their sociocultural histories is helpful to think about what circulates over the years, embedding these contestations over haze data deeper and deeper into political discourse. Ahmed described "stickiness" (Ahmed, 2004) as affects becoming attached to signs, objects or persons through the repetition of that affect. The seasonal nature of the haze suggests that emotions and affects continued to emerge

repeatedly over the years – there was something ‘sticky’ about the circulating emotions that were a result of the persistence of these contestations.

Sensory engagements through entanglements between the body and the haze developed into ways individuals generate counterdata to the official haze figures. These entanglements provided evidence of the haze levels and harm not accounted for in official haze PSI figures. They represent the changing registers of how data is made up and experienced, dismantling data infrastructures by questioning their objectivity. The mediated corporeality of the haze data, such as PSI, was crucial in deconstructing these data infrastructures. For example, descriptions of smell and sight were by far the most common type of responses about the direct experience of the haze. These sensorial engagements form counterdata as they challenged the information gathered to describe the haze, revealing that data infrastructures do not exclusively produce one set of fixed data. In addition to the individual expressions of sensory engagement that challenge the official NEA PSI figures, publishing alternative data on sites like PM Haze and SG Real Hourly PSI also constituted counterdata production. Sites like PM Haze and SG Real Hourly PSI purposefully use data in alternative ways (e.g. by applying a different methodology to the same data) to create counterdata. Even though these sites use the same NEA data, the presentation of that data broadens the space for problematising official data. These challenges open the ‘black box’ of data infrastructures, allowing it to be deconstructed.

In some contexts, “the process of converting qualitative experience into data can be empowering” (D’Ignazio & Klein, 2023: 98). Instead of seeing specific experiences as anecdotal, these sensory engagements, when expressed online in sustained ways like a comment thread, allow individual experiences not just to be validated, but viewed as part of a larger, collective, whole. Smartness is then enacted through the public production of counterdata, where technology and data are applied, accepted and engaged with. This develops into a way to participate actively in the smart city. It also suggests an alternative way of observing what active participation can look like beyond the use of disruptive technology or public protests. By engaging with established data practices, smart city residents can engage with change, with or without involvement in larger activist collectives. The sites discussed above that provide alternative data to NEA’s official figures are some examples of this. PM Haze, in particular, has organised residents around the haze issue. According to their website, the idea for PM Haze was developed in 2013, when the haze

returned to Singapore after a brief break between 1998 and 2012. In the next few years, the founding members of PM Haze continued to meet to discuss the haze issue and the role of palm oil in exacerbating the haze. In 2016, PM Haze became an official registered charity and grew in membership, conducting research and building partnerships with organisations and institutions around the region. They do not only provide haze data that NEA does not – such as the 1-hour PSI figures – and material around responding to the haze. They also organise campaigns around the promotion of sustainable palm oil. In 2019, PM Haze developed an online shopping tool allowing consumers to buy products made using ethical palm oil (Reuters, 2019). PM Haze is no longer a site just for haze data – it has grown into a credible advocacy group that aims to empower the community with knowledge and choices to help them build more sustainable palm oil consumption patterns. In October 2016, PM Haze wrote a letter to The Straits Times forum, calling for major supermarket chains to stock RSPO-certified palm oil. In the same month, the chief executive of NTUC FairPrice, Singapore's largest grocery retailer, Seah Kian Peng, responded to PM Haze's letter. In his response, Seah announced that the supermarket now carries cooking oil from RSPO-certified sources (Tan, 2016b). This is an example of the kind of impact PM Haze has been able to have. The growth of PM Haze into an advocacy group is notable in Singapore's civic space, which has been rated as 'obstructed' by the CIVICUS Monitor for its intimidation of civil society, activists and journalists (Human Rights Watch, 2021).

3.2 Public Trust

In 2022, then-Deputy Prime Minister Lawrence Wong stated that Singapore enjoyed high levels of trust because "the government has kept the commitment to honour its word" (Tham, 2022). A 2023 global survey by the Edelman Trust Barometer found that the government is the most trusted institution in Singapore. This suggests high levels of trust between the state and the public in Singapore. This trust has implications for realising the smart city as a Smart Nation. In the Smart Nation Report 2.0 (Ministry of Digital Development and Information, 2024), the state aims to maximise the value of data in a "trusted digital environment" (2024: 67). The report emphasises how data is considered a key resource in the Smart Nation. A previous report by the Smart Nation office, titled "Smart Nation: The Way Forward" addressed this issue of trust, stating that a trusted environment is "key to confidence and participation in a Smart Nation" (Smart Nation and Digital Government Office, 2018: 19). One stated aspect of building a trusted digital environment is facilitating effective data

sharing between public agencies and citizens. The government's open data platform, Data.gov, has been active since 2011 in order to encourage co-creation with communities. Data capacity remains largely centralised within the state however, with the state taking on the responsibility of "data guardianship" (Singapore Department of Statistics, 2023). With the centralisation of data capacity, there is a possibility for state control to be "both mobilised and reinforced through data-driven technologies" (Olojo, 2024: 172). In Singapore, the centralisation of data includes environmental data and, specifically, haze data such as the PSI[65]. In a 2019 interview with Dr Khairunnisa Yahya, a senior scientific officer with NEA, Channel News Asia reported that the PSI is the best reading for Singapore as it allows the city-state to have "control of the entire process, ensuring a more accurate reading of the local situation" (Mohan, 2019). Significantly, centralisation, as a function of the governance style of the city-state, is linked in the interview to accuracy.

Contestations over haze data challenge the notion that the high trust between the state and society can be operationalized in every instance. These contestations problematise NEA's data as objective and neutral by revealing underlying assumptions of accuracy that accompany this data. D'Ignazio and Klein (2023) argue that data is a product of "unequal social relations" (2023: 149), and understanding the specific contexts in which data is produced and analysed is essential in understanding the phenomenon the data is being used to present. This feminist framing of looking beyond the face value of data and interrogating the complex power relations involved in its production reveals data's limitations. When applied to NEA's haze data, this perspective problematises the notion that there are only ever high levels of trust between the state and the public in Singapore. The contestations over the accuracy of NEA's haze data reveal that multiple processes are implicated in these relations of trust, which can be fractured, emergent and highly contextual. This is revealed through instances where residents can negotiate trust with the state and each other through the collective generation of counterdata.

> "I invite Vivian to come and run in the haze and tell me it's 167." (RU 2, 2015)

[65] The PSI is a type of air quality index used in Singapore. It is derived from aggregating data collected over 24-hours. It is based on a scale developed by the United States Environmental Protection Agency (US EPA) but that has since been replaced in 1999. The methodology used for calculating PSI figures is provided on the NEA Website under its Frequently Asked Questions (FAQ) Section

The above comment by a Reddit user (RU 2) in 2015 makes a call for Minister Vivian Balakrishnan, the Minister of Foreign Affairs, to experience the haze in order to defend the official PSI levels. The underlying frustration with the discrepancy between how the haze feels and what NEA communicates as the pollution level emerges as a direct challenge for the minister. It is an implicit accusation about the inaccuracy of these figures. Comments like this, the increase in responses challenging official NEA data, and more individuals posting about the sensory experience of the haze between 2013 and 2019 suggest that the lack of trust in official data has increased since 2013.

In addition, this lack of trust in official data is complicated by emerging relations of trust being negotiated online between individuals. On Reddit, individuals post questions asking for confirmation that the haze is happening. They do this by seeking validation of their direct sensory experience of the haze that they feel is not reflected in the official PSI figures. I refer here to two threads, in 2016 and 2019, that show how these relations of trust are being formed.

In 2016, a post asked for corroboration around a direct experience of the haze that they felt was not being reflected in official PSI figures:

> "Anyone else feeling the haze? I'm in the South, and though both NEA and AQICN are reporting PSI all green, I'm already sneezy. Anyone else, or am I overreacting?" (RU 19, 2016)

Many responses to this post validated the original poster's experience. Often, the responses mentioned where the commentator was located and whether they were experiencing bad haze.

For example, these were responses from the thread:

> "Yes, in Yishun" (RU 20, 2016)

> "I'm definitely smelling it in the east" (RU 21, 2016)

> "I smelled it in the east as well" (RU 22, 2016)

"Yup, just smelt it half hour ago. It's in the south side, too" (RU 23, 2016)

"Is that why my throat had a burning feeling when I was running earlier?" (RU 24, 2016)

"I don't smell it at home (Northeast), but it has definitely smelled smoky at my office (West). And I smelled it at Suntec today. Definitely not my imagination because I started sneezing too" (RU 25, 2016)

"Yes, the PSI when I last checked was around 50, but my nose disagrees" (RU, 26, 2016)

"I'm in the northeast, I smelt it" (RU 27, 2016)

"I can smell it in the West at 3 am" (RU 28, 2016)

"Am in the west and I smelt it last night, too" (RU 29, 2016)

"In Pasir Ris. Smelled it last night. Don't smell it now though" (RU 30, 2016)

These responses form counterdata to the official PSI figures. In 2019, two similar posts asking for validation of an individual's experience of haze produced a wide range of responses, with comments both validating and challenging the direct experience of the haze. The comments largely drew on personal experience to corroborate the original poster's question about the haze. In response to a post asking, "Is it just me, or is the haze back?" (RU 31, 2019), there were multiple responses that offered both the individual's location and their observation of the haze:

"Yishun got smell" (RU 32, 2019)

"Changi airport also have" (RU 33, 2019)

"Yeah, smelling it here in Khatib too…it's bad" (RU 34, 2019)

> "Definitely in the West as well" (RU 35, 2019)

In addition to responses like the above that corroborate the individual experience of the haze, one commenter wrote: "At least I'm not the only one that thinks the haze is in the West." (RU 36, 2019) This suggests that the responses validate the individual who posed the original question in their post and the general community of users experiencing the haze in a way that the official PSI figures do not confirm. In another post asking, "There's a burning smell in Sengkang now…anyone else notice?" (RU 37, 2019), the responses were similarly corroborative.

> "It's here in Yishun, too" (RU 38, 2019)

> "Hougang too" (RU 39, 2019)

> "Yio Chu Kang too" (RU 40, 2019)

> "It's outside Kallang Wave Mall, too" (RU 41, 2019)

> "Upper Thomson Road too" (RU 42, 2019)

Some comments explicitly criticised NEA's haze data.

> "I feel it, extremely! I checked the NEA website- nothing on the haze though!" (RU 43, 2019)

> "NEA website is always right" (RU 44, 2019)

> "same, psi level showing normal" (RU 45, 2019)

> "This is a mass sensory hallucination!" (RU 46, 2019)

These exchanges suggests that there is frustration around the official PSI levels. Individuals depend on these figures and check them regularly. However, their direct experience of the

haze problematises the accuracy of the figures. The response, “This is a mass sensory hallucination!” conveys suspicion about the haze data and suggests that something more sinister is occurring. It also indicates negative communicative expectations (Bond & Lee, 2005), which suggests an underlying distrust of the state. These circulating affects of suspicion and distrust produce and reproduce the perception that the official haze data are incorrect. Corroboration with one another is then used as a strategy to respond collectively to the perceived inaccuracies of official haze data. The affective exposure to suspicion and distrust here generates interpretive agency. Individuals produce corroborative data when they validate each other’s responses by stating their own experience of the haze. This way, data sources on the haze become diffused; the state is no longer the sole producer of the PSI figures.

“Cybernetic sociality” (Rose, 2020) emerges from big data, and is more related to the idea of societies of control (Sadowski and Pasquale, 2015). The kinds of online social practices discussed in this chapter however, emerge from sensorial experiences that become counterdata through practices implicated in the larger data infrastructures in smart cities. Here, a social, sensory activity acts as a check against the state’s consolidation of power through data infrastructures. This shows how a combination of technological and social means effectively opened up the space of political discourse around the haze online. The micro-scale of the entanglements between particulate matter and individual bodies relates to how the nation’s technological infrastructure – particularly its haze and data infrastructures – shapes its citizens' daily experiences and behaviours. On an individual level, bodies are sites where haze data, such as the PSI, can be materialised through sensation. This engagement transforms into counterdata through specific forms of online communication, resulting in the contestation of official haze data. This counterdata impacts the data practices of the state. Thus, counterdata has the capacity to effectively enhance political participation. This dynamic reflects broader themes about the intersection of personal and political geographies, where the body becomes a node within the more extensive network of smart infrastructure, shaping and being shaped by state-driven data practices.

3.3 Sarcasm and Humour

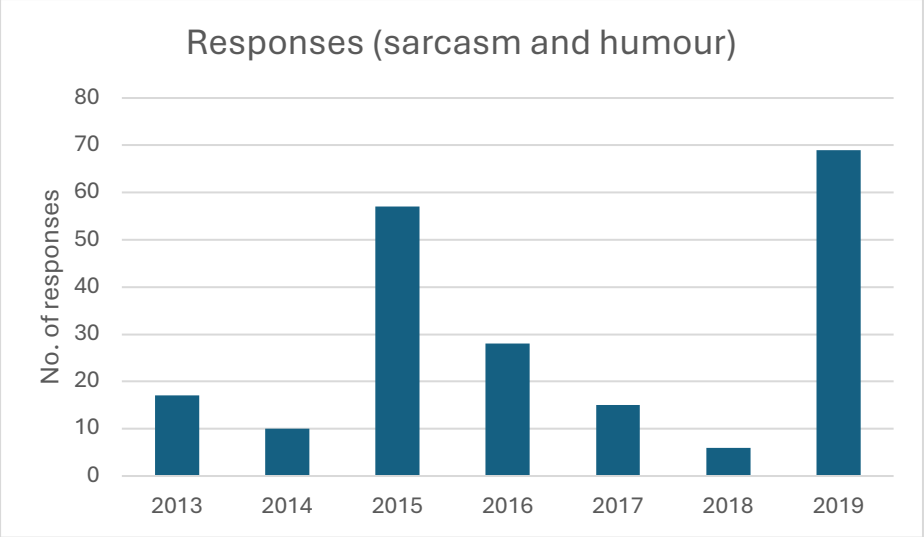


Fig. 12: Total number of Reddit responses that included sarcasm or humour (2013-2019)

The number of responses that used sarcasm and humour to discuss the haze increased overall from 2013-2019. The highest level of responses that used sarcasm and humour was in 2019, followed closely by 2015.

Nested Level	**Code Name**	**Number of Snippets**	**Code Description**
>	humour	107	This encompasses comments that are made in jest, as jokes, and to be funny
>>	sarcasm	119	Sarcasm is a little different in that it involves the use of irony to mock or convey contempt

Table 10: Details for the codes 'humour' and 'sarcasm'

The above shows the code description used to code the responses for sarcasm and humour. Due to the complex and often implicit nature of the opinions expressed through sarcasm and humour, I paid attention to the feelings and emotions expressed through humour and sarcasm. Frequently, sarcasm and humour were used to mask critical political opinions. Some examples of the kind of sarcasm used to express criticism for the state's response are below:

"Water is not actually wet" (RU 8, 2019)

"Drowning not caused by water" (RU 18, 2016)

"That's what happens when you turn on Singapore Flyer fast enough" (RU 10, 2019)

"Just smile and wave boys…smile and wave" (RU 11, 2019)

"If you don't breathe in the air, then where got haze?" (RU 17, 2016)

Some of the political opinions expressed through sarcasm and humour were implicit and difficult to understand at first. I paid attention to the emotions expressed about the state. Through attention to residents' everyday lived experiences, humour and sarcasm can be studied as ways of being political. Sarcasm and humour can be understood in relation to fear affects and the presence of legal and health risks. The meanings of risk are "discursively negotiated, dynamic and embedded within the wide social relations that constitute everyday life" (Parkhill et al., 2011: 31). Particularly in what can be said about politics in Singapore, affects circulate through the threads when responses, such as the above, deliberately, and repeatedly avoid criticising the state directly. Sarcasm and humour then mark tangible and intangible meanings about the state. It is not just about making jokes or quips but about broadening the political discourse online so that individuals can talk seriously about their lived experience of the haze – which includes the state's responses to it. The use of satire in political discourse in Singapore is not just about witty repartee - "Just smile and wave boys…smile and wave" was a comment posted in response to a post discussing how official NEA figures did not reflect how high the air pollution levels were. This underlines a helplessness and frustration around the options available to respond to the state. Sarcasm in allegory enables individuals to express discontent and negativity, highlighting undercurrents of anger. This can be seen in comments like "drowning not caused by water" (RU 18, 2016) and "water is not actually wet" (RU 8, 2019). Some comments were more complex to understand – a few suggested the haze was only real if we had to breathe in the air. This comment, "If you don't breathe in the air, then where got haze?" (RU 17, 2016) expressed, through satire, an impossible event as the only way to support the official haze figures. This reveals anxieties and anger related to the official discourse around the haze and how bad it is.

The large number of sarcastic and humorous comments and the various creative and implicit ways individuals referred to state action suggest that there was something activating about the ability to use these tools to communicate anxieties around the haze. These responses reflect the relationship between the state and its citizens, forming a counter-affective practice. Anxieties and anger around the haze get expressed in playful sarcasm and humour, where

individuals online manipulate the syntax of their responses to express implicit political views. Although sarcasm and humour tended to mask explicitly critical comments about the state's response to the haze, they opened up the space for political discourse online. These affects are crucially related to sources of power. These sources of power may be multiple and fleeting, but the general norm around discussing political opinions remained on these threads. This norm of being covert about political opinions generally, not only when it related to the Singapore state, can be seen when Reddit users continue expressing covert political opinions through sarcasm and humour when discussing the Indonesian state. The overlap between the codes 'sarcasm' and 'Indonesia' was also the most common among the threads.

Code 1	Code 2	No. of snippets
Sarcasm	Indonesia	26

Table 11: Details for the codes 'sarcasm' and 'Indonesia'

This could be attributed to the numerous responses thanking Indonesia for the haze. In January 2015, Indonesia's then-Vice President, Jusuf Kalla, commented on neighbouring countries' reactions to the haze by saying, "For 11 months, they enjoyed nice air from Indonesia, and they never thanked us". (The Straits Times, 2015). This statement led to many Reddit responses thanking Indonesia, not just in 2015 but every year (up to 2019) after and including the year the comment was made. Some examples of the responses thanking Indonesia over the years include:

> "Ok, thank you Indonesia" (RU 3, 2016)
>
> "Thanks Indonesia" (RU 5, 2015)
>
> "Thanks for the clean air, Indonesia!" (RU 14, 2017)
>
> "Thanks, Indonesia!" (RU 15, 2016)
>
> "See la, you guys didn't thank Indonesia" (RU 6, 2019)
>
> "Why you never thank Indonesia for the good air quality?" (RU 13, 2018)
>
> "we get the haze we deserve" (RU 4, 2015)

"Let's send our thanks to: http://thankyouindoforthecleanair" (RU 12, 2017)

Sarcasm, perhaps more so than humour (sarcasm has a higher number of snippets when compared to humour), had become a way for politics to be discussed. Sarcasm here represented a pedagogical form (Henry et al., 2023) that subverted the perception of Singaporeans as politically apathetic[66]. Even though it limited political criticism to expressions that were covert, sarcasm was a way to express frustration without directly calling out the state in a manner that could lead to legal trouble. This idea of sarcasm as a pedagogical form can be mobilised to capture how rhetorical and literary devices can foster alternative ways of conceptualising active participation in smart cities beyond public protests.

The counter-production of data generally aims to subvert state control (Olojo, 2024). However, the data practices I studied diverged from those that Gabrys observed, which were activist in nature. As opposed to 'evidencing harm' in a way that delegitimised official data, using sensations as a method of classifying the haze experience showed how the PSI classification system is just one of many systems that could be used to measure the level of air pollution. The counterdata presented an alternative to the official NEA PSI figures in quantifying or measuring how bad the haze was. The official PSI figure, however, was not rejected. Through their sensory engagements, Reddit users developed an alternative classification system to the official PSI, rather than a replacement. This alternative revealed the constructedness of the data historically used by the NEA to measure levels of air pollution. The PSI, as a classification system, has been naturalised – this "means that we don't question how [it is] …constructed, [or] what values or judgements might be encoded into [it]" (D'Ignazio & Klein, 2023: 104). It is not until these systems become objects of contention that we ask these questions and subsequently interrogate some of the hegemonic powers that show up in producing knowledge around phenomena we use these systems to measure.

4. Conclusion

[66] A study of over 2,000 Singapore citizens and permanent residents by the Institute of Policy Studies in 2021 showed a continuing trend that surfaced in a report done as part of the World Values Survey in 2002 – that Singaporeans are generally politically disinterested, with only 7.1 per cent of respondents in 2021 stating they frequently discuss politics with friends. This represents an improvement from 3.8 per cent in 2002. These results are made starker when compared with other societies. For example, Singapore topped the survey with over 90 per cent of respondents saying they would never organize political activities. China came in second with 83.9 per cent (Ong, 2021)

Smart cities produce smartness through embedding digital technologies into the urban fabric (Kitchin et al., 2015). Data is used extensively in smart cities' urban planning and administration (Kitchin et al., 2015). Exploring how smart city residents engage with data through the 'real-time city' becomes crucial to understanding the way of life in these cities. Through this limited case study of Reddit threads on the /r/Singapore subreddit, this chapter shows how sensory experiences constituted a kind of counterdata that revealed the constructedness of data infrastructures. Sensory experiences made data infrastructures visible. 'Data' as something unitary and static is then problematised as an objective tool for effective governance in smart cities. The transformation of sensorial engagement into evidence, then counterdata, shows how data is fundamentally changeable – not fixed, static or objective. Contestations over haze data were not just responses to air pollution but a method to actively participate in the decision-making processes in the smart city.

The patterns observed in the Reddit responses reveal how sensory experiences were used to affirm individual experiences of the haze, creating in these threads a sense of shared affectivities that opened political discourse around the haze. Attending to some of the granularity of these conversations also revealed affects around trust, sentimentality, sarcasm, and humour. In a conversation about emotion, affect and power, Ahmed discussed how inequality can be intensely corporeal work (Schmitz & Ahmed, 2014). Climate change governance can also be seen as profoundly corporeal work through the mediated corporeality of haze data. Data infrastructures, increasingly used to generate data on environmental and climate events, are implicated in more extensive relations and circulations of trust between society and state. Resistance to the state, then, can be conceptualised as corporeal, too. Through direct engagement with the materiality of the haze and the sensory experiences it produced, PSI data was deprioritised as the only tool the public had to engage with the haze. Their senses became a way of knowing and a tool for evidencing harm (Gabrys, 2017) in ways that were communicable to each other. Data then is not just proof. It becomes more than an indication of evidence. Data can be used in new and disruptive ways to demonstrate what is important to people and how they bring their experiences into spaces that matter to them.

In online state material, the Smart Nation project explains aspects of its smart urbanism, making normative assumptions that data-driven urbanism leads to a more knowable city, which will then be more governable. Technological solutions are often presented as socially beneficial ways to counter state centralisation and hegemony when it comes to 'knowing' a

city. However, the smart city dialectic does not automatically address issues of inequality and vulnerability around the data capacities it creates. By developing institutions and technological capacity that work to increase residents' data literacy, the state has also created a capacity for data and technologies to diffuse state power. The contestations over haze data revealed how technologies and data could be used to challenge the largely top-down distribution of knowledge on the haze. Knowledge of the haze is consolidated through the state's singular ownership of the data-gathering infrastructure and the widespread power of the NEA to disseminate information about the haze. However, the state's power becomes diffused through digitally mediated forms of collectivity enabled by online communications about the shared physical experience of the haze. Even without developing an environmental movement within formal political spaces, Reddit users were able to challenge the state through expanding the space of discourse around the haze data online. Enacting smartness through producing counterdata is a specific method of challenging state power. However, it is not a method that is accessible to all. Due to various forms of digital exclusion, which limit certain groups of people's access to collectivising and challenging state power online, the specific practices on the Reddit platform discussed are not universal options. Access to technology and organisational structures is needed to produce such counterdata. Even for those who do sensorially experience the haze, the ability to communicate it on a platform and create impact through their discussion is not guaranteed.

Chapter 7: Conclusion

This thesis has investigated the affective experiences of the residents of smart estates in the neighbourhood of Punggol in Singapore. It has done this in order to understand how the vision of the Smart Nation manifests in on-the-ground realities. This thesis also examined the practices through which the smart city's affective experiences become evident. The material engagements smart estate residents had with smart infrastructure produced affects that resulted in individual and collective practices of smartness. Both Chapter 4 and 5 showed how affective experiences of smart city residents can be produced through engagements with smart and non-smart materialities in smart estates. The assumption that smartness should only be collapsed into what can be observed or expressed in people's engagement with so-called 'smart' technology risks leaving out a range of meaningful affective experiences in the smart city. By expanding observation to both smart and non-smart infrastructure, the affects that emerged in the emotional landscape of the everyday revealed complexities and tensions that problematise binary assessments of the smart city experience as 'good' or 'bad'.

In Chapter 4, I discussed the affective experiences that emerge in smart estate residents engagements with the materialities of their estates. In my analysis, I made the distinction between two types of engagements. Firstly, the kinds of engagements respondents had with smart and sustainable technologies that I expected to be significant in their lives but did not emerge as important in our conversations. Secondly, the engagements with the smart and sustainable technologies respondents expressed as significant in their everyday lives. Here, the disconnect between the top-down implementation of smart urbanism and ground-up concerns created friction that respondents described through feelings of ambivalence. The emotional landscape in these estates consisted of conflicting feelings that brought precision to the experience of ambivalence and tensions that respondents expressed. Without a robust feedback loop between the state and respondents, there were often feelings of frustration and uncertainty around the changes that urban planning initiatives like the Smart Nation project brought. This chapter foregrounded how ambivalence, an emotion often expressed by respondents, was actually felt. In the process of investigating the specific emotions associated with ambivalence, I showed how ambivalence was associated less with apathy and passivity and more with fleeting negative and positive emotions.

In Chapter 5, I discussed how respondents regularly expressed loneliness, frustration, suspicion, isolation and distrust in relation to their experience of their smart estates. Their emotional lives were not just made up of negative feelings, however. The positive and negative emotions that respondents expressed about their social lives revealed deep tensions that were often exacerbated by the built environment of their smart estates. These tensions revealed how complex, dynamic and shifting the emotional landscapes of these smart estates were. These landscapes were not static as they accommodated affective experiences that would shift between different emotional states and perceptions. I examined the tensions between privacy and connection that was being experienced by respondents who often felt overwhelmed yet disconnected. These dynamics were implicated in the social lives of respondents as their emotions and affects enacted the social practices that produced and reproduced their smart estates. Through this, I showed how affective experiences of smart city residents are produced by, and also produce, socialities through relations that are multi-dimensional.

In Chapter 6, I showed how affective experiences of smart city residents can provide people with tools to expand political discourse. Using data from Reddit, I showed how patterns observed in the responses revealed how sensory experiences were used to affirm individual experiences of the haze. Attending to the granularity of these conversations revealed affects around trust, sentimentality, sarcasm, and humour. The shared affectivities that developed online opened up political discourse around the haze. Here, bodily encounters with the substances of the haze produced affects through sensory engagements that revealed the constructedness of data infrastructures that were part of the smart assemblages across the city. This chapter showed how bodily experiences of the materiality of the haze produce a critical engagement with data. While Chapter 4 observed the Smart Nation as experienced at an estate scale and Chapter 5 observed it at a more inter-personal scale in both domestic and public spaces, this chapter observed the Smart Nation project as it was experienced through the materiality of air; between ‘sensing’ parts of the body, such as the skin or eyes, and haze particulates.

The haze as a case study is important to this thesis as it allowed for a micro-level observation of the mechanisms that produce infrastructural (in)visibilities in the Smart Nation. Everyday interactions in the larger assemblages of the smart city implicate infrastructures across the

city. The examination of haze revealed entanglements between affects, the body, city-wide data infrastructures and larger state-wide and national efforts to manage the haze. The practices of smartness these entanglements produced help to expand current conceptualisations of what smart citizenship should be. Active participation and co-creation, both ideas that are central to the smart city discourse, assume that urban life flourishes under the conditions of freedom, engagement, and political participation that can be observed in behaviours enacted in public spaces (Cardullo and Kitchin, 2018; Kitchin, 2014; Shelton and Lodato, 2018; Ho, 2017). The active participation of smart citizens is often seen as crucial to the success of smart initiatives (Joss et al., 2017; Shelton and Lodato, 2018; DeWaal and Dignum, 2017). There is, however, a range of experiences of smart city residents. As the scale of observation shifts from the estate to neighbourly relations and everyday social practices and, finally, to the substance-level sensory engagements of skin and air pollution, this thesis showed how there is a variety of everyday affective experiences that are characteristic of smart cities.

This thesis used the neighbourhood of Punggol as an example. This analysis offered a place-based study of the smart city, revealing insights about how smart city residents, like the ones in Punggol that have been studied in this thesis, might experience smartness. The thesis made three main contributions to the scholarship on smart cities. The first contribution is conceptual, as the thesis identified and discussed how attention to affect enhanced the conceptual frameworks through which the smart city is understood. Within the smart city literature, there are generally three main focus areas for smart city research (Burns et al., 2021: 463): the first, critiques of smart as a capitalist or neoliberal strategy (Hollands, 2015; Sadowski, 2020; White, 2016; Cardullo & Kitchin, 2019; Grossi & Pianezzi, 2017), the second, the unpacking of smart as a discourse (Soderstrom et al., 2014; White, 2016; Wiig, 2015; Luque-Ayala & Marvin, 2015), and thirdly, the use of smart cities to achieve various modes and goals of governance – mainly through the processes of surveillance and co-creation (Sassen, 2016; Sassen, 2021; Pereira et al., 2017; Miao & Phelps, 2019). The fourth and more recent one, that smart cities can be understood as affective, is much less established (Zhu et al,, 2022; Cook & Valdez, 2021; Rose & Willis, 2019). Through identifying and examining the different affective experiences that are characteristic of the smart city I contribute to the limited scholarship that use affect as a conceptual focus for smart city research. The various focus areas of smart city research suggest that cities, then, are not just

fixed entities but “variously complicate, enable, disrupt, resist and translate SU [smart urbanism]” (Luque-Ayala and Marvin, 2015: 2108).

The second contribution is empirical, as this thesis developed the first account of the everyday affective lives of smart city residents in the Punggol area of Singapore. Specifically, I expanded on Yeo’s 2023 study of smart city residents in the Yuhua estate in Singapore. While Yeo’s study focused on the smart ageing experience in an old estate that had been retrofitted with smart technology, this thesis studied the deliberately planned smart estates of Punggol. Observations in Punggol showed how smart urbanism is affectively experienced, even in Singapore's tightly managed and over-planned neighbourhoods .This insight builds on work done on smart cities that use Foucauldian frameworks and socio-material approaches to understand how the different kinds of applications of smart urbanism can produce varying experiences of smartness (Ho, 2017; Calder, 2016; Shamsuzsoha et al., 2021; Calvada et al., 2019; Joo, 2023; Woods, 2020; Kong and Woods, 2018; Woods and Kong, 2020). Specifically, I expanded on Ho’s work on the biopolitics of smart citizenship in Singapore (2017) that showed changes in people’s behaviours when they engage with smart technologies, resulting in a unique kind of smart subject – smart government relationship. While Ho’s used the concept of biopolitics to understand the different power relations in smart city, this thesis looks at the affective aspects of power relations in order to understand power as non-static and emergent parts of the larger smart city.

I acknowledge that there are some limitations in representativeness and usefulness in the insights gained from this thesis as it is based the experience of the smart city from the point of view of a small group of smart estate residents in Punggol. I also acknowledge that there have been many Smart Nation developments both in Punggol and outside of the neighbourhood since I did my fieldwork. The data I collected for this project pre-dated the completion of the Punggol Digital District (PDD) and the Tengah neighbourhood. The PDD was officially opened in 2024 and had been designed specifically to encourage a seamless smart ecosystem. When I was doing fieldwork on the Punggol neighbourhood, I had access to a few estates deliberately designed to be smart and eco-friendly. With the quick pace of development of the area, new smart estates have emerged every year. This has meant that the potential for the data collected to become obsolete quickly is significant. Additionally, the district of Tengah, a smart town with many eco-innovations deployed across HDB estates, will be completed in 2025. It is Singapore's first integrated smart energy town, consisting of

42,000 homes across five districts. This thesis provides a situated accounts of smart city life, examining how smart city residents experience smartness in HDBs. This thesis can contribute to the expanding scholarship on the different ways in which smart urbanism has been applied through top-down initiatives like state housing planning policies.

This thesis makes a minor contribution to methodology, as it expands on existing work that uses collaborative and participatory methods, such as walk-along and participant drawing sessions, to co-produce shared experiences that allow the observation and study of affects. The continuous nature of co-production in participant-led methods can cultivate a "more caring, emphatic and attentive [way] of engaging with others" (Duedahl and Stilling Blichfeldt, 2020: 438) that is conducive for exploring affectivities. Leow's description of experiencing Singapore as a 'dystopian' smart city was described acutely, from so far away, in specific, sensorial terms. One could feel her sense of dread and alarm. Her descriptions suggest that the affects produced by the simulacrum that the smart city assembles and possibly exports through images are dynamic and real.

Critiques of smart cities increasingly avoid the binary of understanding technologies as utopian or dystopian, and smart cities as good or bad cities. There are entanglements beyond the technological that implicate more extensive socio-political and cultural processes and impact what it means to be entangled in the mechanisms of a smart city. These entanglements are where the modalities of the everyday can be understood. Smart futures, then, are drawn out of trajectories that stem from these everyday realities. They are not disembedded futures. Work on infrastructure and aspiration (Appadurai, 2013; Appadurai, 2015) suggest that infrastructures reveal what people think society should be like as they are concrete materializations of desires for the future. In this way, smart estates can be conceptualized as infrastructure by which smart cities imagine their local or national futures. They are, however, contested sites, even as they adhere to high levels of uniformity and standardisation from a material point of view. The experiences of the residents of these estates then, is key to understanding the dynamics and tensions in these sites, producing insight on how smart city residents might imagine their own futures.

Here, I have outlined the findings and contributions of this thesis. I now reflect on the research process, and its impacts on the project as a whole. In 2022, I attended a dinner at the

home of an arts foundation founder who was interested in understanding smart cities better. She had chosen an artist who was working on muons for that year's residency. In his work on muons, he explored the invisible materiality of the smart city and its representations. The conversation at this dinner, which was attended by artists, museum curators, urban planners, academics, former journalists, writers, and university students, centered on how we all felt about the smart transition in Singapore. Post-covid concerns around the impact of the expansion of the surveillance infrastructure in the city, as well as the growing effects of social inequality and marginality, took centre stage. The conversation circled these issues, forcing some of our techno-utopian musings on autonomous vehicles and robots to contend with considerations of the unevenness of the smart city experience. The resident artist brought up how the inspiration for his work on muons came from his observations of how the smart city worked in visible and invisible ways. The invisible ways in which 'smart' as an organising power worked, were what he wanted to explore. He used muons to visualise this invisibility, showing how 'smartness', as symbolised through muons, was everywhere – whether or not we could see it.

I recall this experience in this thesis's conclusion in order to return to the research's initial considerations around the (in)visibilities of smart infrastructure. Part of the experience of the smart city consists of acts of noticing and making visible material-discursive practices that firmly embed 'smartness' within existing power relations. As a researcher, I am implicated in these assemblages of the smart city. There were many instances during fieldwork where this was clear. I recall the hum of maintenance forming the soundtrack of my time doing fieldwork in Punggol. I found the constant sounds of maintenance work being carried out around me jarring. While sitting on a bench near a void-deck in Punggol, or walking through the estates near Waterway Terraces to get to the main shopping centre located next to the MRT station, it seemed like the sounds created by maintenance activities followed me. The blast of cleaners washing common areas, the beeping of the vehicles of trash collectors, the various chimes, dings and clanging sounds of electricians, armed with their toolboxes, fixing various aspects of the estates – all these added up to a constant background hum made out of maintenance activity. No matter what time of the day I came by the estates, there would always be someone pressure-washing the grounds or meticulously pruning green spaces in the common areas. This sensory experience was, to me, a significant one. It stuck out to me as something that could be analysed in relation to city-state's highly curated landscape that

required a huge amount of interventionist effort through maintenance (Comaroff, 2007; Comaroff and Ong, 2016). I lamented the invisibility of its "constant gardener" (Comaroff, 2007: 62), the maintenance workers. I thought of the practice of maintenance as a kind of relationship between infrastructures and the future (Anand et al., 2018: 62). In these estates, I saw the infrastructure and maintenance as representing an aspirational future amidst a stratified present. I saw maintenance as representing the dynamics of (in)visibility in smart cities that produce inequalities. When going back to the interview transcripts with respondents who lived in these smart estates however, no one spoke about maintenance. Despite maintenance works sticking out to me as something significant in the estates, it was not a significant part of the daily lives of the residents of the smart estates. Previously, I had written a section on maintenance that has now been removed, drawing on my own experience and biases about what a space should feel like. I lived in an old and quiet neighbourhood in Singapore, where there was no daily maintenance work carried out in the same way I observed in the HDB estates in Punggol. The sounds were not something I was used to. They stuck out. This was *my* experience, however.

Although the methods I used were informed by ontological understandings of the smart city, these understandings did not necessarily filter out various personal assumptions and biases. At the point of writing this, I have been able to look back and reflect on how I have undertaken the research for this project. I have also been able to address some of the concerns around my personal assumptions and biases filtering into the thesis. I have done three things in this thesis to address some of the limitations of the lack of consideration for bias early on. Firstly, in response to the suggestion to include more details on the research methods, the methodology section now includes participant information and details on the data collection and analysis processes to make sense of how the insights in the empirical chapters have been generated. Secondly, I have also returned to the interview transcripts to look closely at the data. This has led to the inclusion of more direct quotes from respondents. By including their voice more prominently in the thesis, I aimed to limit my own personal opinions from being centered. Thirdly, I have reflected and identified some specific ways in which assumptions and biases have filtered into the thesis, particularly in the selection of smart and sustainable infrastructures that I studied in the estates. In Chapter 4, I acknowledge these biases when I make a distinction between the engagements that respondents who live in the smart estates in Punggol have with technologies prompted by myself and the engagements with types of

materiality within their estates that emerged more organically in conversation. While time and effort has been taken to take stay close to the data, and allow insights to emerge from it, rather than to predetermine some of the findings, this thesis still includes biases. The inclusion of more details in the methodology chapter, however, and a review of the different assumptions and biases that was present in previous writings aimed to limit the impacts of this.

As I reflect on how these assumptions and biases emerged in my analysis, I am prompted to think about some considerations for future work: Firstly, how can we study smartness without letting it disappear into academic or policy discourse? Secondly, what kinds of field methods or analysis will allow an "engaged witness" (Scheper-Hughes & Bourgois, 2004), a native ethnographer, to avoid overwhelming the reactions of respondents? The oscillating affects discussed in this thesis suggest that the ambivalences smart city residents experience can turn a paradox, like that theorized within Berlant's conceptualization of "cruel optimism" (Berlant, 2011), into a kind of muscle that allows people to withstand the demands and stressors of the city. Many respondents expressed negative emotions and discussed negative experiences, but the oscillating affects they experienced between the good and bad often resulted in a reconciliation of their grievances with the prospect of a lifetime in smart estates. A few residents who fervently expressed frustration and unhappiness with the application of smart urbanism via the Smart Nation, such as Calvin, also discussed how they would want to retire in Punggol. These types of affects of ambivalence reveal forms of life that can escape the techniques of governance in a smart city. An affective approach makes sense of this. One of the objectives of using qualitative methods and an affective framework to understand the experience of smart city residents was to do so without being limited to smart discourse. The result of doing so has showed how the relation between engagement and affect is complicated. Individuals engage affectively with smart infrastructures, and what eventually becomes sensed, measured, and produced as data reveals how smart cities are both infrastructural and affective spaces.

Overall, this thesis has showed how there are a variety of smart city experiences. Studying them through the lens of affect reveals insights on how these experiences are felt on the ground in non-fixed, often fleeting ways. Through this analysis, the thesis contributes to scholarship studying the variations in the modes for implementing and participating in

smartness. By focusing on the everyday experiences of these processes, the coherency that the Smart Nation project assumes between its different pillars – Digital Governance, Digital Society and Digital Economy – can be interrogated.

Bibliography

Abdullah, W. J. (2018). Selective history and hegemony-making: The case of Singapore. *International Political Science Review*, 39(4), 473-486.

Abu-Lughod, L. (2008). Writing against culture. In *The cultural geography reader* (pp. 62-71). Routledge.

Acquisti, A., Brandimarte, L., & Loewenstein, G. (2015). Privacy and human behavior in the age of information. *Science*, *347*(6221), 509-514.

Adey, P. (2008). Airports, mobility and the calculative architecture of affective control. *Geoforum*, *39*(1), 438-451.

Adey, P. (2013). Air/atmospheres of the megacity. *Theory, Culture & Society*, *30*(7-8), 291-308.

Agrawal, A. (2005). Environmentality: Community, intimate government, and the making of environmental subjects in Kumaon, India. *Current anthropology*, *46*(2), 161-190.

Agyeman, J., & McLaren, D. (2017). Sharing cities. *Environment: Science and Policy for Sustainable Development*, 59(3), 22-27.

Åhäll, L. (2018). Affect as methodology: Feminism and the politics of emotion. *International Political Sociology*, *12*(1), 36-52.

Ahmed, S. (2004). Affective economies. *Social text*, *22*(2), 117-139.

Ahmed, S. (2006). *Queer Phenomenology: Orientations, Objects, Others*. New York, USA: Duke University Press. https://doi.org/10.1515/9780822388074

Ahmed, S. (2010). Orientations matter. *New materialisms: Ontology, agency, and politics*, *234*, 257.

Airvivo. (n.d.) https://www.airviro.com/airviro/applications/national/singapore-1.6869

Akbari, A. (2022). Authoritarian smart city: A research agenda. *Surveillance and society*, *20*(4), 441-449.

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of urban technology*, 22(1), 3-21.

Amin, A. (2002). Ethnicity and the multicultural city: living with diversity. *Environment and planning A*, *34*(6), 959-980.

Amin, A. (2014). Lively infrastructure. *Theory, Culture & Society*, 31(7-8), 137-161.

Amin, A., & Cirolia, L. R. (2018). Politics/matter: Governing Cape Town's informal settlements. *Urban Studies*, 55(2), 274-295.

Amin, A., & Thrift, N. (2017). *Seeing like a city*. John Wiley & Sons.

Amir, S. (2012). *The technological state in Indonesia: The co-constitution of high technology and authoritarian politics*. Routledge.

Anand, N. (2011). Pressure: The politechnics of water supply in Mumbai. *Cultural Anthropology*, 26(4), 542-564.

Anand, N. (2017). *Hydraulic city: Water and the infrastructures of citizenship in Mumbai*. Duke University Press.

Anand, N., Gupta, A., & Appel, H. (Eds.). (2018). *The promise of infrastructure*. Duke University Press.

Anderson, B. (2006). Becoming and being hopeful: towards a theory of affect. *Environment and planning d: society and space*, 24(5), 733-752.

Anderson, B. (2009). Affective atmospheres. *Emotion, space and society*, *2*(2), 77-81.

Anderson, B. (2012). Affect and biopower: towards a politics of life. *Transactions of the institute of British geographers*, *37*(1), 28-43.

Anderson, J. O., Thundiyil, J. G., & Stolbach, A. (2012). Clearing the air: a review of the effects of particulate matter air pollution on human health. *Journal of medical toxicology*, *8*, 166-175.

Anderson, B. (2016). Neoliberal affects. *Progress in Human Geography*, 40(6), 734-753.

Anderson, B. (2017). *Encountering affect: Capacities, apparatuses, conditions*. Routledge.

Anderson, B., & Holden, A. (2008). Affective urbanism and the event of hope. *Space and Culture*, *11*(2), 142-159.

Andrade, C. (2020). The limitations of online surveys. *Indian journal of psychological medicine*, *42*(6), 575-576.

Andres, Gabrielle. (2021). Singaporeans say bridging digital divide 'key issue' in forging post-COVID 19 future: DPM Heng. *Channel News Asia*. https://www.channelnewsasia.com/singapore/singapore-digitalisation-divide-smart-nation-heng-swee-keat-320251

Andreotta, M., Nugroho, R., Hurlstone, M.J. (2019)Analyzing social media data: A mixed-methods framework combining computational and qualitative text analysis. *Behavioural Research* **51**, 1766–1781

Angelidou, M. (2014). Smart city policies: A spatial approach. *Cities*, *41*, S3-S11.

Anjaria, J. S., & McFarlane, C. (Eds.). (2011). *Urban navigations: politics, space and the city in South Asia.* Routledge.

Antonakaki, M., French, J. E., & Guner, C. (2018). Realising Sara Ahmed's' feminist snap': Voices, embodiment, affectivity. *ephemera: theory & politics in organization*, *18*(4).

Appadurai, A. (2013). Housing and Hope. *Places Journal*. https://placesjournal.org/article/housing-and-hope/?cn-reloaded=1

Appadurai, A. (2015). Afterword: The dreamwork of capitalism. *Comparative Studies of South Asia, Africa and the Middle East*, 35(3), 481-485.

Appel, H. (2012). Offshore work: Oil, modularity, and the how of capitalism in Equatorial Guinea. *American Ethnologist*, 39(4), 692-709.

Arku, R. N., Buttazzoni, A., Agyapon-Ntra, K., & Bandauko, E. (2022). Highlighting smart city mirages in public perceptions: A Twitter sentiment analysis of four African smart city projects. *Cities*, *130*, 103857.

Ash, J. (2010). Architectures of affect: anticipating and manipulating the event in processes of videogame design and testing. *Environment and Planning D: Society and Space*, *28*(4), 653-671.

Ayata, B., Harders, C., Özkaya, D., & Wahba, D. (2019). Interviews as situated affective encounters: a relational and processual approach for empirical research on affect, emotion and politics. In *Analyzing affective societies* (pp. 63-77). Routledge.

Azzali, S., Yew, A. S. Y., Wong, C., & Chaiechi, T. (2022). Silver cities: planning for an ageing population in Singapore. An urban planning policy case study of Kampung Admiralty. *Archnet-IJAR: International Journal of Architectural Research*, *16*(2), 281-306.

Back, L., & Puwar, N. (2012). A manifesto for live methods: provocations and capacities. *The sociological review*, *60*(1), 6-17.

Barr, M. D. (2016). Ordinary Singapore: the decline of Singapore exceptionalism. *Journal of Contemporary Asia*, *46*(1), 1-17.

Barua, M. (2021). Infrastructure and non-human life: A wider ontology. *Progress in Human Geography*, 45(6), 1467-1489.

Battarra, R., Zucaro, F., & Tremiterra, M. R. (2018). Smart mobility and elderly people. Can ICT make the city more accessible for everybody?. *TeMA-Journal of Land Use, Mobility and Environment*, 23-42.

Batty, M., Morphet, R., Masucci, P., & Stanilov, K. (2014). Entropy, complexity, and spatial information. *Journal of geographical systems*, 16, 363-385.

Bennet, J. (2005). The agency of assemblages and the North American blackout. *Public Culture* 17(3): 445-65.

Berlant, L. (2011). *Cruel Optimism*. New York, USA: Duke University Press. https://doi.org/10.1515/9780822394716

Berlant, L. (2016). The commons: Infrastructures for troubling times. *Environment and Planning D: Society and space*, *34*(3), 393-419.

Berney, R. (2017). *Learning from Bogotá: Pedagogical urbanism and the reshaping of public space*. University of Texas Press.

Berry, K. S. (2015). Research as bricolage: Embracing relationality, multiplicity and complexity. In *Doing educational research* (pp. 77-110). Brill.

Beyt, A. (2023). Affect and Embodied Emotions. In *The Routledge Handbook of Religion and the Body* (pp. 25-39). Routledge.

Bhuyan, M. R., & Yuen, B. (2022). Older adults' views of the connections between neighbourhood built environment and health in Singapore. *Journal of Population Ageing*, *15*(1), 279-299.

Bhuyan, M. R., Lane, A. P., Moogoor, A., Močnik, Š., & Yuen, B. (2020). Meaning of age-friendly neighbourhood: An exploratory study with older adults and key informants in Singapore. *Cities*, *107*, 102940.

Bille, M., & Simonsen, K. (2021). Atmospheric practices: On affecting and being affected. *Space and Culture*, *24*(2), 295-309.

Bissell, D. (2010). Passenger mobilities: affective atmospheres and the sociality of public transport. *Environment and Planning D: Society and Space*, *28*(2), 270-289.

Blank, G., Bolsover, G., & Dubois, E. (2014, August). A new privacy paradox: Young people and privacy on social network sites. In *Prepared for the Annual Meeting of the American Sociological Association* (Vol. 17).

Bond, G. D., & Lee, A. Y. (2005). The darkest side of trust: Validating the generalized communication suspicion scale with prison inmates. *Personality and Individual Differences*, *38*(6), 1429-1438.

Bosworth, K. (2023). What is 'affective infrastructure'?. *Dialogues in Human Geography*, *13*(1), 54-72.

Boyle, L., Harlow, J., & Keeler, L. W. (2024). (D) evolving smartness: exploring the changing modalities of smart city making in Africa. *Urban Geography*, *45*(4), 586-610.

Braun, T., Fung, B. C., Iqbal, F., & Shah, B. (2018). Security and privacy challenges in smart cities. *Sustainable cities and society*, *39*, 499-507.

Brennan, T. (2004). *The transmission of affect.* Cornell University Press.

Bulkeley, H., & Castán Broto, V. (2013). Government by experiment? Global cities and the governing of climate change. *Transactions of the institute of British geographers*, 38(3), 361-375.

Bundgaard, L., & Borrás, S. (2021). City-wide scale-up of smart city pilot projects: Governance conditions. *Technological Forecasting and Social Change*, *172*, 121014.

Burke, C. (2001). Hands-on history: towards a critique of the 'everyday'. History of Education, 30(2), 191-201.

Burns, R., Fast, V., Levenda, A., & Miller, B. (2021). Smart cities: Between worlding and provincialising. *Urban studies*, *58*(3), 461-470.

Caldeira, T. P. (2000). *City of walls: crime, segregation, and citizenship in São Paulo*. University of California Press.

Calder, K. E. (2016). *Singapore: Smart city, smart state*. Brookings Institution Press.

Calvey, D. (2021). Sensory ethnography: A creative turn. *Journal of Organizational Ethnography*, *10*(3), 346-357

Calvillo, N., Halpern, O., LeCavalier, J., & Pietsch, W. (2015). Test bed as urban epistemology. In *Smart Urbanism* (pp. 145-167). Routledge.

Calzada, I. (2017). The techno-politics of data and smart devolution in city-regions: Comparing Glasgow, Bristol, Barcelona, and Bilbao. *Systems*, 5(1), 18.

Calzada, I. (2018). (Smart) citizens from data providers to decision-makers? The case study of Barcelona. Sustainability, 10(9), 3252.

Calzada, I. (2021). The right to have digital rights in smart cities. *Sustainability*, *13*(20), 11438.

Calzada, I., & Cobo, C. (2015). Unplugging: Deconstructing the smart city. *Journal of Urban Technology*, 22(1), 23-43.

Campregher, C. (2010). Shifting perspectives on development: an actor-network study of a dam in Costa Rica. Anthropological Quarterly, 783-804.

Cao, H., & Kang, C. I. (2024). A citizen participation model for co-creation of public value in a smart city. *Journal of Urban Affairs*, *46*(5), 905-924.

Cao, Y., Heng, C. K., & Fung, J. C. (2019). Using walk-along interviews to identify environmental factors influencing older adults' out-of-home behaviors in a high-rise, high-density neighborhood. *International journal of environmental research and public health*, *16*(21), 4251.

Cao, Y., Heng, C. K., & Fung, J. C. (2022). Towards human-centric planning: Older people's everyday life in neighbourhood spaces in Singapore's public housing. *Habitat International*, *127*, 102649.

Cao, Y., Heng, C. K., & Fung, J. C. (2023). Older Adults' Out-of-Home Activities in a Super-Aged High-Rise, High-Density Neighborhood: A Qualitative Study. *Journal of Aging and Environment*, *37*(1), 100-125.

Cardullo, P. (2020). *Citizens in the 'Smart City': Participation, Co-production, Governance*. Routledge.

Cardullo, P., & Kitchin, R. (2019). Being a 'citizen' in the smart city: Up and down the scaffold of smart citizen participation in Dublin, Ireland. *GeoJournal*, 84(1), 1-13.

Cardullo, P., Kitchin, R., & Di Feliciantonio, C. (2018). Living labs and vacancy in the neoliberal city. *Cities*, *73*, 44-50.

Carlson, J. D. (2019). Renewable Energy and Class Struggles. *RCC Perspectives*, (2), 47-56.

Cavada, M., Tight, M. R., & Rogers, C. D. (2019). A smart city case study of Singapore—Is Singapore truly smart?. In *Smart city emergence* (pp. 295-314). Elsevier.

Chan, C. M., Lau, Y., & Pan, S. L. (2008). E-government implementation: A macro analysis of Singapore's e-government initiatives. *Government Information Quarterly*, *25*(2), 239-255.

Chan, I. (2022). Political Apathy, Soft Authoritarianism, and Singapore's Perspectives on the South China Sea. In *Populism, Nationalism and South China Sea Dispute: Chinese and Southeast Asian Perspectives* (pp. 111-137). Singapore: Springer Singapore.

Chan, Y. K. (2016). No room to swing a cat? Animal treatment and urban space in Singapore. *Southeast Asian Studies*, *5*(2), 305-329.

Chang, F., & Das, D. (2020). Smart nation Singapore: Developing policies for a citizen-oriented smart city initiative. *Developing national urban policies: Ways forward to green and smart cities*, 425-440.

Chee, L. (2017). Keeping cats, hoarding things: domestic situations in the public spaces of the Singaporean housing block. *The Journal of Architecture*, *22*(6), 1041-1065.

Cheney-Lippold, J. (2011). A new algorithmic identity: Soft biopolitics and the modulation of control. *Theory, culture & society*, 28(6), 164-181.

Chhabra, S. (2022). Why Does Privacy Paradox Exist?: A Qualitative Inquiry to Understand the Reasons for Privacy Paradox Among Smartphone Users. *Journal of Electronic Commerce in Organizations (JECO)*, *20*(1), 1-20.

Chib, A., Alvarez, K., & Todorovic, T. (2022). Critical perspectives on the smart city: Efficiency objectives vs inclusion ideals. *Journal of Urban Technology*, *29*(4), 83-99.

Cho, I.S. (2021). HDB-NUS Study on the Social Aspects of the Built Environment. *Innovation*. 15(1). http://www.innovationmagazine.com/volumes/v15n1/coverstory3.html

Cho, M., Ha, T. M., Lim, Z. M. T., & Chong, K. H. (2018). "Small places" of ageing in a high-rise housing neighbourhood. *Journal of Aging Studies*, *47*, 57-65.

Chong, K. H. (2018). Reclamation of urban voids and the return of the "kampung spirit" in Singapore's public housing. In *Creative ageing cities* (pp. 19-46). Routledge.

Chong, K. H., & Cho, M. (2018). *Creative ageing cities*. Singapore: Routledge.

Chua, B. H. (2002). *Political Legitimacy and Housing: Singapore's Stakeholder Society*. Routledge.

Closs Stephens, A. (2016). The affective atmospheres of nationalism. *cultural geographies*, *23*(2), 181-198.

Clough, P. T. (2008). (De) coding the subject-in-affect. *Subjectivity*, *23*, 140-155.

Co, C. (2020). After the success of Singapore's first eco-town in Punggol, what next for HDB green living? *Channel News Asia*. https://www.channelnewsasia.com/singapore/hdb-green-towns-punggol-solar-energy-climate-change-1339816

Coleman, L. (2014). Infrastructure and interpretation: meters, dams, and state imagination in Scotland and India. *American Ethnologist*, 41(3), 457-472.

Collier, P. (2011). Building an African infrastructure. F*inance and Development*, 48(4).

Collier, S. J., & Lakoff, A. (2008). *The problem of securing health. In Biosecurity interventions: global health and security in question*. Columbia University Press.

Comaroff, J. (2007). Ghostly topographies: landscape and biopower in modern Singapore. *cultural geographies*, 14(1), 56-73.

Comaroff, J. (2014). Built on sand: Singapore and the new state of risk. Harvard Design Magazine: architecture, landscape architecture, *urban design and planning*, (39), 138.

Comaroff, J. and Ong, K.S. (2016). Paramilitary Gardening: Landscape and Authoritarianism. *Why Singapore Blog*. https://whysingaporeblog.files.wordpress.com/2016/09/paramilitary-gardening.pdf

Cook, M., & Valdez, A. M. (2021). Exploring smart city atmospheres: The case of Milton Keynes. *Geoforum*, *127*, 180-188.

Dalakoglou, D. (2016). Infrastructural gap: Commons, state and anthropology. *City*, 20(6), 822-831.

Dalakoglou, D., & Harvey, P. (2012). Roads and anthropology: Ethnographic perspectives on space, time and (im)mobility. *Mobilities*, 7(4), 459-465.

Das, D., & Zhang, J. J. (2021). Pandemic in a smart city: Singapore's COVID-19 management through technology & society. *Urban Geography*, *42*(3), 408-416.

Das, V. (2010). Engaging the life of the other: Love and everyday life. *Ordinary ethics: Anthropology, language, and action*, 376-99. Fordham University Press.

Datta, A. (2012). 'Where is the global city?'Visual narratives of London among East European migrants. *Urban Studies*, *49*(8), 1725-1740.

Datta, A. (2015). A 100 smart cities, a 100 utopias. *Dialogues in Human Geography*, *5*(1), 49-53.

Datta, A. (2018). The digital turn in postcolonial urbanism: Smart citizenship in the making of India's 100 smart cities. *Transactions of the Institute of British Geographers*, *43*(3), 405-419.

Datta, A. (2019). Postcolonial urban futures: Imagining and governing India's smart urban age. *Environment and Planning D: Society and Space*, *37*(3), 393-410.

Datta, A. (2020). The "smart safe city": Gendered time, speed, and violence in the margins of India's urban age. *Annals of the American Association of Geographers*, *110*(5), 1318-1334.

Datta, A., & Ahmed, N. (2020). Intimate infrastructures: The rubrics of gendered safety and urban violence in Kerala, India. *Geoforum*, 110, 67-76

Datta, A., & Odendaal, N. (2019). Smart cities and the banality of power. *Environment and Planning D: Society and Space*, *37*(3), 387-392.

De Jong, M., Joss, S., Schraven, D., Zhan, C., & Weijnen, M. (2015). Sustainable–smart–resilient–low carbon–eco–knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. *Journal of Cleaner production*, 109, 25-38.

De Waal, M., & Dignum, M. (2017). The citizen in the smart city. How the smart city could transform citizenship. *IT-Information Technology*, *59*(6), 263-273.

Degen, M. M., & Rose, G. (2012). The sensory experiencing of urban design: The role of walking and perceptual memory. *Urban studies*, 49(15), 3271-3287.

Deitz, S., Lobben, A., & Alferez, A. (2021). Squeaky wheels: Missing data, disability, and power in the smart city. *Big Data & Society*, 8(2), 20539517211047735.

Deleuze, G. (1988). *Spinoza: practical philosophy*. City Lights Books.

Diehl, J. A., & Chan, I. S. L. (2021). Is it just apathy? Using the Theory of Planned Behaviour to understand

young adults'(18 to 35 years old) response to government efforts to increase planning participation in Singapore. *Urban Governance*, *1*(2), 89-97.

Dowling, R., & McGuirk, P. (2022). Autonomous vehicle experiments and the city. *Urban Geography*, 43(3), 409-426.

Duarte, F., & Firmino, R. J. (2017). *Unplugging the city: The urban phenomenon and its sociotechnical controversies*. Routledge.

Duedahl, E., & Stilling Blichfeldt, B. (2020). To walk the talk of go-along methods: Navigating the unknown terrains of being-along. *Scandinavian Journal of Hospitality and Tourism*, *20*(5), 438-458.

Duff, C. (2010). On the role of affect and practice in the production of place. *Environment and planning D: Society and Space*, *28*(5), 881-895.

Duff, C. (2017). The affective right to the city. *Transactions of the Institute of British Geographers*, *42*(4), 516-529.

Duke-NUS. (2021). "All the lonely people": The impact of loneliness in old age on life and health expectancy. News. https://www.duke-nus.edu.sg/allnews/impact-of-loneliness-on-life-and-health-expectancy

Edensor, T. (2012). Illuminated atmospheres: Anticipating and reproducing the flow of affective experience in Blackpool. *Environment and planning D: society and space*, *30*(6), 1103-1122.

Edensor, T. (2015). The gloomy city: Rethinking the relationship between light and dark. *Urban studies*, *52*(3), 422-438.

Eger, J. (2003) Smart communities: becoming smart is not so much about developing technology as about engaging the body politic to reinvent governance in the digital age, *Urban Land* 60(1), pp. 50–55.

Ehrkamp, P., & Leitner, H. (2003). Beyond national citizenship: Turkish immigrants and the (re) construction of citizenship in Germany. *Urban geography*, *24*(2), 127-146.

Elyachar, J. (2010). Phatic labor, infrastructure, and the question of empowerment in Cairo. *American Ethnologist*, 37(3), 452-464.

Energy Market Authority. (2024). Singapore Energy Statistics 2024. https://www.ema.gov.sg/resources/singapore-energy-statistics/chapter6

Engels, F. (1884) 2010. The origin of the family, private property and the state. New York: Penguin Books.

Environmental Quality Index (EQI). (2024). US EPA. https://www.epa.gov/healthresearch/environmental-quality-index-eqi

Ernwein, M., & Matthey, L. (2019). Events in the affective city: Affect, attention and alignment in two ordinary urban events. *Environment and Planning A: Economy and Space*, *51*(2), 283-301.

Ettlinger, N. (2011). Governmentality as epistemology. *Annals of the Association of American Geographers*, *101*(3), 537-560.

Evans, J., & Jones, P. (2011). The walking interview: Methodology, mobility and place. *Applied Geography*, 31(2), 849-858.

Evans, J., Vácha, T., Kok, H., & Watson, K. (2021). How cities learn: From experimentation to transformation. *Urban Planning*, *6*(1), 171-182.

Farías, I., & Blok, A. (2016). Technical democracy as a challenge to urban studies: Introduction. *City,* 20(4), 539-548.

Feldman, A. (1999). The role of conversation in collaborative action research. *Educational action research*, *7*(1), 125-147.

Fisher, M. (2009). *Capitalist realism: Is there no alternative?* Zero Books.

Foth, M. (Ed.). (2008). *Handbook of research on urban informatics: the practice and promise of the real-time city: the practice and promise of the real-time city*. IGI Global.

Foucault, M. (1991). *The Foucault effect: Studies in governmentality*. University of Chicago Press.

Foucault, M. (2007). *Security, territory, population: lectures at the Collège de France, 1977-78*. Springer.

Foucault, M. (2008). *The birth of biopolitics: lectures at the Collège de France, 1978-1979*. Palgrave Macmillan.

Franke, T., Lukowicz, P., & Blanke, U. (2015). Smart crowds in smart cities: real life, city scale deployments of a smartphone based participatory crowd management platform. *Journal of Internet Services and Applications*, *6*, 1-19.

Gabrys, J. (2014). Programming environments: Environmentality and citizen sensing in the smart city. *Environment and planning D: Society and space*, *32*(1), 30-48.

Gabrys, J. (2017). Citizen sensing, air pollution and fracking: From 'caring about your air'to speculative practices of evidencing harm. *The Sociological Review*, *65*(2), 172-192.

Gale, K., & Wyatt, J. (2013). Assemblage/ethnography: Troubling constructions of self in the play of materiality and representation. In *Contemporary British Autoethnography* (pp. 139-155). Brill.

Gandy, M. (2005). Cyborg urbanization: complexity and monstrosity in the contemporary city. *International journal of urban and regional research*, *29*(1), 26-49.

Gandy, M. (2014). *The fabric of space: Water, modernity, and the urban imagination*. MIT press.

Gao, Q., Woods, O., Kong, L., & Shee, S. Y. (2024). Lived religion in a digital age: technology, affect and the pervasive space-times of 'new'religious praxis. *Social & Cultural Geography*, *25*(1), 29-48.

Garau, C., & Annunziata, A. (2019). Smart city governance and children's agency: an assessment of the green infrastructure impact on children's activities in Cagliari (Italy) with the tool "opportunities for children in urban spaces (OCUS)". *Sustainability*, *11*(18), 4848.

Garde-Hansen, J., & Gorton, K. (2013). *Emotion online: Theorizing affect on the Internet*. Springer.

Gershon, W. S. (2013). Vibrational affect: Sound theory and practice in qualitative research. *Cultural studies? critical methodologies*, *13*(4), 257-262.

Ghosh, K. (2006). Between global flows and local dams: indigenousness, locality, and the transnational sphere in Jharkhand, India. Cultural Anthropology, 21(4), 501-534.

Gibson, W. (1993). Welcome to 'Disneyland With the Death Penalty.' WIRED. https://www.wired.com/1993/04/gibson-2/

Glasmeier, A., & Christopherson, S. (2015). Thinking about smart cities. Cambridge Journal of Regions, Economy and Society, 8(1), 3-12.

Goh, D. P. (2001). The politics of the environment in Singapore? Lessons from a" strange" case. *Asian Journal of Social Science*, *29*(1), 9-34.

Goh, K. (2013). Global garden city: Trans-territorial ecologies in Singapore. *ACSA*, *101*.

Goldsmith, S., & Crawford, S. (2014). *The responsive city: Engaging communities through data-smart governance*. John Wiley & Sons.

Gonzaga, E. (2019). Precarious nostalgia in the tropical smart city: Transmedia memory, urban informatics, and the Singapore golden jubilee. *Cultural Studies*, 33(1), 147-169.

GovTech Singapore. (2023). eGov Masterplans. https://www.tech.gov.sg/media/corporate-publications/egov-masterplans

Graham, S. (2001). The city as sociotechnical process Networked mobilities and urban social inequalities. *City*, 5(3), 339-349.

Graham, S. (2010). When infrastructures fail. In *Disrupted cities* (pp. 13-38). Routledge.

Graham, S., & Marvin, S. (2002). *Splintering urbanism: networked infrastructures, technological mobilities and the urban condition*. Routledge.

Graham, S., & McFarlane, C. (Eds.). (2014). *Infrastructural lives: Urban infrastructure in context.* Routledge.
Green, B. (2019). *The smart enough city: Putting technology in its place to reclaim our urban future*. MIT Press.

Gregg, M., & Seigworth, G. J. (Eds.). (2020). *The affect theory reader*. Duke University Press.

Grossi, G., & Pianezzi, D. (2017). Smart cities: Utopia or neoliberal ideology?. *Cities*, *69*, 79-85.

Guest, P. (2021). Singapore's tech-utopia dream is turning into a surveillance state nightmare. *Rest of World*. https://restofworld.org/2021/singapores-tech-utopia-dream-is-turning-into-a-surveillance-state-nightmare/

Guldi, J. (2012). *Roads to power: Britain invents the infrastructure state*. Harvard University Press.

Gupta, J., Verrest, H., & Jaffe, R. (2015). Theorizing governance. *Geographies of urban governance: Advanced theories, methods and practices*, 27-43.

Guschke, B. L. (2023). Fire inside me–Exploring the possibilities of embodied queer listening. *Culture and Organization*, *29*(6), 564-581.

Halpern, O., LeCavalier, J., Calvillo, N., & Pietsch, W. (2013). Test-bed urbanism. *Public Culture*, 25(2), 272-306.

Hamnett, S., & Yuen, B. (Eds.). (2019). *Planning Singapore: the experimental city*. Routledge.

Han, H. (2017). Singapore, a garden city: Authoritarian environmentalism in a developmental state. *The Journal of Environment & Development*, *26*(1), 3-24.

Haraway, D. (2010). A cyborg manifesto (1985). *Cultural theory: An anthology*, *454*.

Harding, S. (1992). After the neutrality ideal: Science, politics, and" strong objectivity". *Social research*, 567-587.

Harris, M. (Ed.). (2007). *Ways of knowing: New approaches in the anthropology of knowledge and learning (Vol. 18)*. Berghahn Books.

Harvey, D. (2012). *Rebel cities: From the right to the city to the urban revolution.* Verso books.

Hautea, S., Parks, P., Takahashi, B., & Zeng, J. (2021). Showing they care (or don't): Affective publics and ambivalent climate activism on TikTok. *Social media+ society*, *7*(2), 20563051211012344.

Hemmings, C. (2005). Invoking affect: Cultural theory and the ontological turn. *Cultural studies*, *19*(5), 548-567.

Henry, S., Bryan, A., & Neary, A. (2023). 'Laughing ourselves out of the closet': comedy as a queer pedagogical form. *Ethics and education*, *18*(1), 151-166.

Ho, E. (2017). Smart subjects for a Smart Nation? Governing (smart) mentalities in Singapore. *Urban Studies*, 54(13), 3101-3118.

Ho, E. L. E., & Hatfield, M. E. (2011). Migration and everyday matters: Sociality and materiality. *Population, Space and Place*, *17*(6), 707-713.

Hoe, S. L. (2016). Defining a smart nation: the case of Singapore. *Journal of information, Communication and Ethics in Society*, *14*(4), 323-333.

Holgersson, H. (2016). Challenging the hegemonic gaze on foot: Walk-alongs as a useful method in gentrification research. In *Walking in the European City* (pp. 207-224). Routledge.

Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City*, *12*(3), 303–320. https://doi.org/10.1080/13604810802479126

Hollands, R. G. (2015). Beyond the corporate smart city?: Glimpses of other possibilities of smartness. In *Smart Urbanism* (pp. 168-184). Routledge.

Holmes, A. G. D. (2020). Researcher Positionality--A Consideration of Its Influence and Place in Qualitative Research--A New Researcher Guide. Shanlax *International Journal of Education*, 8(4), 1-10.
https://www.singstat.gov.sg/find-data/search-by-theme/households/households/latest-data

Hull, E. (2012). Banking in the bush: waiting for credit in South Africa's rural economy. *Africa*, 82(1), 168-186.

Humphrey, C. (2005). Ideology in infrastructure: architecture and Soviet imagination. *Journal of the Royal Anthropological Institute*, *11*(1), 39-58.

Hunter, C., & Kivinen, N. (Eds.). (2022). *Affect in organization and management*. Taylor & Francis.

Imai, H. (2008). Senses on the move: Multisensory encounters with street vendors in the Japanese Urban Alleyway Roji. *The Senses and Society*, 3(3), 329-339.

Ingold, T. (1993). The temporality of the landscape. *World archaeology*, *25*(2), 152-174.

Ingold, T. (2010). Footprints through the weather-world: walking, breathing, knowing. *Journal of the Royal Anthropological Institute*, 16, S121-S139.

IQAir World Air Quality Index (AQI) Ranking (n.d.). https://www.iqair.com/sg/world-air-quality-ranking

Isenhour, C. and Reno, J. (2019). On Materiality and Meaning: Ethnographic Engagements with Reuse, Repair & Care in *Anthropology Faculty Scholarship*. 39.
https://digitalcommons.library.umaine.edu/ant_facpub/39

Jacobs-Huey, L. (2002). The natives are gazing and talking back: Reviewing the problematics of positionality, voice, and accountability among" native" anthropologists. *American anthropologist*, 104(3), 791-804.

Jalais, A. (2021). The Singapore "Garden City": The death and life of nature in an Asian City. *Death and life of nature in Asian cities*, 82-101.

Jameson, S., Richter, C., & Taylor, L. (2019). People's strategies for perceived surveillance in Amsterdam Smart City. *Urban Geography*, *40*(10), 1467-1484.

Jenkins-Smith, H. C., & Smith, W. K. (2019). Ideology, culture, and risk perception. In *Politics, policy, and culture* (pp. 17-32). Routledge.

Jha, S., & Pathak, D. N. (Eds.). (2022). *Neighbourhoods and Neighbourliness in Urban South Asia: Subjectivities and Spatiality*. Taylor & Francis.

Jianli, H. (2006). Positioning the student political activism of Singapore: articulation, contestation and omission. *Inter-Asia Cultural Studies*, *7*(3), 403-430.

Joo, Y. M. (2023). Developmentalist smart cities? The cases of Singapore and Seoul. *International Journal of Urban Sciences*, *27*(sup1), 164-182.

Joo, Y. M., & Tan, T. B. (2020). Smart cities in Asia: An introduction. *Smart Cities in Asia: Governing Development in the Era of Hyper-Connectivity;* Edward Elgar Publishing: Cheltenham, UK, 1-17.

Joss, S., Cook, M., & Dayot, Y. (2017). Smart cities: Towards a new citizenship regime? A discourse analysis of the British smart city standard. *Journal of Urban Technology*, *24*(4), 29-49.

Juarez Miro, C. (2022). The comment gap: Affective publics and gatekeeping in The New York Times' comment sections. *Journalism*, *23*(4), 858-874.

Jurado Pérez, L., & Salvachúa, J. (2021). An approach to build e-health iot reactive multi-services based on technologies around cloud computing for elderly care in smart city homes. *Applied Sciences*, *11*(11), 5172.

Juvonen, T., & Kolehmainen, M. (Eds.). (2018). *Affective inequalities in intimate relationships*. London: Routledge.

Kaika, M., & Swyngedouw, E. (2000). Fetishizing the modern city: The phantasmagoria of urban technological networks. *International journal of urban and regional research*, 24(1), 120-138.

Kalemba, J., Mayes, R., McDonald, P., & Williams, P. (2024). Performativity and affective atmospheres in digitally mediated care labour. *Journal of Cultural Economy*, *17*(1), 108-120.

Karvonen, A., Martin, C., & Evans, J. (2018). University campuses as testbeds of smart urban innovation. In *Creating smart cities* (pp. 104-118). Routledge.

Kashanipour, A. R., Sandborn, P., & Cui, Q. (2016). Review of quantitative methods for designing availability-based contracts. *Journal of Cost Analysis and Parametrics*, 9(1), 69-91.

Kashanipour, J. (2021). The Gradual Gaze: Drawing as a Practice of Ethnographic Description. *Anthropology and Humanism*, 46(1), 81-94.

Katsara, A. (2008). The impacts of new technologies on urban transformations. *WIT Transactions on Ecology and the Environment*, *117*, 305-314.

Keating, T. P. (2019). Pre-individual affects: Gilbert Simondon and the individuation of relation. *cultural geographies*, *26*(2), 211-226.

Keshavarzi, G., Yildirim, Y., & Arefi, M. (2021). Does scale matter? An overview of the "smart cities" literature. *Sustainable Cities and Society*, *74*, 103151.

Kim, S. J. (2024). Research ethics and issues regarding the use of ChatGPT-like artificial intelligence platforms by authors and reviewers: a narrative review. *Science Editing*, *11*(2), 96-106.

Kitchin, R. (2014). The real-time city? Big data and smart urbanism. *GeoJournal*, *79*, 1-14.

Kitchin, R. (2016). The ethics of smart cities and urban science. *Philosophical transactions of the royal society A: Mathematical, physical and engineering sciences*, *374*(2083), 20160115.

Kitchin, R. (2018). Reframing, reimagining and remaking smart cities. In *Creating smart cities* (pp. 219-230). Routledge.

Kitchin, R. (2020). Civil liberties or public health, or civil liberties and public health? Using surveillance technologies to tackle the spread of COVID-19. *Space and Polity*, *24*(3), 362-381.

Kitchin, R., & Dodge, M. (2014). Code/space: Software and everyday life. MIT Press.

Kitchin, R., Lauriault, T. P., & McArdle, G. (2015). Smart cities and the politics of urban data. In *Smart urbanism* (pp. 16-33). Routledge.

Klauser, F. R., & Söderström, O. (2016). Smart city initiatives and the Foucauldian logics of governing through code. *Smart Urbanism. Utopian Vision or False Dawn*, 108-125.

Klauser, F., Paasche, T., & Söderström, O. (2014). Michel Foucault and the smart city: Power dynamics inherent in contemporary governing through code. *Environment and Planning D: Society and Space*, 32(5), 869-885.

Klinenberg, E. (2018). *Palaces for the people: How social infrastructure can help fight inequality, polarization, and the decline of civic life*. Crown.

Knox, H. (2017). Affective infrastructures and the political imagination. *Public Culture*, *29*(2), 363-384.

Knudsen, B. T., & Stage, C. (2015). Introduction: affective methodologies. In *Affective methodologies: Developing cultural research strategies for the study of affect* (pp. 1-22). London: Palgrave Macmillan UK.

Kočková, J. (2016). Walking in the city: A case study of the streets in Brno. *Human Affairs*, *26*(4), 422-439.

Koh, A. (2002). Towards a critical pedagogy: creating 'thinking schools' in Singapore. *Journal of curriculum studies*, 34(3), 255-264.

Kolehmainen, M., & Juvonen, T. (2018). Introduction: Thinking with and through affective inequalities. In *Affective inequalities in intimate relationships* (pp. 1-15). Routledge.

Kolehmainen, M., Lahti, A., & Kinnunen, A. (2023). Affective intensities of single lives: An alternative account of temporal aspects of couple normativity. *Sociology*, *57*(1), 3-19.

Kong, L., & Woods, O. (2018). The ideological alignment of smart urbanism in Singapore: Critical reflections on a political paradox. *Urban Studies*, *55*(4), 679-701.

Kong, L., & Woods, O. (2021). Scaling smartness,(de) provincialising the city? The ASEAN Smart Cities Network and the translational politics of technocratic regionalism. *Cities*, *117*, 103326.

Kontokosta, C. E., & Hong, B. (2021). Bias in smart city governance: How socio-spatial disparities in 311 complaint behavior impact the fairness of data-driven decisions. *Sustainable Cities and Society*, *64*, 102503.

Kraftl, P., & Adey, P. (2008). Architecture/affect/inhabitation: Geographies of being-in buildings. *Annals of the Association of American Geographers*, *98*(1), 213-231.

Kusenbach, M. (2003). Street phenomenology: The go-along as ethnographic research tool. *Ethnography*, 4(3), 455-485

Lambert, S. R. (2016). *Bodies and becomings: human and animal encounters in early modern English literature* (Doctoral dissertation).

Larkin, B. (2008). Itineraries of Indian cinema: African videos, Bollywood, and global media. *The Bollywood Reader*, 216-228.

Larkin, B. (2013). The politics and poetics of infrastructure. *Annual review of anthropology*, 42, 327-343.

Laruffa, F. (2024). Making sense of (post) neoliberalism. *Politics & Society*, *52*(4), 586-629.

Latham, A., & Layton, J. (2019). Social infrastructure and the public life of cities: Studying urban sociality and public spaces. *Geography Compass*, 13(7), e12444.

Latham, A., & McCormack, D. P. (2017). Affective cities. In *Routledge handbook of physical cultural studies* (pp. 369-377). Routledge.

Lee, C. (2020). Responses of Singapore to COVID-19 pandemic: the whole-of-government approach. *Good public governance in a global pandemic*, *205*.

Lee, C. Y. P., Lin, R. T., Renia, L., & Ng, L. F. (2020). Serological approaches for COVID-19: epidemiologic perspective on surveillance and control. *Frontiers in immunology*, 11, 879.

Lee, J. Y., Woods, O., & Kong, L. (2020). Towards more inclusive smart cities: Reconciling the divergent realities of data and discourse at the margins. *Geography Compass*, *14*(9), e12504.

Lee, J., & Ingold, T. (2020). Fieldwork on foot: Perceiving, routing, socializing. In *Locating the field* (pp. 67-85). Routledge.

Lee, S. (2023). The acceptance model of smart city service: focused on Seoul. *Sustainability*, *15*(3), 2695.

Lee, T., & Lee, H. (2020). <? covid19?> Tracing surveillance and auto-regulation in Singapore:'smart'responses to COVID-19. *Media International Australia*, *177*(1), 47-60.

Lefebvre, H. (1974). *The Production of Space*. Blackwell.

Leino, H., & Puumala, E. (2021). What can co-creation do for the citizens? Applying co-creation for the promotion of participation in cities. *Environment and Planning C: Politics and Space*, *39*(4), 781-799.

León, L. F. A., & Rosen, J. (2021). Technology as ideology in urban governance. In *Smart Spaces and Places* (pp. 166-175). Routledge.

Leow, J. (2020). 'This is Singapore': On Watching Westworld in the Diaspora. *Evergreen Review*. https://evergreenreview.com/read/this-is-singapore-on-watching-westworld-in-the-diaspora/

Leys, R. (2011). The turn to affect: A critique. *Critical inquiry*, 37(3), 434-472.

Lin, T. T. (2019). Communicating haze crisis online: Comparing traditional media news and new media perspectives in Singapore. *Environmental Communication*, *13*(7), 864-878.

Listerborn, C. (2024). Between smart housing and home. EU-funded climate smart interventions in Swedish public housing. *Housing Studies*, 1-20.

Liu, W., Xu, Z., & Yang, T. (2018). Health effects of air pollution in China. *International journal of environmental research and public health*, *15*(7), 1471.

Loong, S. (2018). 'This country, law very strong': Securitization beyond the border in the everyday lives of Bangladeshi migrant workers in Singapore. *Geoforum*, *90*, 11-19.

Lünenborg, M. (2019). Affective publics. In *Affective societies* (pp. 319-329). Routledge.

Luque-Ayala, A., & Marvin, S. (2015). Developing a critical understanding of smart urbanism. *Urban studies*, 52(12), 2105-2116.

Luttrell, W. (2000). " Good enough" methods for ethnographic research. *Harvard Educational Review*, 70(4), 499-523.

Lynch, K., Baker, J., Lyons, M., Feeley, M., Hanlon, N., Walsh, J., & Cantillon, S. (2016). *Affective equality: Love, care and injustice*. Springer.

Madden, D. (2019). "Ranked: The 25 Smartest Countries in the World". *Forbes Online*. https://www.forbes.com/sites/duncanmadden/2019/01/11/ranked-the-25-smartest-countries-in-the-world/

Mahmood, S. (2006). Secularism, hermeneutics, and empire: The politics of Islamic reformation. *Public culture*, *18*(2), 323-347.

March, H., & Ribera-Fumaz, R. (2016). Smart contradictions: The politics of making Barcelona a Self-sufficient city. *European urban and regional studies*, *23*(4), 816-830.

Martens, L. (2012). The politics and practices of looking. Advances in visual methodology, 39-56.

Martin, C. J., Evans, J., & Karvonen, A. (2018). Smart and sustainable? Five tensions in the visions and practices of the smart-sustainable city in Europe and North America. *Technological Forecasting and Social Change*, *133*, 269-278.

Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.). (2015). *Smart urbanism: Utopian vision or false dawn?*. Routledge.

Masquelier, A. (1992). Encounter with a road siren: machines, bodies and commodities in the imagination of a Mawri healer. *Visual Anthropology Review*, 8(1), 56-69.

Massumi, B. (1995). The autonomy of affect. Cultural critique, (31), 83-109.

Massumi, B. (2002). *Parables for the Virtual: Movement, Affect, Sensation.* Duke University Press.

Massumi, B. (2015). *Politics of Affect*. Polity.

Matejskova, T., & Leitner, H. (2011). Urban encounters with difference: The contact hypothesis and immigrant integration projects in eastern Berlin. *Social & Cultural Geography*, *12*(7), 717-741.

Mbembe, A. (2001). *On the postcolony (Vol. 41).* University of California Press.

McCormack, D. P. (2008). Engineering affective atmospheres on the moving geographies of the 1897 Andrée expedition. *cultural geographies*, *15*(4), 413-430.

McCormack, D. P. (2014). *Refrains for moving bodies: Experience and experiment in affective spaces*. Duke University Press.

McFarlane, C. (2011). Assemblage and critical urbanism. *City*, 15(2), 204-224.

McFarlane, C. (2016). The geographies of urban density: Topology, politics and the city. *Progress in human geography*, *40*(5), 629-648.

McFarlane, C., & Silver, J. (2017). Navigating the city: Dialectics of everyday urbanism. *Transactions of the Institute of British Geographers*, 42(3), 458-471.

McLean, A., Bulkeley, H., & Crang, M. (2016). Negotiating the urban smart grid: Socio-technical experimentation in the city of Austin. *Urban Studies*, 53(15), 3246-3263.

McNeill, D. (2015). Global firms and smart technologies: IBM and the reduction of cities. *Transactions of the institute of British geographers*, *40*(4), 562-574.

Miao, J. T., & Phelps, N. A. (2019). The intrapreneurial state: Singapore's emergence in the smart and sustainable urban solutions field. *Territory, Politics, Governance*, *7*(3), 316-335.

Miller, P., & Rose, N. (2008). *Governing the present: Administering economic, social and personal life.* Polity.

Ministry of Communication and Information. (2018). Digital Readiness Blueprint. https://www.mddi.gov.sg/files/dr%20blueprint.pdf

Ministry of National Development. (2022). Integrated Community Platform to tackle municipal issues piloted in Toa Payoh East. https://www.mnd.gov.sg/newsroom/press-releases/view/integrated-community-platform-to-tackle-municipal-issues-piloted-in-toa-payoh-east

Minkkinen, P. (2022). Ethnography in motion, or walking With WG sebald. *Social & Legal Studies*, 31(3), 347-364.

Mitchell, C., & De Lange, N. (2011). Community-based participatory video and social action in rural South Africa. *The SAGE handbook of visual research methods*, 171-185.

Mitchell, T. (1991). The limits of the state: Beyond statist approaches and their critics. *American political science review*, *85*(1), 77-96.

Močnik, Š., Moogoor, A., & Yuen, B. (2022). Exploring facilitators and barriers of older adults' outdoor mobility: A walk-along study in Singapore. *Journal of Transport & Health*, *26*, 101386.

Mohan, M. (2019). "Understand the haze: What do Singapore's air quality readings mean and how do they differ from others?" in *Channel News Asia Online*. https://www.channelnewsasia.com/singapore/haze-101-singapore-psi-reading-meanings-1316026

Morgan, L.H. (1877) 1985. *Ancient society*. Tucson: University of Arizona Press.

Morrison, A. (2020). The Politics of Feeling: The Phenomenology of Affect in Sara Ahmed and Judith Butler. In *Symposium: Canadian Journal of Continental Philosophy/Revue Canadienne de Philosophie Continentale* (Vol. 24, No. 2).

Mouton, M. (2021). Worlding infrastructure in the global South: Philippine experiments and the art of being 'smart'. *Urban Studies*, *58*(3), 621-638.

Mrázek R. **2002**. *Engineers of Happy Land: Technology and Nationalism in a Colony* Princeton, NJ: Princeton Univ. Press

Mutalib, H. (2002). The socio-economic dimension in Singapore's quest for security and stability. *Pacific Affairs,* 39-56.

Nallari, A., & Poorthuis, A. (2021). Rethinking 'kampung'or 'village'in the (re) making of Singapore and Singaporeans. *Singapore Journal of Tropical Geography*, *42*(3), 431-450.

National Climate Change Secretariat. (2015). Sustainable Singapore Blueprint. https://www.clc.gov.sg/docs/default-source/books/ssbcombined-cover-text.pdf

Nencel, L. (2014, March). Situating reflexivity: Voices, positionalities and representations in feminist ethnographic texts. In *Women's Studies International Forum* (Vol. 43, pp. 75-83). Pergamon.

Ng, C. J. W. (2018). Skilling the nation, empowering the citizen: Neoliberal instantiations in Singapore's lifelong learning policy. *Journal of Language and Politics*, *17*(1), 118-140.

Ng, H. Y. (2016). What drives young people into opposition parties under hybrid regimes? A comparison of Hong Kong and Singapore. *Asian Politics & Policy*, *8*(3), 436-455.

Ng, K.G. (2021). Singaporeans prioritise green spaces, affordable housing in URA poll on long-term land use plans. *The Straits Times*. https://www.straitstimes.com/singapore/singaporeans-prioritise-green-spaces-affordable-housing-in-ura-poll-on-long-term-land-use

Ngai, S. (2004). *Ugly feelings*. Harvard University Press.

Nielsen, E. S. (2014). Smart growth machines: The ecological modernization of urban political economy. In *From Sustainable to Resilient Cities: Global Concerns and Urban Efforts* (Vol. 14, pp. 169-190). Emerald Group Publishing Limited.

Noveck, B. S. (2018). Forging smarter cities through CrowdLaw. *Media and Communication*, 6(4), 123-126.

Odendaal, N. (2016). Getting smart about smart cities in Cape Town. In Luque-Ayala, A., McFarlane, C. and Marvin, S. (eds.) *Smart urbanism: Utopian vision or false dawn*, 71-87. Routledge.

Odendaal, N. (2021). Recombining place: COVID-19 and community action networks in South Africa. *International Journal of E-Planning Research (IJEPR)*, *10*(2), 124-131.

Olivi, M. (2023). The (Dystopian) Promise of Happiness: Hope, Happiness and Optimism in Contemporary Feminist Dystopias. *DIVE-IN–An International Journal on Diversity and Inclusion*, *3*(2), 227-247.

Olojo, S. (2024). *Counterdata*. Data Society. https://datasociety.net/wp-content/uploads/2024/04/Keywords_Counterdata_Olojo_04242024.pdf)

Ong, A. (1987). Disassembling gender in the electronics age. *Feminist Studies*, 13(2): 609-626.

Ong, J. (2021, July 2). Most Singaporeans politically apathetic, not keen on activism: IPS. *The Straits Times*. **https://www.straitstimes.com/singapore/most-singaporeans-politically-apathetic-not-keen-on-activism-ips**

Ozaki, R., & Shaw, I. (2014). Entangled practices: governance, sustainable technologies, and energy consumption. *Sociology*, *48*(3), 590-605.

Paiva, D., & Sánchez-Fuarros, I. (2021). The territoriality of atmosphere: Rethinking affective urbanism through the collateral atmospheres of Lisbon's tourism. *Transactions of the Institute of British Geographers*, *46*(2), 392-405.

Papacharissi, Z. (2016). Affective publics and structures of storytelling: Sentiment, events and mediality. *Information, communication & society*, *19*(3), 307-324.

Parkhill, K. A., Henwood, K. L., Pidgeon, N. F., & Simmons, P. (2011). Laughing it off? Humour, affect and emotion work in communities living with nuclear risk 1. *The British Journal of Sociology*, *62*(2), 324-346.

Pereira, R., Correia, D., Mendes, L., Rabadão, C., Barroso, J., & Pereira, A. (2018). Low-Cost Smart Surveillance System for Smart Cities. In *Universal Access in Human-Computer Interaction. Virtual, Augmented, and Intelligent Environments: 12th International Conference, UAHCI 2018, Held as Part of HCI International 2018, Las Vegas, NV, USA, July 15-20, 2018, Proceedings, Part II 12* (pp. 330-339). Springer International Publishing.

Peterson, M. (2017). Living with difference in hyper-diverse areas: how important are encounters in semi-public spaces?. *Social & Cultural Geography*, *18*(8), 1067-1085.

Pettit, C., Bakelmun, A., Lieske, S. N., Glackin, S., Thomson, G., Shearer, H., ... & Newman, P. (2018). Planning support systems for smart cities. *City, culture and society*, *12*, 13-24.

Pink, S. (2006). *The future of visual anthropology: Engaging the senses.* Taylor & Francis.

Pink, S. (2007). Walking with video. *Visual studies*, 22(3), 240-252.

Pink, S. (2008). An urban tour: The sensory sociality of ethnographic place-making. *Ethnography*, *9*(2), 175-196.

Pink, S. (2009). Urban social movements and small places: Slow cities as sites of activism. *City,* 13(4), 451-465.

Pink, S. (2012). *Situating everyday life: Practices and places*. Sage.

Pink, S. (2015*). Doing sensory ethnography*. Sage.

Pink, S., & Mackley, K. L. (2015). Social science, design and everyday life: Refiguring showering through anthropological ethnography. *Journal of Design Research*, *13*(3), 278-292.

Pink, S., Hubbard, P., O'neill, M., & Radley, A. (2010). Walking across disciplines: from ethnography to arts practice. *Visual studies,* 25(1), 1-7.

Pink, S., Strengers, Y., Martin, R., & Dahlgren, K. (2022). Smart Home Masculinities. *Australian Feminist Studies*, *37*(112), 117-133.

Ponting, A. & Zhou, Y. (2016). Lessons from New York for Singapore's Journey. *Centre for Liveable Cities*. https://www.clc.gov.sg/docs/default-source/commentaries/lessons-from-new-york-for-singapore-smart-nation-journey.pdf

Porter, G., Hampshire, K., Abane, A., Munthali, A., Robson, E., Mashiri, M., & Maponya, G. (2010). Where dogs, ghosts and lions roam: learning from mobile ethnographies on the journey from school. *Children's geographies*, 8(2), 91-105.

Powells, G., Bulkeley, H., & McLean, A. (2015). Geographies of smart urban power. In Luque-Ayala, A., McFarlane, C. and Marvin, S. (eds.) *Smart urbanism: Utopian vision or false dawn*, 141-160. Routledge.

Ramakrishnan, K., & O'Reilly, K. (2023). Mapping affective infrastructures otherwise. *Dialogues in Human Geography*, *13*(1), 91-94.

Raza, S. (2022). Artificial Unintelligence: How "Smart" and AI technologies perpetuate bias and systemic discrimination. *Gender, sex and tech*, 185-205.

Raza, S. (2024). On the Uses of Phenomenology in Sociological Research: A Typology, some Criticisms and a Plea. *Journal for the Theory of Social Behaviour*.

Rijshouwer, E. A., Leclercq, E. M., & van Zoonen, L. (2022). Public views of the smart city: Towards the construction of a social problem. *Big Data & Society*, *9*(1), 20539517211072190.

Ringrose, J., & Coleman, R. (2013). Looking and desiring machines: A feminist Deleuzian mapping of bodies and affects. *Deleuze and research methodologies*, 125-144.

Rodan, G. (1998). The Internet and political control in Singapore. *Political Science Quarterly,* 113(1), 63-89.

Rodan, G. (2008). Singapore "exceptionalism"? Authoritarian rule and state transformation. In *Political Transitions in Dominant Party Systems* (pp. 247-267). Routledge.

Røpke, I. (2009). Theories of practice—New inspiration for ecological economic studies on consumption. *Ecological economics*, *68*(10), 2490-2497.

Rose, G. (1993). *Feminism and geography: the limits of geographical knowledge.* Polity.

Rose, G. (2020). Actually-existing sociality in a smart city: The social as sociological, neoliberal and cybernetic. *City*, *24*(3-4), 512-529.

Rose, G., & Willis, A. (2019). Seeing the smart city on Twitter: Colour and the affective territories of becoming smart. *Environment and Planning D: Society and Space*, *37*(3), 411-427.

Rose, G., Degen, M., & Basdas, B. (2010). More on 'big things': building events and feelings. *Transactions of the Institute of British Geographers*, 35(3), 334-349.

Rostow, W. W. (1960). *Comparative Politics: Critical Concepts in Political Science*. London: Routledge.

Roy, A. (2011). Slumdog cities: Rethinking subaltern urbanism. *International journal of urban and regional research*, 35(2), 223-238.

Sadowski, J., & Bendor, R. (2019). Selling smartness: Corporate narratives and the smart city as a sociotechnical imaginary. *Science, Technology, & Human Values*, *44*(3), 540-563.

Sadowski, J., & Pasquale, F. A. (2015). The spectrum of control: A social theory of the smart city. *First Monday*, 20(7).

Safransky, S. (2020). Geographies of algorithmic violence: Redlining the smart city. *International Journal of Urban and Regional Research*, *44*(2), 200-218.

Sassen, S., & Kourtit, K. (2021). A post-corona perspective for smart cities: 'Should I stay or should I go?'. *Sustainability*, *13*(17), 9988.

Savin-Baden, M., & Major, C. H. (2013). *Qualitative research: The essential guide to theory and practice.* Taylor & Francis.

Schatzki, T. R. (2001). *Subject, body, place*. Taylor & Francis.

Scheper-Hughes, N., & Bourgois, P. I. (Eds.). (2004). *Violence in war and peace: An anthology* (Vol. 5). Blackwell Pub..

Schiermer, B. (2021). Creative affects: affective phases in creative work processes. *Distinktion: Journal of Social Theory*, *22*(3), 421-440.

Schlatter, C. (1994). Environmental pollution and human health. *Science of the Total Environment*, *143*(1), 93-101.

Schmitz, S., & Ahmed, S. (2014). Affect/emotion: orientation matters. a conversation between Sigrid Schmitz and Sara Ahmed. *FZG–Freiburger Zeitschrift für GeschlechterStudien*, *20*(2), 13-14.

Schwenkel, C. (2015). Spectacular infrastructure and its breakdown in socialist Vietnam. *American Ethnologist*, *42*(3), 520-534.

Sebrechts, M., Borny, S., Wauters, T., Volckaert, B., & De Turck, F. (2021). Service relationship orchestration: Lessons learned from running large scale smart city platforms on kubernetes. *IEEE Access*, *9*, 133387-133401.

Semyachkov, K. (2021). Smart City as a Model for Sustainable Development of Territories. In *SHS Web of Conferences* (Vol. 110, p. 05003). EDP Sciences.

Shamir, R. (2013). *Current flow: The electrification of Palestine*. Stanford University Press.

Shamsuzzoha, A., Nieminen, J., Piya, S., & Rutledge, K. (2021). Smart city for sustainable environment: A comparison of participatory strategies from Helsinki, Singapore and London. *Cities*, *114*, 103194.

Shelton, T., & Lodato, T. (2019). Actually existing smart citizens: Expertise and (non) participation in the making of the smart city. *City*, 23(1), 35-52.

Shelton, T., Zook, M., & Wiig, A. (2015). The 'actually existing smart city'. *Cambridge journal of regions, economy and society*, *8*(1), 13-25.

Shilon, M., & Marom, N. (2023). Affective politics of air pollution: atmospheres and activism in the Tel Aviv Metropolitan Region. *Environmental Politics*, *32*(6), 988-1011.

Shusterman, R. (2008). *Body consciousness: A philosophy of mindfulness and somaesthetics.* Cambridge University Press.

Shwayri, S. T. (2013). A model Korean ubiquitous eco-city? The politics of making Songdo. *Journal of Urban Technology*, *20*(1), 39-55.

Simone, A. (2004). People as infrastructure: Intersecting fragments in Johannesburg. *Public culture*, 16(3), 407-429.

Simone, A. (2010). *The social infrastructures of city life in contemporary Africa*. Nordiska Afrikainstitutet.

Simone, A. (2014). People as Infrastructure. *The People, Place, and Space Reader*, 241.

Singapore Institute of International Affairs. (2021). Report: Haze Outlook 2021. https://www.siiaonline.org/report/report-haze-outlook-2021/

Singstat. (2022). Population Trends. *Department of Statistics Singapore*. https://www.singstat.gov.sg/-/media/files/publications/population/population2022.pdf

Singstat. (2024). Households. *Department of Statistics Singapore*. https://www.singstat.gov.sg/find-data/search-by-theme/households/households/latest-data

Skoric, M. M., Ying, D., & Ng, Y. (2009). Bowling online, not alone: Online social capital and political participation in Singapore. *Journal of Computer-Mediated Communication*, *14*(2), 414-433.

Slaby, J. (2016). Relational Affect. Working Paper. *Affective Societies* 02/16. http://edocs.fu-berlin.de/docs/receive/FUDOCS_series_000000000562

Slater, D. (2010). *Ordering power: Contentious politics and authoritarian leviathans in Southeast Asia.* Cambridge University Press.

Smart Nation Singapore. (2017). Transcript of Speech by Minister Vivian Balakrishnan at the 2nd Raffles Dialogue on Human Well-Being and Security. https://www.smartnation.gov.sg/media-hub/speeches/2nd-raffles-dialogue-on-human-well-being-and-security-2017/

Smart Nation Singapore. (2024) Punggol Smart Town. https://www.smartnation.gov.sg/initiatives/punggolst/

Smart Nation Singapore. (n.d.). https://www.smartnation.gov.sg/

Smith, D. E. (1987). *The everyday world as problematic: A feminist sociology.* University of Toronto Press.

Smith, T. E., & Varkkey, H. (2022). Southeast Asian haze and socio-environmental–epidemiological feedback. In Shin, H.B., McKenzie, M., Oh, D.O. (eds.) *Covid-19 in Southeast Asia: Insights for a Post-Pandemic World*. LSE Press.

Sneath, D. (2009). Reading the signs by Lenin's light: Development, divination and metonymic fields in Mongolia. *Ethnos*, 74(1), 72-90.

Söderström, O., Blake, E., & Odendaal, N. (2021). More-than-local, more-than-mobile: The smart city effect in South Africa. *Geoforum*, *122*, 103-117.

Song, M. (2020). A Case Study on Energy focused Smart City, London of the UK: Based on the Framework of 'Business Model Innovation'. *International journal of advanced smart convergence*, *9*(2), 8-19.

Springgay, S., & Truman, S. E. (2018). On the need for methods beyond proceduralism: Speculative middles,(in) tensions, and response-ability in research. *Qualitative Inquiry*, 24(3), 203-214.

Sriramesh, K., & Rivera-Sánchez, M. (2006). E-government in a corporatist, communitarian society: the case of Singapore. *New Media & Society*, *8*(5), 707-730.

Star, S. L. (1999). The ethnography of infrastructure. *American behavioural scientist*, 43(3), 377-391.

Starosielski, N. (2015). *The undersea network.* Duke University Press.

Steinbeck, S., & Munar, A. M. (2024). Affective atmospheres in children's museum experiences. *Leisure Studies*, *43*(3), 378-394.

Stewart, K. (2020). *Ordinary affects*. Duke University Press.

Street, A. (2012). Affective infrastructure: Hospital landscapes of hope and failure. *Space and Culture*, *15*(1), 44-56.

Suman, A. B., Peca, M., Greyl, L., Greco, L., & Carsetti, P. (2023). The "citizen sensing paradigm" to foster urban transitions: lessons from civic environmental monitoring in Rome. *European Journal of Risk Regulation*, *14*(3), 526-548.

Szczech-Pietkiewicz, E., Szweda-Lewandowska, Z., Felczak, J., & Kubicki, P. (2024). Smart city, ICT, and older people: Developing inclusive public space and housing conditions. In *Smart Cities* (pp. 133-153). Routledge.

Szewczenko, A. (2020). The concept of smart city in terms of improving the quality and accessibility of urban space for the elderly; literature review. *Architecture, Civil Engineering, Environment*, *13*(2), 27-35.

Tan, A. (2015a, October 8). Official one-hour PSI figures, please. *The Straits Times*. https://www.straitstimes.com/opinion/official-one-hour-psi-figures-please#xtor=CS1-10

Tan, A. (2015b, October 9). NEA: No to 1-hour PSI. *The Straits Times.* https://www.straitstimes.com/singapore/nea-no-to-1-hour-psi

Tan, A. (2016a, September 1). askST: How do I interpret the new 1-hour PM2.5 readings? *The Straits Times*. https://www.straitstimes.com/singapore/environment/askst-how-do-i-interpret-the-new-1-hour-pm25-readings

Tan, A. (2016b, October 19). Eco-friendly cooking oil now available at FairPrice. The Straits Times. https://www.straitstimes.com/singapore/environment/eco-friendly-cooking-oil-now-available-at-fairprice

Tan, A. (2019a, September 20). askST: Why air quality measurements in Singapore differ from other indexes. *The Straits Times*. https://www.straitstimes.com/singapore/environment/why-air-quality-measurements-in-singapore-differ-from-other-indexes

Tan, A. (2019b, November 4). askST: Why are Singapore's PSI readings so different from those elsewhere, and which are correct? *The Straits Times*. https://www.straitstimes.com/singapore/environment/why-are-singapores-psi-readings-so-different-from-those-used-elsewhere-and

Tan, C. W., Pan, S. L., & Lim, E. T. (2005). Managing stakeholder interests in e-government implementation: Lessons learned from a Singapore e-government project. *Journal of Global Information Management (JGIM)*, *13*(1), 31-53.

Tan, E. K. (2018). Battling the haze of cross-boundary (mis) governance in transboundary air pollution: A perspective from Singapore. In *Pollution across borders: Transboundary fire, smoke and haze in Southeast Asia* (pp. 297-307).

Tan, K. P. (2012). The ideology of pragmatism: Neo-liberal globalisation and political authoritarianism in Singapore. *Journal of Contemporary Asia*, 42(1), 67-92.

Terruhn, J., & Ye, J. (2022). Encountering neighbors: coexisting with difference in Auckland's Avondale. *Urban Geography*, *43*(4), 613-631.

Tham, Y.C. (2022, September 17). High level of trust in S'pore due to culture of honouring one's word and one another: DPM Lawrence Wong in *The Straits Times*. https://www.straitstimes.com/singapore/politics/high-level-of-trust-in-spore-due-to-culture-of-honouring-ones-word-and-one-another-dpm-lawrence-wong

The National Environment Agency. (n.d.). Default. https://www.haze.gov.sg/

The Straits Times. (2015). Indonesia's Vice-President Jusuf Kalla criticises neighbours for grumbling about haze. https://www.straitstimes.com/asia/se-asia/indonesias-vice-president-jusuf-kalla-criticises-neighbours-for-grumbling-about-haze

Thompson, E. C. (2006). Singaporean exceptionalism and its implications for ASEAN regionalism. *Contemporary Southeast Asia*, 183-206.

Thrift, N., & French, S. (2002). The automatic production of space. *Transactions of the institute of British geographers*, 27(3), 309-335.

Tolia-Kelly, D. P. (2006). Affect: An ethnocentric encounter? Exploring the'universalist'imperative of emotional/affectual geographies. *Area*, *38*(2), 213-217.

Tong, B. (2024). Community Building Through Place-Making Activities: Older Landscapers in a Singaporean Residential Town. *Journal of Cross-Cultural Gerontology*, 1-24.

Townsend, A. M. (2013). *Smart cities: Big data, civic hackers, and the quest for a new utopia.* WW Norton & Company.

Tschakert, P., Bourgault du Coudray, C., & Horwitz, P. (2024). Walking journeys into everyday climatic-affective atmospheres: The emotional labour of balancing grief and hope. *Environment and Planning E: Nature and Space*, *7*(1), 189-211.

Tse, R.T., & Xiao, Y. (2016, June). A portable Wireless Sensor Network system for real-time environmental monitoring. In *2016 IEEE 17th International Symposium on A World of Wireless, Mobile and Multimedia Networks (WoWMoM)* (pp. 1-6). IEEE.

Uhlmann, A. (2020). Affect, meaning, becoming, and power: Massumi, Spinoza, Deleuze, and neuroscience. *Affect and literature*, 159-174.

Usher, M. (2019). Desalination: Techno-diplomacy and hydraulic state restructuring through reverse osmosis membranes in Singapore. *Transactions of the Institute of British Geographers,* 44(1), 110-124.

Usher, M. (2024). Territory, hydraulics, biopolitics: internal colonization through urban catchment management in Singapore. *Territory, Politics, Governance*, *12*(6), 846-865.

Van der Graaf, S. (2020). The right to the city in the platform age: Child-friendly city and smart city premises in contention. *Information*, *11*(6), 285.

Vannini, P. (2015). Non-representational ethnography: New ways of animating lifeworlds. *cultural geographies*, *22*(2), 317-327.

Vannini, P., & Vannini, A. (2008). Of walking shoes, boats, golf carts, bicycles, and a slow technoculture: A technography of movement and embodied media on Protection Island. *Qualitative Inquiry*, *14*(7), 1272-1301.

Vanolo, A. (2014). Smartmentality: The smart city as disciplinary strategy. *Urban studies*, 51(5), 883-898.

Velasco, E., & Rastan, S. (2015). Air quality in Singapore during the 2013 smoke-haze episode over the Strait of Malacca: Lessons learned. *Sustainable Cities and Society,* 17, 122-131.

Verlie, B. (2017). Rethinking climate education: Climate as entanglement. *Educational Studies*, *53*(6), 560-572.

Verrest, H., & Pfeffer, K. (2019). Elaborating the urbanism in smart urbanism: distilling relevant dimensions for a comprehensive analysis of Smart City approaches. *Information, Communication & Society*, *22*(9), 1328-1342.

Viernes, J. P. (2017). *Loose Taps: Finding Queer Orientations in Tap Dance Performance* (Doctoral dissertation, Barnard College).

Viitanen, J., & Kingston, R. (2014). Smart cities and green growth: outsourcing democratic and environmental resilience to the global technology sector. *Environment and Planning A*, 46(4), 803-819.

Violaris, E. (2021). Examining concepts of reflexivity and positionality in native and indigenous research methods. *Ethnographic Encounters*, *11*(1), 64-70.

Von Schnitzler, A. (2013). Traveling technologies: Infrastructure, ethical regimes, and the materiality of politics in South Africa. *Cultural anthropology*, *28*(4), 670-693.

Vuolteenaho, J., Leurs, K., & Sumiala, J. (2015). Digital urbanisms: Exploring the spectacular, ordinary and contested facets of the media city. *Observatorio (OBS*)*.

Webber, S., Maalsen, S., & Emmanuel, L. (2024). Tracking, calculating, watching: Governing and delay in the Jakarta Smart City. *Transactions of the Institute of British Geographers*, *49*(2), e12630

Wee, C. L. (2001). The end of disciplinary modernisation? The Asian economic crisis and the ongoing reinvention of Singapore. *Third World Quarterly*, *22*(6), 987-1002.

Westin, A. F. (1968). Privacy and freedom. *Washington and Lee Law Review*, *25*(1), 166.

Wetherell, M. (2013). Affect and discourse–What's the problem? From affect as excess to affective/discursive practice. *Subjectivity*, *6*, 349-368.

Wetherell, M. (2015). Trends in the turn to affect: A social psychological critique. *Body & Society*, *21*(2), 139-166.

Wetherell, M., & Beer, D. (2014). The future of affect theory: An interview with Margaret Wetherell. *Theory, Culture & Society*, *15*.

White, J. M. (2016). Anticipatory logics of the smart city's global imaginary. *Urban Geography*, *37*(4), 572-589.

Wiig, A., & Wyly, E. (2016). Introduction: Thinking through the politics of the smart city. *Urban Geography*, 37(4), 485-493.

Willems, T., & Graham, C. (2019). The imagination of Singapore's smart nation as digital infrastructure: Rendering (digital) work invisible. *East Asian Science, Technology and Society: An International Journal*, *13*(4), 511-536.

Williams, R. (1977). *Marxism and Literature.* Oxford University Press.

Wilson, H. F., & Anderson, B. (2020). Detachment, disaffection, and other ambivalent affects. *Environment and Planning C: Politics and Space*, *38*(4), 591-598.

Woo, J. J. (2018). Technology and governance in Singapore's smart nation initiative. *Ash Center Policy Briefs Series*. Harvard University, Cambridge. Master's Thesis. http://nrs.harvard.edu/urn-3:HUL.InstRepos:42372461

Wood, D. M., & Mackinnon, D. (2019). Partial platforms and oligoptic surveillance in the smart city. *Surveillance & Society*, *17*(1/2), 176-182.

Woods, O., & Kong, L. (2017). Mobile cities, modelling policies: Importing/exporting the Singapore 'model' of development. In *A research agenda for cities* (pp. 206-217). Edward Elgar Publishing.

Woods, O. (2019). Sonic spaces, spiritual bodies: The affective experience of the roots reggae soundsystem. *Transactions of the Institute of British Geographers*, *44*(1), 181-194.

Woods, O. (2020). Subverting the logics of "smartness" in Singapore: Smart eldercare and parallel regimes of sustainability. *Sustainable Cities and Society*, *53*, 101940.

Woods, O. (2021). Affective cosmopolitanisms in Singapore: Dancehall and the decolonisation of the self. *Transactions of the Institute of British Geographers*, *46*(1), 135-148.

Woods, O. (2023). The illusory infrastructure of ink: Machinic bodies and epidermic affects in Singapore. *Emotion, Space and Society*, *49*, 100991.

Woods, O. (2024). The affective embeddings of gacha games: Aesthetic assemblages and the mediated expression of the self. *New Media & Society*, *26*(2), 823-838.

Woods, O., & Kong, L. (2020). New cultures of care? The spatio-temporal modalities of home-based smart eldercare technologies in Singapore. *Social & Cultural Geography*, *21*(9), 1307-1327.

Woods, O., Bunnell, T., & Kong, L. (2023). The state-led platformisation of financial services: Frictionless ecosystems and an expansive logic of "smartness" in Singapore. *Geoforum*, *146*, 103849.

Woods, O., Bunnell, T., & Kong, L. (2024a). Insourcing the smart city: assembling an ideo-technical ecosystem of talent, skills, and civic-mindedness in Singapore. *Urban Geography*, *45*(5), 735-754.

Woods, O., Bunnell, T., & Kong, L. (2024b). Island platforms and the hyper-terrestrialisation of Singapore's smart city-state. *Territory, Politics, Governance*, 1-19.

Wu, X., Duan, R., & Ni, J. (2024). Unveiling security, privacy, and ethical concerns of ChatGPT. *Journal of Information and Intelligence*, *2*(2), 102-115.

Wylie, J. (2005). A single day's walking: narrating self and landscape on the South West Coast Path. *Transactions of the institute of British Geographers*, 30(2), 234-247.

Wynn, M. G., Hosseini, S. Z., & Parpanchi, S. M. (2022). Housing development and the smart city: A case study of Tehran, Iran. *Journal of Infrastructure Policy and Development*, *7*(2), 1-24.

Yarker, S. (2021). *Creating spaces for an ageing society: The role of critical social infrastructure.* Emerald Publishing Limited.

Ye, J. (2016). The ambivalence of familiarity: understanding breathable diversity through fleeting encounters in Singapore's Jurong West. *Area*, *48*(1), 77-83.

Ye, J. (2017). Contours of urban diversity and coexistence. *Geography Compass*, *11*(9), e12327.

Yea, S., & Chok, S. (2018). Unfreedom unbound: Developing a cumulative approach to understanding unfree labour in Singapore. *Work, Employment and Society*, *32*(5), 925-941.

Yeo, S. J. I. (2023). Smart urban living in Singapore? Thinking through everyday geographies. *Urban Geography*, *44*(4), 687-706.

Yeo, S. J. I., & Lin, W. (2020). Autonomous vehicles, human agency and the potential of urban life. *Geography Compass*, *14*(10), e12531.

Yeoh, B. S. (2015). Affective practices in the European city of encounter: Reflections from a distance. *City*, *19*(4), 545-551.

Yoo, Y. (2021). Toward sustainable governance: Strategic analysis of the smart city Seoul portal in Korea. *Sustainability*, *13*(11), 5886.

Zhao, W., & Zou, Y. (2025). Smart governance for affordable housing in China: Preparation, practice, and paradoxes. *Cities*, *156*, 105500.

Zhu, H., Shen, L., & Ren, Y. (2022). How can smart city shape a happier life? The mechanism for developing a Happiness Driven Smart City. *Sustainable cities and society*, *80*, 103791.

Zhuang, K. V., & Goggin, G. (2024). New possibilities or problems for disability and inclusion? The case of AI and ADMs across work. *Telematics and Informatics*, 102156.

Zmigrod, L., Eisenberg, I. W., Bissett, P. G., Robbins, T. W., & Poldrack, R. A. (2021). The cognitive and perceptual correlates of ideological attitudes: a data-driven approach. *Philosophical Transactions of the Royal Society B*, *376*(1822), 20200424.

Zuev, D., & Simpson, T. (2024). Affective atmospheres in Macau: from the sublime to the uncanny. *Visual Studies*, *39*(1-2), 73-86.

Appendix 1

Year	Key Events
1963	Singapore's first mainframe computer, an IBM 1401 system, installed in the Central Provident Fund Board (CPFB) to automate the ledger accounting system that kept track of 1.6 million CPF members' accounts
1981	The national computerisation drive began, with the mission to computerize the Civil Service. Formation of the National Computer Board (NCB)
1986	National IT Plan – Electronic data exchange networks were extended from government sector to private sector
1988	The NCB was tasked with developing the IT2000 Masterplan for Singapore with a vision to "Transform Singapore into an Intelligent Island, where the use of information technology is pervasive in every aspect of our society, at work, at home and at play"
1991	The National Science and Technology Board set up a city-wide computer network called Technet, connecting academic institutions to each other and the internet
1997	Singapore was one of the first few countries to introduce a city-wide broadband network, Singapore One, that provided its residents with high-speed internet access
1998	The National Library Board became the world's first public library system to use Radio Frequency Identification (RFID) technology to enable self-service borrowing and returning
2000	The Housing & Development Board (HDB) introduced an electronic application system for flat purchases, shortening processing time

2000	The Infocomm 21 Master Plan was launched to develop Singapore into a leading infocomm hub for the provision of telecommunications services, e-business transactions and distribution of digital goods and services
2003	Singpass was introduced, offering Singapore residents a convenient and secure way to access government digital services. It is now used widely to manage everyday transactions with not just the government, but private sector organisations both online and in-person
2003	Singapore's Economic Review Committee aimed to position Singapore as a Living Lab in which to create, test, commercialize and deploy innovative ICT-based solutions
2006	Wireless@SG was introduced, offering residents free Wi-Fi island-wide
2006	Intelligent Nation 2015 Masterplan launched
2011	The eGov2015 Masterplan was introduced to develop next generation whole-of-government ICT infrastructure. Data.gov.sg was also launched to provide access to publicly available government data to encourage research and applications development
2014	Smart Nation Program Office launched. Smart Nation vision and initiative introduced
2016	The Government Technology Agency (GovTech) was formed, responsible for supporting infrastructure development in the Smart Nation initiative
2016	HDB announced the new Smart HDB Town Framework. This framework detailed HDB's plans to introduce elements of 'smart' in HDB estates
2016	The Monetary Authority of Singapore (MAS) published the "Singapore Payments Roadmap", which outlined a plan to increase the use of electronic payments across the city

2017	The Smart Nation & Digital Government Office (SNDGO) was formed, leading the Smart Nation project and Singapore's digital transformation
2017	Key Strategic National Projects were identified by the SNDGO to direct the adoption of digital and smart technologies in Singapore; these include Punggol Smart Town, Smart Nation Sensor Platform, and Smart Urban Mobility
2019	The National AI Strategy is unveiled at the SFF X SWITCH (Singapore FinTech Festival and Singapore Week of Innovation and TeCHnology) Conference
2020	The MAS and the SNDGG launched the Singapore Financial Data Exchange (SGFinDex), enabling Singaporeans to consolidate their financial information for more effective financial planning
2022	Local telecoms giant Singtel launches its 5G Standalone (SA) network; Singapore becomes the first country in the world to have nationwide 5G coverage

Source: This timeline has been developed from information found in the physical Smart Nation Timeline in the URA Smart City Gallery, and online material from GovTech Singapore and Smart Nation Singapore websites. Material from Ponting and Yimin's (2016) article for the Centre for Liveable Cities has also been adapted.

Appendix 2: Initial Codebook

Nested Level	Code Name
>	Challenges to official haze data
>	Support of official haze data
>	Sight
>	Smell
>	Taste
>	Touch
>	Hearing
>	Hot

Appendix 3: All Codes

Order of Code in List	Nested Level	Code Name
1	>	Individualization of responsibility
2	>>	consumer duty
3	>	complains
4	>>	hungry ghost month
5	>>	army
6	>>	confusion
7	>>	negative feelings
8	>>>	fear
9	>>	“Gahmen”
10	>	climate change
11	>	Indonesia
12	>	China
13	>	perceptions of Singapore
14	>	support for government response
15	>>	using NEA figures
16	>>	defending NEA figures
17	>	explanation of PSI
18	>>	PM2.5
19	>>	PM10
20	>>	alternatives to NEA
21	>>	comparisons with previous years
22	>	consistency
23	>>	seasonality
24	>	feel
25	>>	aircon
26	>>	the elemental
27	>>>	wind

28	>>>	rain
29	>>	hot
30	>>	sick
31	>>>	sneezing
32	>>>	runny nose
33	>>>	allergies
34	>>	skin sensations
35	>>>	itchy
36	>>	see
37	>>>	eyes
38	>>>	reference to photos
39	>>	smell
40	>>>	cough
41	>>>	choke
42	>>>	throat
43	>>>	breathing
44	>>>	smoke
45	>>>	burning
46	>	humour
47	>>	sarcasm
48	>	health risk
49	>	challenging official haze data (PSI, PM2.5 and P10)
50	>>	criticism of state response
51	>>>	criticism of Singapore companies
52	>>	distrust
53	>>	Needing corroboration
54	>	work
55	>	school

Appendix 4: Frequency of Codes

Nested Level	Code Name	Number of Snippets
>>>	runny nose	1
>	Individualization of responsibility	2
>>	confusion	2
>>	the elemental	2
>>>	itchy	2
>>	“Gahmen”	3
>>	skin sensations	3
>>>	choke	3
>>>	fear	5
>>>	allergies	5
>>>	reference to photos	7
>>	hungry ghost month	8
>>>	sneezing	8
>>>	smoke	8
>>	Needing corroboration	9
>	work	9
>>	consumer duty	10
>	complains	10
>	China	10
>>	seasonality	10
>>	hot	10
>>>	criticism of Singapore companies	10
>	climate change	11
>	feel	12
>>>	cough	12
>>>	throat	12
>>	aircon	13

>	consistency	14
>>>	eyes	14
>>	distrust	16
>	perceptions of Singapore	17
>>	sick	17
>>	PM10	18
>	support for government response	19
>>>	rain	19
>>>	burning	19
>>>	breathing	21
>>	comparisons with previous years	23
>>	negative feelings	26
>>	criticism of state response	27
>>>	wind	30
>	school	31
>	health risk	35
>>	defending NEA figures	39
>>	army	44
>>	using NEA figures	48
>>	see	50
>	explanation of PSI	53
>>	alternatives to NEA	53
>>	PM2.5	59
>	challenging official haze data (PSI, PM2.5 and P10)	81
>>	smell	101
>	humour	107
>	Indonesia	113
>>	sarcasm	119

Appendix 5: Codes with most co-incidences with each other

Code 1	Code 2	No. of snippets
Sarcasm	Indonesia	26
Explanation of PSI	Defending NEA's figures	12
Burning	Smell	13
Humour	Sarcasm	24
Distrust	Challenging official haze data	11

Appendix 6: Direct Reddit quotes

Serial Number for Reddit User (RU)	Year	Serial Number for Reddit User (RU)	Year
RU 1	2019	RU 26	2016
RU 2	2015	RU 27	2016
RU 3	2016	RU 28	2016
RU 4	2015	RU 29	2016
RU 5	2015	RU 30	2016
RU 6	2019	RU 31	2019
RU 7	2019	RU 32	2019
RU 8	2019	RU 33	2019
RU 9	2019	RU 34	2019
RU 10	2019	RU 35	2019
RU 11	2019	RU 36	2019
RU 12	2017	RU 37	2019
RU 13	2018	RU 38	2019
RU 14	2017	RU 39	2019
RU 15	2016	RU 40	2019
RU 16	2019	RU 41	2019
RU 17	2016	RU 42	2019
RU 18	2016	RU 43	2019
RU 19	2016	RU 44	2019
RU 20	2016	RU 45	2019
RU 21	2016	RU 46	2019
RU 22	2016		
RU 23	2016		
RU 24	2016		
RU 25	2016		

Appendix 7: Participant Information Sheet

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Exploring the intersection of 'smart' and sustainable in Singapore's high-rise government housing estates

PARTICIPANT INFORMATION SHEET - RESIDENT

1. ***What is the purpose of this research?***

This PhD project aims to study the intersection of 'smart' and sustainable infrastructures in Singapore's high-rise government housing estates, focusing on the Punggol eco-town. It explores the construction of human and non-human assemblages within these infrastructures in order to study how ideas of 'smart' are generated, circulated and felt in the everyday lives of ordinary Singaporeans. In addition to this, the project hopes to explore the implications of 'smart' on postcolonial state-building, including the exporting of policies through particular kinds of 'policy mobilities' and the construction of Singapore as a "living laboratory".

2. ***Why have I been invited to take part?***

You have been invited because you are a resident of the Punggol neighbourhood.

3. ***Do I have to take part?***

No. You can ask questions about the research before deciding whether or not to participate. If you do agree to participate, you may withdraw yourself from the study at any time, without giving a reason, by emailing me, Amillin, at nurul.hussain@seh.ox.ac.uk, with your decision.

4. ***What will happen to me if I take part in the research?***

If you are happy to take part in the research, you will be contacted in order to arrange your participation in a 3-hour long workshop in the Punggol neighbourhood, with 4-7 other residents. Additionally, you will be invited to an hour-long 1-1 interview at your convenience, sometime between mid-June 2019 to September 2019.

Prior to the workshop, the workshop schedule will be emailed to you. At the workshop, you will be asked to sign a consent form and we will talk through the process of the workshop. At

any time, you will have the chance to ask questions, clarify your answers, or stop participating in the project.

Prior to the interview, the interview questions will be emailed to you. At the interview, you will be asked to sign a consent form and we will talk through the process of the interview. At any time, you will have the chance to ask questions, clarify your answers, or stop participating in the project. The interviews will be audio-recorded for research purposes if you consent to it.

5. ***What happens to the data provided?*** [67]

The information you provide as part of the study is the **research data**. Any research data from which you can be identified (e.g. your name, date of birth, audio recording), is known as **personal data**. It does not include data where the identity has been removed (anonymous data).

Use of your personal data in the study will be minimised wherever possible.

The **research data** will be stored confidentially using a password-protected folder within a computer and password protected external hard drive, as well as the University of Oxford's secure HFS backup service.

Your responses will be anonymised, with identifiers removed to ensure confidentiality. Personal data will be stored confidentially using the same procedure described above. I, the researcher, will have sole access to personally identifiable data, and it will not be available to any third parties.

I would like your permission to use direct quotes. I assure you that your quotes will be anonymized, with identifiers removed.

All research data and records will be stored for at least 3 years after publication or public release of the work of the research. Your personal data may be retained and stored for an additional period of time as necessary for the purposes of the study, and for further research.

I would like your permission to use anonymised data in future studies, and to share data with other researchers (e.g. in online databases). All personal information that could identify you will be removed or changed before information is shared with other researchers or results are made public.

6. ***Will the research be published?***

The research may be published in online publications and/or academic journals.

The University of Oxford is committed to the dissemination of its research for the benefit of society and the economy and, in support of this commitment, has established an online archive of research materials. This archive includes digital copies of student theses successfully submitted as part of a University of Oxford postgraduate degree programme.

[67] Please refer to CUREC's Best Practice Guidance on Data Collection and Management (BPG 09)

Holding the archive online gives easy access for researchers to the full text of freely available theses, thereby increasing the likely impact and use of that research.

The research will be written up as a thesis. On successful submission of the thesis, it will be deposited both in print and online in the University archives, to facilitate its use in future research. The thesis will be openly accessible.

7. *Who is organising and funding the research?*

This research is done with support from the researcher's department, the University of Oxford's School of Geography and the Environment, as well as with fieldwork funding from the Singapore Academic and Research Talent Scheme (START) from the Ministry of Education, administered through Nanyang Technological University.

8. *Who has reviewed this study?*

This study has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.

9. *Who do I contact if I have a concern about the study or I wish to complain?*

If you have a concern about any aspect of this study, please speak to the researcher, Amillin [tel: +65 91707671 OR +44 07380444313] or her supervisor, Professor Derek McCormack [tel: +44 01865275988], who will do their best to answer your query. The researcher should acknowledge your concern within 10 working days and give you an indication of how they intend to deal with it. If you remain unhappy or wish to make a formal complaint, please contact the relevant chair of the Research Ethics Committee at the University of Oxford who will seek to resolve the matter in a reasonably expeditious manner:

Chair, **Social Sciences & Humanities Inter-Divisional Research Ethics Committee**; Email: ethics@socsci.ox.ac.uk; Address: Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD

10. *Data Protection*

The University of Oxford is the data controller with respect to your personal data, and as such will determine how your personal data is used in the study.

The University will process your personal data for the purpose of the research outlined above. Research is a task that we perform in the public interest.

Further information about your rights with respect to your personal data is available from http://www.admin.ox.ac.uk/councilsec/compliance/gdpr/individualrights/.

11. *Further Information and Contact Details*

If you would like to discuss the research with someone beforehand (or if you have questions afterwards), please contact:

Nurul Amillin Hussain
School of Geography and the Environment
Tel: +44 07380444313 or +65 91707671
Email: enquiries@geog.ox.ac.uk

Appendix 8: Participant Consent Form

SCHOOL OF GEOGRAPHY AND THE ENVIRONMENT
UNIVERSITY OF OXFORD
OUCE, South Parks Road, Oxford OX1 3QY United Kingdom
Tel: +44(0)1865 275890
research-degrees-coordinator@ouce.ox.ac.uk, geog.ox.ac.uk
Director of Graduate Studies: Professor Danny Dorling

Ms. Nurul Amillin Hussain
DPhil Candidate in Geography
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PARTICIPANT CONSENT FORM

Ethics Approval Reference: SOGE 1A 19-26

Purpose of Study: This DPhil thesis project aims to explore the intersection of 'smart' and sustainable infrastructures in Singapore's high-rise government housing estates, focusing on the newly built eco-town of Punggol.

Please initial each box

1	I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	☐
2	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without any adverse consequences or academic penalty.	☐
3	I understand that research data collected during the study may be looked at by designated individuals from the University of Oxford where it is relevant to my taking part in this study. I give permission for these individuals to access my data.	☐
4	I understand that this project has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.	☐
5	I understand who will have access to personal data provided and how the data will be stored.	☐
6	I understand how this research will be written up and published.	☐
7	I understand how to raise a concern or make a complaint.	☐
8	I agree to take part in the above study.	☐

Thank you for participating in this study.

Name of Participant	Date	Signature
Name of person taking consent	Date	Signature

Appendix 9: NEA Official PSI Bands

24-hr PSI	Healthy persons	Elderly, pregnant women, children	Persons with chronic lung disease, heart disease
≤100 (Good/Moderate)	Normal activities	Normal activities	Normal activities
101- 200 (Unhealthy)	Reduce^ prolonged** or strenuous*** outdoor physical exertion	Minimise^^ prolonged** or strenuous*** outdoor physical exertion	Avoid^^^ prolonged** or strenuous*** outdoor physical exertion
201 – 300 (Very Unhealthy)	Avoid^^^ prolonged** or strenuous*** outdoor physical exertion	Minimise^^ outdoor activity	Avoid^^^ outdoor activity
>300 (Hazardous)	Minimise^^ outdoor activity	Avoid^^^ outdoor activity	Avoid^^^ outdoor activity

Source: National Environment Agency Website

Appendix 10: NEA Official PM2.5 Bands

1-hr $PM_{2.5}$ conc ($\mu g/m^3$)	Band	Descriptor
0 - 55	1	Normal
56 - 150	2	Elevated
151 - 250	3	High
>=251	4	Very High

Source: National Environment Agency Website